Azimuth Consulting Group Inc.
218 – 2902 West Broadway
Vancouver, BC
Canada V6K 2G8

Phone: 604-321-4180
www.azimuthgroup.ca

Technical Memorandum

Predictive effects assessment for fish in the pits at Meadowbank during closure

Client:	Agnico Eagle Mines Limited – Meadowbank Division
Project:	Risks to fish from exposure to tailings and porewater during post-closure
Prepared by:	Eric Franz (MSc), Jenna Keen (MET, RPBio), Marianna DiMauro (MRM, RPBio)
Reviewed by:	Ryan Hill (MRM, RPBio)
Date:	November 13, 2024 (Final)

NOTICE TO READER

This report was prepared by Azimuth Consulting Group Inc. (Azimuth), for the use of Agnico Eagle Mines Ltd., who has been party to the development of the scope of work for this project and understands its limitations. The extent to which previous investigations were relied on is detailed in the report.

In providing this report and performing the services in preparation of this report Azimuth accepts no responsibility in respect of the site described in this report or for any business decisions relating to the site, including decisions in respect of the management, purchase, sale or investment in the site.

This report and the assessments and recommendations contained in it are intended for the sole and exclusive use of Agnico Eagle.

Any use of, reliance on, or decision made by a third party based on this report, or the services performed by Azimuth in preparation of this report is expressly prohibited, without prior written authorization from Azimuth. Without such prior written authorization, Azimuth accepts no liability or responsibility for any loss, damage, or liability of any kind that may be suffered or incurred by any third party as a result of that third party's use of, reliance on, or any decision made based on this report or the services performed by Azimuth in preparation of this report.

The findings contained in this report are based, in part, upon information provided by others. In preparing this report, Azimuth has assumed that the data or other information provided by others is factual and accurate. If any of the information is inaccurate, site conditions change, new information is discovered, and/or unexpected conditions are encountered in future work, then modifications by Azimuth to the findings, conclusions and recommendations of this report may be necessary.

In addition, the conclusions and recommendations of this report are based upon applicable legislation existing at the time the report was drafted. Changes to legislation, such as an alteration in acceptable limits of contamination, may alter conclusions and recommendations.

This report is time-sensitive and pertains to a specific site and a specific scope of work. It is not applicable to any other site, development or remediation other than that to which it specifically refers. Any change in the site, remediation or proposed development may necessitate a supplementary investigation and assessment.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

1.1 Background

The Nunavut Water Board (NWB) granted Agnico Eagle Mines Ltd (Agnico Eagle) authorization to dispose of tailings from the Whale Tail Pit deposits into Goose Pit and Portage Pit on May 24, 2019 (**Figure 1-1**). One of the conditions of the updated Water Licence was for Agnico Eagle to review mitigation options to protect against impacts to water quality and aquatic life from contaminants in the tailings. Agnico Eagle hired Azimuth Consulting Group Inc. (Azimuth) to support closure planning. The first step in the process involved identifying under what conditions mitigation options may be considered to protect aquatic life. The first deliverable under this scope of work was a technical memorandum that summarized comments from the agencies during the permitting process in 2018 and 2019 (Azimuth, 2022). That memorandum also included chemistry data from surface water, tailings, and porewater sampling programs that were conducted in 2022. The key outcome from that scope of work was a framework to help guide closure planning. The framework is presented in **Figure 1-2**.

1.2 Objective and Scope

The objective of this deliverable is to assess if fish are at risk from exposure to contaminants in the tailings in the pits at Meadowbank after the dikes are breached and the pits are connected to Third Portage Lake. Effects to fish habitat would normally be considered in an ecological risk assessment. However, habitat in the pits was assigned zero value in the No-Net Loss Plan (NNLP) Addendum (Agnico Eagle, 2020)[1]. Because habitat in the pits is not expected to support fish productivity under the NNLP, the effects assessment focused on potential effects to fish from direct or indirect exposure to contaminants in the tailings (see scenario 3b and scenario 3c in **Figure 1-2**). Potential effects to fish from surface water exposure (scenario 1) are being evaluated as part of a separate scope of work which includes updated water quality predictions and site-specific water quality objectives for closure. Risks to periphyton and benthic invertebrate communities (scenario 3a) were not evaluated because the depositional areas of the pits were assigned zero habitat value in the NNLP Addendum (Agnico Eagle, 2020). Ultimately, the risk assessment findings will help support refinement of the Final Closure Plan, specifically, whether a non-acid generator (NAG) rockfill cover is needed to protect fish from exposure to contaminants in the tailings.

[1] Habitat losses associated with the pits will be offset by enhancing Arctic Grayling spawning habitat in local streams.

1.3 Approach

We used the following approach to evaluate potential effects to fish inhabiting the pits during post-closure:

- First, we describe the *expected* conditions in the pits at closure and habitat preferences for fish species in Third Portage Lake. Characterizing the expected conditions in the pits and habitat preferences for the various fish species in Third Portage Lake is an important aspect of the conceptual exposure model (**Section 2**).
- Second, we identified parameters of potential concern (POPC) in porewater by comparing measured concentrations against relevant water quality guidelines (WQGs) in Canada (**Section 3**).
- Lastly, we used the two lines of evidence – porewater chemistry compared to toxicity thresholds and laboratory toxicity tests – to provide an overall assessment of whether contaminants in the tailings pose a risk to the viability of fish populations in Third Portage Lake (**Section 4**).

1.3.1 Lines of Evidence

In ecological risk assessment, lines of evidence (LOEs) are pairings of exposure and effects measures that are used to evaluate the receptor (e.g., fish) and attribute being protected (e.g., viability of the population). For species without a special conservation status, which is the case for fish species in Third Portage Lake, we want to ensure that contaminants do not impair the population's ability to sustain itself over the long term. We assume that assessing biological endpoints at the organism level (e.g., survival, growth and reproduction) will protect population-level attributes (e.g., fish abundance).

Lines of evidence that measure biological endpoints for the population/community on-site are typically given more weight in a risk assessment because they are more ecologically relevant than laboratory toxicity tests or chemistry-based lines of evidence. However, it is not always possible to directly assess the population or community of interest, which is the case when the risk assessment is for future conditions. To assess risks to fish exposed to tailings during post-closure, we relied on two LOEs: (1) porewater chemistry compared to toxicity thresholds and (2) laboratory toxicity tests with Fathead Minnow and Rainbow Trout. Each LOE has advantages and disadvantages, but they provide complementary information for assessing the risk to fish exposed to tailings in the pits. An overview of each LOE is provided below.

Porewater Chemistry Compared to Toxicity Thresholds in the Literature

This LOE compared porewater chemistry results for the short-list of parameters that exceeded WQGs to toxicity benchmarks specific to fish. WQGs are a useful starting point for identifying POPC, but it is the underlying fish toxicity data that are relevant to assessing effects and not the WQG values themselves.

Short-term (acute) and long-term (chronic) toxicity data were considered in the assessment, but we put more emphasis on the acute toxicity test results because we expect fish will only be transiently exposed to contaminants in the porewater given the low habitat value of the tailings. Toxicity data for sensitive life stages for cold water species were given priority in the effects assessment. Overall, results from this LOE were given a lower weighting than the results from the laboratory toxicity tests because thresholds in the literature provide limited information on the potential effects to fish on a site-specific basis. For example, it is possible to exceed thresholds in the literature but not have an adverse effect because of site-related factors that modify the bioavailability of contaminants or because resident species have adapted to higher exposure conditions.

Laboratory Toxicity Tests

Laboratory toxicity tests are often used to assess risk to aquatic receptors under future conditions. Data obtained from highly controlled laboratory studies on standardized species are generally assumed to be reproducible and of high quality. There are, however, some uncertainties regarding porewater toxicity testing that need to be acknowledged. First, conditions in the laboratory are not representative of actual conditions that fish will be exposed to in the pits. A variety of physical, chemical, and biological factors have the potential to influence the bioavailability and toxicity of contaminants in porewater, and mimicking those conditions in the laboratory is not feasible. Second, the species used in toxicity testing are frequently chosen because they are amenable to maintenance and use under controlled laboratory conditions and not because they are representative of species in the wild (Rohr et al., 2016). Indeed, the lack of standardized test methods for Arctic species is one of the main uncertainties in assessing contaminant-related risks in northern ecosystems (Eldridge et al., 2022).

We acknowledge that there are uncertainties about the ecological relevance of the porewater tests for assessing risks to fish. That said, laboratory toxicity tests with standard test species are the most relevant, practical, and cost-effective LOE for assessing future risks to fish. To account for some of the uncertainty regarding the sensitivity of different fish species to contaminants in porewater, laboratory tests were conducted on two species: Fathead Minnow (*Pimephales promelas*) and Rainbow Trout (*Oncorhynchus mykiss*). Two Fathead Minnow tests were conducted in May 2023: a 7-day test for effects on survival and growth and a 96-hour single concentration test to verify that un-ionized ammonia was the cause of mortality. A 96-hour single-concentration test with Rainbow Trout was conducted in September 2024 to provide information about the sensitivity of salmonids to POPC.

Because of practical constraints around extracting enough porewater to meet the volume requirements for laboratory toxicity tests, the laboratory toxicity tests were conducted using reclaim water from Goose Pit as a surrogate media for porewater. AtkinsRéalis (2024b) reviewed porewater and surface water chemistry results from Goose Pit and concluded that the concentrations of most parameters were

similar between porewater and surface water at depth, except for magnesium and nitrate (higher in porewater compared to surface water) and alkalinity, arsenic, and selenium (lower in porewater compared to surface water). Overall, reclaim water was considered a reasonable surrogate for assessing potential effects to fish from short-term exposure to POPC. Chemistry results for the reclaim water samples used in the toxicity tests are provided in **Appendix A**.

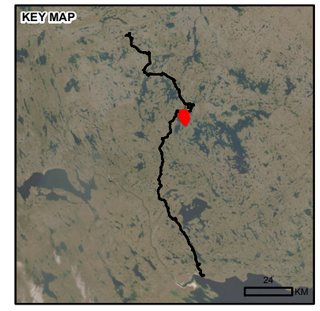
1.3.2 Protection Goal for Fish in the Pits

Interpreting the results of a risk assessment is easier if protection goals and acceptable effect levels are clearly articulated. A *protection goal* is a narrative statement that defines the level of protection for a receptor of concern. Fisheries and Oceans Canada (DFO) approved the offsetting plan to compensate for the loss of habitat within the surface area of the pits, so from a regulatory perspective, there is no expectation that the pits will provide habitat to support fish. Based on our review of the comments from the agencies, protecting fish populations against short-term effects to survival is a defensible goal for two reasons. First, there is abundant spawning, rearing, and overwintering habitat throughout Third Portage Lake to support the long-term viability of Lake Trout and other resident species. Second, none of the fish species in Third Portage Lake have special conservation status that would require protection at the level of individual organisms (i.e., to live, reproduce, and thrive). Furthermore, we note that fish use of the pits will likely be limited compared to the rest of Third Portage Lake due to habitat quality considerations discussed in **Section 2**.

LEGEND

FOOTPRINT (2021)

KEY MAP



0 500 1,000

1:25,000 METRES

REFERENCE(S)

1. INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. IMAGERY COPYRIGHT © 20220709 ESRI AND ITS LICENSORS. SOURCE: MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.

COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 14N

CLIENT

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION

PROJECT

MEADOWBANK COMPLEX
CLOSURE AND RECLAMATION PLAN

TITLE

MEADOWBANK MINE FOOTPRINT (2021)

CONSULTANT

wsp

YYYY-MM-DD	2024-11-12
DESIGNED	JDL
PREPARED	CDB
REVIEWED	JDL
APPROVED	JDL

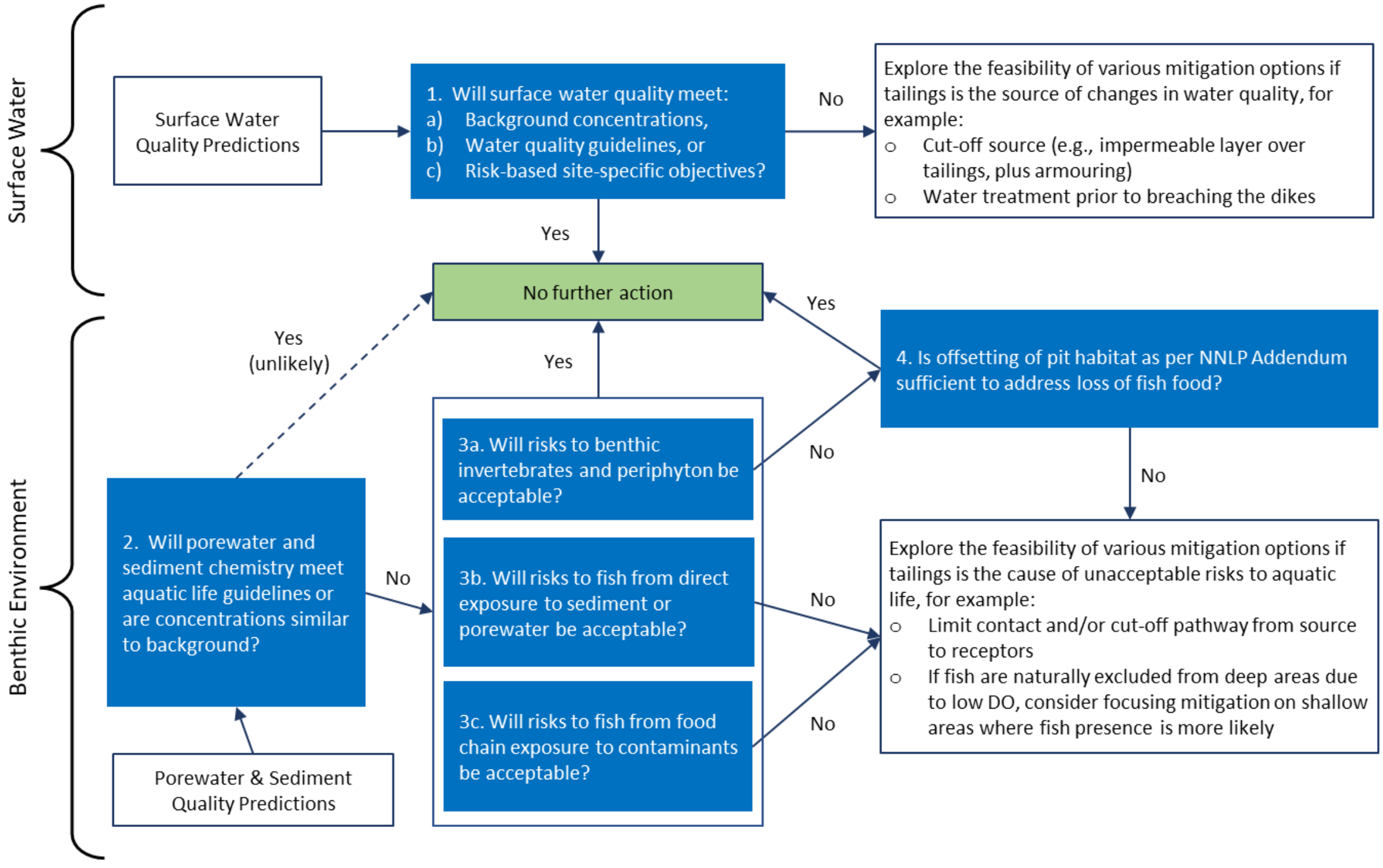
PROJECT NO.	CONTROL	REV.	FIGURE
CA008762.2948	3000/20	0	1.3-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

0 25mm

PATH: W:\Client\Agnico_Eagle_Mines_Ltd\Whale_Tail\69_PROJECTS\CA0008762_2948\3000\20\NA\02_PRODUCTION\MXD\Report\CA0008762_2948_3000_020_01_03_02_MBK_FOOTPRINT_Y2W.mxd PRINTED ON: 2024-11-12 AT: 3:55:45 PM

Figure 1-2. Proposed approach for identifying conditions in the pits where risk management measures may be warranted after re-flooding.



2 CONCEPTUAL MODEL OF EXPOSURE

This section describes the expected conditions in the depositional areas of Goose Pit and Portage Pit after the Bay-Goose and South Camp Dikes are breached and the pits are reconnected to Third Portage Lake. Characterizing the conditions in the pits during closure is important for determining the likelihood that resident fish species will use the pits during closure. Assumptions about future conditions in the pits are based on information presented in the NNLP Addendum (Agnico Eagle, 2020), the in-pit tailings consolidation model (AtkinsRéalis, 2024a), and from the hydrodynamic water quality model for Goose Pit (AtkinsRéalis, 2024b [draft]). Based on the available information, we've assumed that the following conditions will characterize Goose Pit and Portage Pit during closure:

- Surface water quality in the pits will be protective of aquatic life (i.e., concentrations similar to background and/or less than CCME aquatic life or site-specific water quality objectives).
- At least 8 m of water will cover the in-pit tailings following reflooding. As part of the hydrodynamic water quality forecast for Goose Pit, AtkinsRéalis simulated changes in water quality under two scenarios where tailings were deposited to elevations of 114 masl (8 m) and 126 masl (20 m) (AtkinsRéalis, 2024b). We adopted the 8 m cover scenario for assessing risks to fish because the model indicated dissolved oxygen (DO) concentrations may not be a limiting factor for fish inhabiting the benthic zone.
- At closure, the rate of porewater flux from tailings to the surface water will be negligible. This assumption is based on modelling completed by AtkinsRéalis (2024a) that showed tailings consolidation occurs in the first 2-3 years after deposition (max flux rate of 0.004 m^3/s to 0.007 m^3/s depending on the model). After 2-3 years, the flux rate of porewater to the overlying water decreased to nil (zero) in the model.
- The chemistry of the tailings deposited to Goose Pit and Portage Pit in the future will be similar to current conditions based on samples collected in 2022 and 2023. This assumes that the underlying geology of the ore at Whale Tail is relatively homogenous in terms of the POPC concentrations. Therefore, current tailings and porewater chemistry data from Goose Pit are a reasonable estimate of future conditions if Agnico Eagle decides to utilize the available storage capacity in Goose Pit and Portage Pit.
- Primary productivity in Third Portage Lake is naturally low. Therefore, it could take decades or longer for a functionally diverse and abundant benthic invertebrate community to form in the pits.

- Fish are unlikely to forage on or seek cover near the tailings because of poor habitat quality. Therefore, incidental ingestion and direct contact with contaminants in the tailings are considered insignificant exposure pathways for free-swimming fish.

2.1 Goose Pit and Portage Pit as Potential Aquatic Habitat for Fish

2.1.1 Pit Morphology and Habitat Suitability

The morphology of Goose Pit and Portage Pit is one of the factors that will dictate fish occupancy and exposure to contaminants at various life stages and times of year. Pit lakes are characterized by high depth-to-surface area ratios, steep sides, and flat benthic surfaces. As shown in **Figure 2-1**, there is sparse littoral habitat within Goose Pit. The lack of complex habitat will likely be a barrier for fish use of the pits during closure because the dominant fish species in Third Portage Lake require variable coarse substrates along shorelines or shoals for spawning, foraging, and refuge (Richardson et al., 2001).

Although the quality of littoral habitat within the boundaries of Goose Pit and Portage Pit is sparse, areas of Third Portage Lake that were dewatered but are outside the perimeter of Goose Pit and Portage Pit E will likely function as productive fish habitat during closure (see **Figure 2-1**). Offsetting calculations in the NNLP Addendum estimated that re-flooding of the area around Goose Pit and Portage Pit and habitat improvements such as boulder gardens and shoals would create 94.2 habitat units (HU) (Agnico Eagle, 2020). The 94.2 HU were excluded from the offset calculation because of uncertainty about whether the re-flooded areas of Second and Third Portage Lakes would serve as productive fish habitat. Regardless of whether these re-flooded areas will provide fish habitat at closure, based on the morphology of the pits, there is a low likelihood that fish will occupy areas of Goose Pit and Portage Pit where tailings were deposited for prolonged periods.

2.1.2 Stratification and Dissolved Oxygen

One of the significant findings from the 2022 water sampling program in Goose Pit was that DO concentrations are routinely below 2-3 mg/L throughout most of the water column during the open water and winter seasons. Subsequent monitoring programs in 2023 and 2024 confirmed no seasonal turnover, and Goose Pit remained hypoxic year-round below 10 m. If low DO concentrations at depth are expected to persist after the dikes are breached, then fish are unlikely to come in direct contact with POPCs in tailings or porewater. Studies looking at the effects of low DO on Rainbow Trout show growth can be affected when concentrations fall below 4.9 mg/L and asphyxiation occurs at 4 mg/L or below (Léger et al., 2021). The greater the depth of hypoxia in the water column, the more likely that fish will avoid these areas in favor of Third Portage Lake where DO concentrations are fully saturated year-round.

To provide clarity about the potential for anoxia to persist at closure, AtkinsRéalis (2024b) modelled changes in DO after the dikes are breached. For this scope of work, we focused on the two simulations where the final tailings elevation is 126 masl (8 m of overlying water). One simulation assumed 1 m of reclaim water over the tailings before re-flooding (simulation 3B-2); the second simulation assumed 5 m of reclaim water over the tailings before re-flooding (simulation 3B-1). The volume of reclaim water at the start of re-flooding can influence mixing because of density differences between reclaim water (high total dissolved solids [TDS] concentrations) and surface water from Third Portage Lake. Both simulations were run for 24 years. The results of the first simulation with 1 m of reclaim water indicated density differences between surface water from Third Portage Lake (top) and reclaim water with high TDS (bottom) is not sufficient to maintain stratification over the long term. However, only the top 2 m of overlying water was fully oxygenated after 20 years (top panel in **Figure 2-2**). Except for fall turnover, the predicted concentration of DO at depth is less than 4 mg/L after 20 years. The simulation with 5 m of reclaim water at the start of re-flooding indicated conditions would remain stratified after 24 years. In this simulation, there was no indication that fall turnover would result in higher DO concentrations at depth (bottom panel in **Figure 2-2**). The authors noted that groundwater infiltration could result in the breakdown of stratification after several decades. For the risk assessment, we conservatively assumed that hypoxia will not be a barrier to fish transiently inhabiting the depositional areas in the future given the uncertainty about the duration of stratification and low DO conditions in the pits.

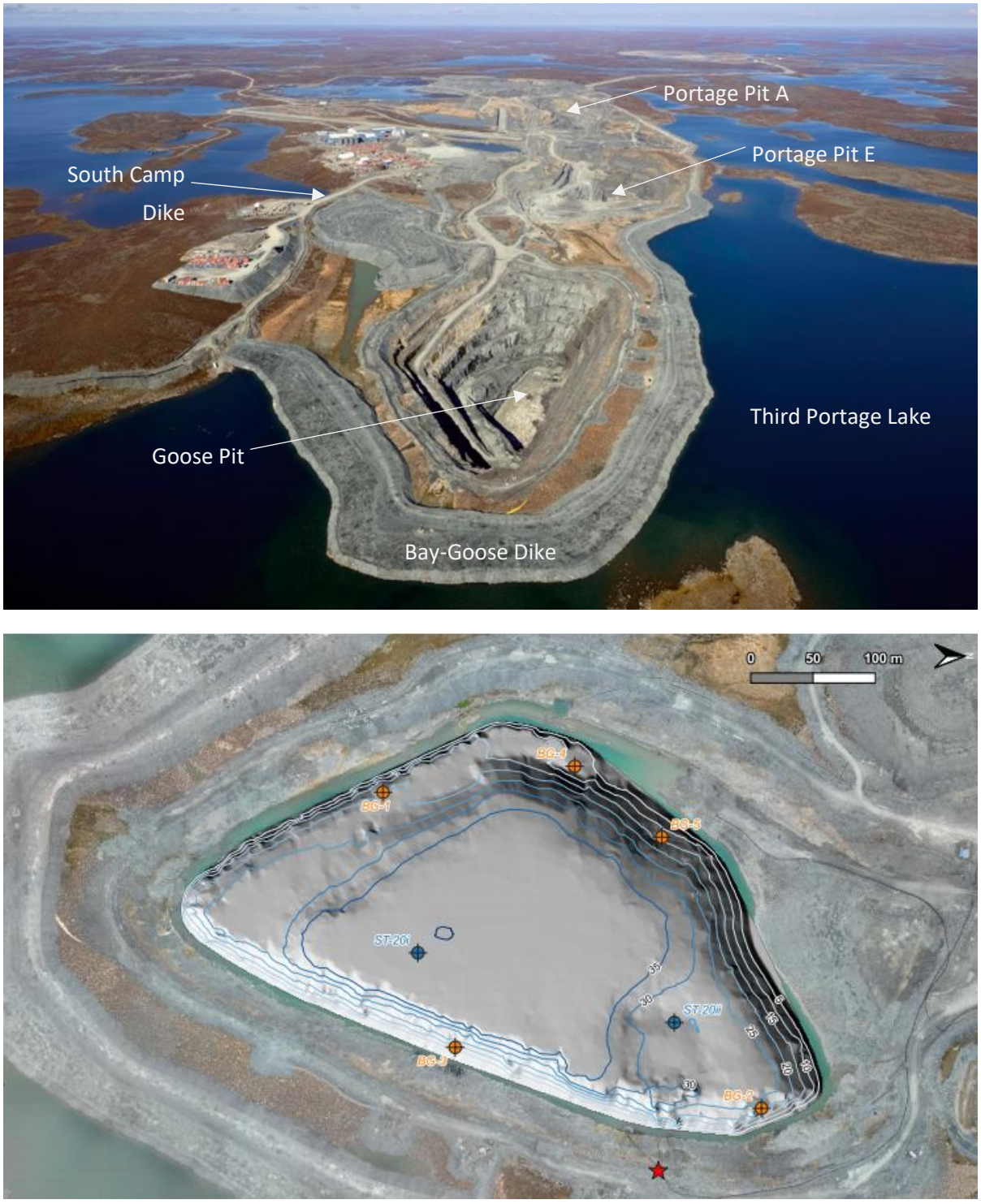
2.1.3 Habitat Quality of the Tailings

Approximately 2.7 Mt of tailings (in dry weight) were deposited in Goose Pit from July 2019 to August 2020 (AtkinsRéalis, 2024b). Tailings were collected from five locations in Goose Pit in 2022 and 2023 and submitted for metals, particle size, and organic carbon analyses. The first sampling program in August 2022 targeted areas around the perimeter of Goose Pit in water depth ranging between 9 m and 23 m (BG stations in **Figure 2-1**). In 2023, tailings were collected from three locations around the perimeter that were sampled in 2022 (BG-1, BG-4, and BG-5) and two deeper locations: ST-20i and ST-20ii. The physical characteristics of the tailings are presented in **Table 2-1**. Roughly 75 to 85 % of the tailings are fine particles in the 4 to 63 µm range (silt). Clay (< 4 µm) comprises between 13 to 23 % of the tailings. A small fraction of the tailings at ST-20ii was comprised of sand (< 2 mm). This location was closest to where tailings were deposited over the wall of the pit, and coarser material would have likely settled in this area.

Organic carbon content ranged from 0.17 to 0.41%. By comparison, average organic carbon content was 3.2 % (range 2.8-3.6%) for the five samples collected from the East Basin of Third Portage Lake in 2023 (Azimuth, 2024). The amount of organic carbon in the tailings was predictably low considering tailings were actively deposited in Goose Pit until August 2020 and the low natural rate of primary productivity.

The tailings samples had relatively low moisture content (26 to 40%). Low moisture content in the tailings samples is consistent with the consolidation model that showed porewater flux would decrease to nil (zero) 2-3 years after tailings deposition ceased.

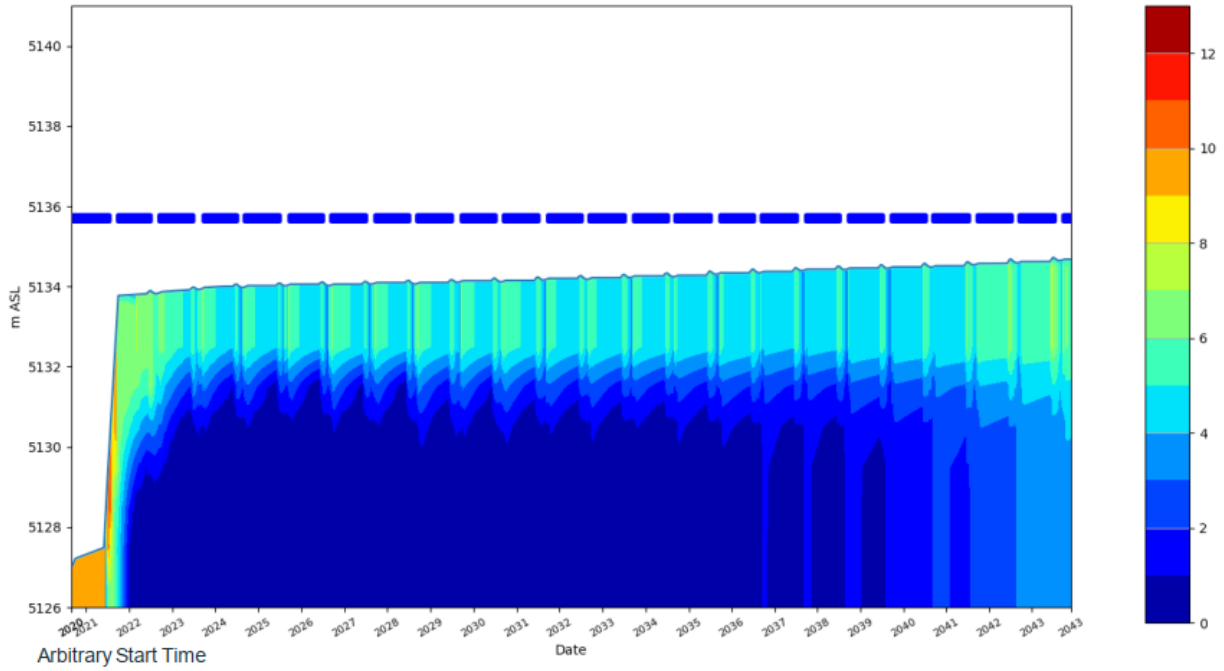
Figure 2-1. Aerial photograph of Goose Pit prior to tailings deposition (top) and the porewater sampling locations, 2022-2024 (bottom).



Note: Porewater samples were collected at BG-1 to BG-5 in 2022. Porewater samples were collected at ST-20i, ST-20ii, BG-1, BG-4, and BG-5 in 2023 and 2024. The red star indicates the location of where tailings were deposited over the wall of Goose Pit.

Figure 2-2. Simulated dissolved oxygen concentrations over 24 years after Goose Pit is reconnected with Third Portage Lake (AtkinsRéalis, 2024b).

Simulation 3 – B2: 1 m of reclaim water over the tailings before reflooding; 8 m water cover.



Simulation 3 – B1: 5 m of reclaim water over the tailings before reflooding; 8 m water cover.

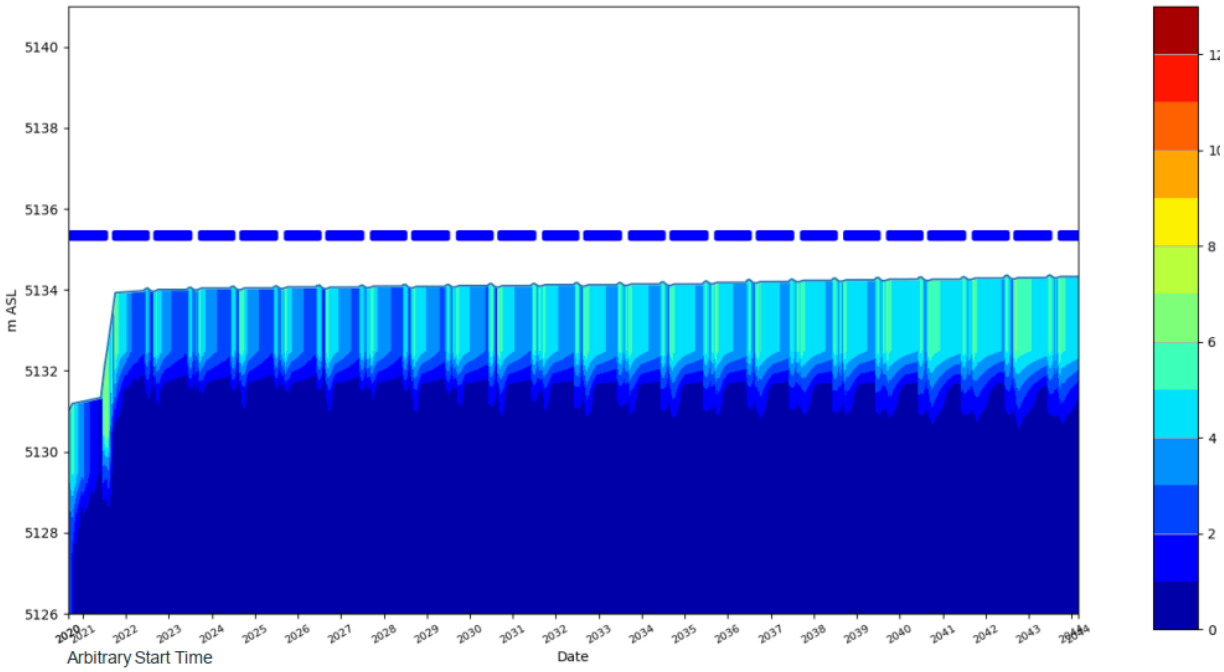


Table 2-1. Habitat characteristics of the tailings samples collected from Goose Pit in 2022 and 2023.

	Goose Pit Tailings Samples - 2022					Goose Pit Tailings Samples - 2023				
Client Sample ID	**BG-1**	**BG-2**	**BG-3**	**BG-4**	**BG-5**	**BG-1**	**BG-4**	**BG-5**	**ST-20i**	**ST-20ii**
Date Sampled	12-Aug	21-Aug	21-Aug	21-Aug	21-Aug	23-Aug	23-Aug	23-Aug	23-Aug	23-Aug
Moisture	26.4	26.4	28.2	29.1	40.3	39.1	36.4	34.5	36.8	32.3
pH	8.30	8.57	8.40	8.42	8.32	9.59	8.41	8.37	8.56	8.46
Clay (<4 µm)	13.3	18.3	19.3	19.9	22.1	22.7	22.5	22.4	14.5	15.1
Silt (4-63 µm)	86.4	81.7	80.6	79.9	77.6	77.1	77.2	77.2	84.4	80.2
Sand 63 µm-2mm)	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	1.1	4.7
TOC (%)	0.41	0.28	0.35	0.24	0.23	0.21	0.17	0.16	0.34	0.314

2.2 Life History and Habitat Preferences for Resident Fish Species

This review aims to identify the species and life stages potentially exposed to contamination in the tailings based on their life history. Assessing the potential impacts of contaminant exposure in wild fish populations is challenging, partly because natural fluctuations in fish populations can be attributed to complex interactions between multiple abiotic and biotic factors (**Figure 2-3**, from Edwards, 2019). Conceptually, species with smaller home ranges that are primarily benthic and prefer silt/clay habitat would – if using the pits – be more exposed to contaminants in the tailings compared to species and life stages that are pelagic and forage over a wide area. Ultimately, the effects on fish will depend on the concentration of the contaminant, exposure duration, pathway, environmental conditions, and attributes of the individual fish including its age and feeding habits (Jezierska and Witeska, 2006).

The fish community in Third Portage Lake is comprised of the following species: Lake Trout, Round Whitefish, Arctic Char, Burbot, Ninespine Stickleback, and Slimy Sculpin. Lake Trout is the dominant species in Third Portage Lake, followed by Round Whitefish and Arctic Char (Cumberland, 2005). Burbot, Ninespine Stickleback, and Slimy Sculpin comprise a small proportion of fish biomass in lakes around the Mine including Third Portage Lake (Azimuth, 2005a). A comprehensive overview of the productivity of the project lakes was included in the *Baseline Aquatic Ecosystem Report* for the Environmental Assessment (Azimuth, 2005a). The findings from the baseline fisheries assessment indicated that spawning, nursery, foraging, and overwintering habitat were abundant and were not limited in any of the lakes. The authors concluded that productivity in the study area lakes around Meadowbank is limited by nutrient availability and not by habitat. Although there is no expectation that the pits will contain fish habitat (as per the NNLP; see **Section 1.2**), there may be useable habitat in the pits and fish presence could therefore be expected.

Figure 2-3. Factors influencing fish exposure to contaminated sediment.

Note: this figure was presented in the plenary session on fish behavior in the Fish Sediment Exposure Workshop (Edwards, 2019).

Richardson et al. (2001) conducted a literature review on the lake habitat preferences and life histories of freshwater fish species that occur in the Northwest Territories and Nunavut. Four distinct life stages were included in the assessment: spawning (eggs), young-of-the-year, (YOY), juveniles, and adults. Habitat requirements were reported on the basis of three physical habitat features: water depth, substrate type, and structure/cover. Each life stage was given a rating based on the frequency of association ranging from not associated (blank) to almost always associated (high). The ratings for each species and life stage are summarized in **Table 2-2**.

Based on our review of physical habitat preferences for each species, Ninespine Stickleback is the only species that could potentially use the tailings based on the high association ratings for water depth between 5-10 m and fine sediment (silt and clay). This assessment is based on physical features alone and does not consider whether there would be food available or vegetative cover, which is a key habitat requirement throughout all life history stages for Ninespine Stickleback (**Table 2-2**). Large-bodied species prefer coarse substrate during their free-swimming life history and are unlikely to inhabit the depositional areas for prolonged periods.

Table 2-2. Habitat and substrate preferences for resident fish species in Third Portage Lake (from Richardson et al., 2001)

Habitat Feature	Lake Trout				Round Whitefish				Arctic Char (resident)				Burbot				Slimy Sculpin				Ninespine Stickleback			
	S	YOY	J	A	S	YOY	J	A	S	YOY	J	A	S	YOY	J	A	S	YOY	J	A	S	YOY	J	A
Depth (m)																								
0-1	H	L	L		H	H	H	H	L	L	L	H	H	H	H		H	H	H	H	H	H		H
1-2	H	M	M	M	M	H	H	H	M	L	L	H	H	H	H		H	H	H	H	L	H		H
2-5	H	H	H	M	M				H	L	L	H		H	H	L	M	H	H	H	L	H		H
5-10	H	H	H	M	L			H	H	L	H	H	L	L	L	L	M	H	H	H	L	M		M
>10	H	H	H	H	L			H	M	H	H	H	L	L	L	H	M	H	H	H	L	M		M
Substrate																								
Bedrock	L										L					H								
Boulder	H	H	H	H	L	L	L	L		H	H	H		H	H	H	H	H						
Rubble	H	H	H	H	M	H			L	H	H	H	L	H	H	H	H	H	H	H	H			H
Cobble	H	H	H	H	M	H			H	H	H	H	H	H	H	H	H	H	H	H	H			H
Gravel	H				H	H			H				H	H	H	H	H	H	H	H	L			L
Sand	L	M			L								H	L	L	L	H	H			M	L		L
Silt	L				L				L				L			L	M				H	H		
Detritus	L								L				L				M				H	H		
Clay	L								L				L				M	M			H	H		H
Pelagic				L					L	L	H	H		M										
Cover																								
None	H			H																				
Submerged veg	L								L		H			M	M	M								
Emerged veg					L						H			M	M	M								
Overhead														M	M	M								
In-situ		H	H							H	H			M	M	M	H							
Other																								
Comments and Observations	• Juveniles may seek cover amongst boulders and woody debris • Lake trout typically spawn in shallow inshore areas of lakes that are free of sand, silt, and detritus • No preference for substrate was found for adult lake trout, and in general they seek cooler deeper waters in the summer (i.e., > 10 m)				• Spawning typically takes place over gravel and rubble substrates • Young round whitefish are most often found over rock, sand and gravel substrates				• Juveniles are most often found in the benthic areas of lakes at depths > 5 m avoiding littoral and shallow benthic habitats which are often occupied by large conspecifics and potential predators • Young-of-the-year and juveniles seek cover amongst boulder, rubble and cobble substrates as well as in vegetation • As juveniles mature, they shift from benthic to pelagic habitats • Adults make seasonal habitat shifts to pelagic habitats in the summer to feed on abundant zooplankton				• Burbot eggs only develop when oxygen concentrations are high • Burbot are broadcast spawners, and spawn over sand, gravel or rubble substrates at a depth of 0.5–3.0 m				• Spawning in May. Males select nest sites on the under side of stones and logs in shallow water < 1.5 m deep • Slimy sculpin prefer areas with current and wind action in waters < 10 m deep				• Vegetation is a key habitat requirement throughout all life history stages • Males typically build their nests amongst weeds in densely vegetated areas • Adult sticklebacks are tolerant of low oxygen and may also frequent open water areas over sand and gravel beaches with sparse vegetation			

Notes:

Life stages:

S = spawning, YOY = young-of-the-year, J = juvenile, A = adult

Habitat ratings for each life stage**:**

blank (not associated); L = low (species is infrequently associated); M = moderate (species is frequently associated); H = high (species is nearly always associated)

Cover**:**

Overhead = riparian cover overhanging the littoral zone, undercut banks and woody debris at the surface of the water

In-situ = rocks and boulders on sand/gravel substrates, submerged woody debris, etc.

3 PARAMETERS OF POTENTIAL CONCERN IN POREWATER

Parameters of potential concern (POPC) are chemicals that exceed numeric guidelines intended to broadly protect aquatic organisms in freshwater environments. The initial list of POPCs included parameters in porewater that exceeded the most recent chronic federal freshwater aquatic life guidelines (WQGs) from Canadian Council of Ministers of the Environment (CCME) or Environment and Climate Change Canada (ECCC). Chronic (30-day average) WQGs from B.C. were adopted for parameters without federal guidelines (e.g., sulphate) or if federal WQGs were outdated (e.g., molybdenum and selenium). The WQGs used in this assessment are provided in **Table A-1** to **Table A-3** along with the porewater chemistry results from 2022-2024. Chemistry results from the bulk tailings samples were not used to identify POPCs in sediments because there are no federal or provincial sediment quality criteria based on toxicity studies with fish. The CCME sediment quality guidelines were derived based on whole-sediment toxicity tests with *Hyalella azteca*. For completeness, chemistry results for the tailings samples from Goose Pit are provided in **Table A-4**.

The following parameters exceeded the selected WQGs in at least one porewater sample from Goose Pit in 2022-2024: ammonia, nitrite, sulphate, cyanide (free), arsenic, cobalt, selenium, and silver. Nitrite and silver were not carried forward as POPCs because there was only one marginal exceedance for each parameter. For nitrite, 9 of the 10 samples were below detection (0.02 mg/L). The concentration of silver was less than the detection limit (0.02 µg/L) in 13 of 15 samples (**Table 3-1**).

The porewater POPCs carried forward in this assessment include ammonia, cyanide, sulphate, arsenic, cobalt, and selenium.

Table 3-1. Summary of parameters of potential concern (POPC) in porewater samples collected from Goose Pit in 2022-2024.

Year	Sample ID	POPC and corresponding guidelines for protection of freshwater aquatic life							
		Ammonia (mg/L)	Nitrite (mg/L)	Sulphate (mg/L)	Free Cyanide (µg/L)	Arsenic (µg/L)	Cobalt (µg/L)	Selenium (µg/L)	Silver (µg/L)
		CCME 2010	CCME 1987	BC ENV 2013	CCME 1987	CCME 1997	ECCC 2017	BC ENV 2014	CCME 2015
		0.855	0.06	429	5	5	1.8	2	0.25
2022	BG-1	*NA*	*NA*	*NA*	*NA*	689	23.5	20.4	0.071
	BG-2	*NA*	0.0747	1180	*NA*	636	42.8	24.7	0.418
	BG-3	*NA*	*<0.02*	1170	*NA*	439	47.6	9.48	*<0.02*
	BG-4	*NA*	*<0.02*	1040	*NA*	235	67.0	3.34	*<0.02*
	BG-5	*NA*	*<0.02*	1070	*NA*	385	131	5.98	*<0.02*
2023	BG-1	*NA*	*NA*	*NA*	*NA*	216	44.8	5.80	*<0.02*
	BG-4	*NA*	*NA*	*NA*	*NA*	346	43.9	7.95	*<0.02*
	BG-5	*NA*	*NA*	*NA*	*NA*	603	43.2	14.7	*<0.02*
	PW_ST-20i	*NA*	*NA*	*NA*	*NA*	158	62.0	2.77	*<0.02*
	PW_ST-20ii	*NA*	*NA*	*NA*	*NA*	347	81.6	6.96	*<0.02*
2024	PW-BG-1	28.3	*<0.02*	1270	3.6	610	40.8	6.18	*<0.02*
	PW-BG-4	23.5	*<0.02*	1200	5.4	235	69.0	2.53	*<0.02*
	PW-BG-5	26.4	*<0.02*	1290	14.6	177	47.3	7.37	*<0.02*
	PW-ST-20i	28.5	*<0.02*	1220	8.0	346	47.8	13.8	*<0.02*
	PW-ST-20ii	17.7	*<0.02*	1240	2.1	423	33.0	1.84	*<0.02*
Count		5	9	9	5	15	15	15	15
Count < DL		0	8	0	0	0	0	0	13
Count > FWAL		5	1	9	3	15	15	14	1
Average Concentration		24.9	see median	1187	6.7	390	55.0	8.92	see median
Median Concentration		26.4	<0.02	1200	5.4	347	47.3	6.96	<0.02
Max Screening Quotient		33	1.2	3.0	2.9	138	73	12	1.7
Min Screening Quotient		21	1.2	2.4	0.4	32	13	0.9	0.3

Notes

NA = not analyzed. Not enough volume of porewater was extracted from tailings samples in 2022 and 2023 to analyze the full suite of parameters (i.e., major ions, nutrients, cyanide species, and metals). Metals were prioritized for analysis followed by nutrients and conventional parameters.

Screening quotients = porewater concentration ÷ the water quality guideline.

Shaded values exceed the chronic freshwater aquatic life guidelines.

4 PREDICTIVE EFFECTS ASSESSMENT

4.1 LOE 1: Porewater Chemistry Compared to Toxicity Thresholds for Fish

This LOE compares porewater chemistry results from Goose Pit in 2022-2024 to toxicity thresholds for fish. For each POPC, we summarized the concentrations measured in porewater samples from Goose Pit, provided an overview of the WQG used for screening, and compared the measured concentrations against toxicity thresholds for fish. Underlying toxicity data were sourced from the WQGs. If WQGs are recent and comprehensive, they are a convenient starting point for literature-based evaluations because the process for deriving guidelines involves rigorous data quality screening.

4.1.1 Ammonia

Ammonia exists in two forms in aquatic environments: un-ionized ammonia (NH_3) and ionized ammonia (NH_4^+). Un-ionized ammonia is more toxic than ionized ammonia because it can permeate the gills of fish and other aquatic organisms. Ammonia toxicity in fish primarily arises from its ability to impair nitrogen excretion. Ammonia normally diffuses across the gills into the water, but when external concentrations are high, this gradient is reversed, and ammonia accumulates in the blood, causing hyperammonemia (Randall and Tsui, 2002). This condition leads to increased blood pH (alkalosis), disrupting normal metabolic processes and reducing the oxygen-carrying capacity of the blood. Chronic ammonia exposure in aquatic organisms can impair growth, reproduction, and immune function, leading to increased mortality (CCME, 2010).

Exposure Data

The concentration of total ammonia (as N) ranged from 17.7 to 28.5 mg/L in the five porewater samples collected from Goose Pit in August 2024. We converted total ammonia (as N) concentrations to un-ionized ammonia (mg NH_3/L) because the toxicity test results referenced in the CCME WQG are expressed in mg NH_3/L. The percentage of un-ionized ammonia at different pH and water temperatures is provided in Table 3 in the WQG factsheet (CCME, 2010). We assumed porewater has a relatively constant temperature of 0-5°C and that laboratory pH is a reliable estimate of *in-situ* porewater pH. Laboratory pH readings from 2022 and 2024 indicate porewater in Goose Pit is slightly alkaline (7.5 to 8). At pH 7.5 and 0°C, only 0.26% of the total ammonia is present as un-ionized ammonia. The percentage of un-ionized ammonia increases to 1.23% at pH 8 and 5°C. If we conservatively assume un-ionized ammonia represents 2% of the total ammonia concentration measured in the porewater samples, un-ionized ammonia concentrations in the porewater samples collected in 2024 would have ranged from 0.35 mg/L to 0.57 mg/L.

Water Quality Guideline and Relevant Toxicity Data

Porewater chemistry data were screened against the chronic CCME WQG (2010). The CCME WQG was derived from a species sensitivity distribution (SSD) curve using chronic EC20 data from five aquatic invertebrate studies, 22 fish studies, and one amphibian study (Environment Canada and Health Canada [EC and HC], 2001). The three most sensitive species were *Hyalella azteca* (28-d partial life cycle test; EC20 = 0.051 mg NH_3/L), Sockeye salmon (62-d EC20 for hatching success; EC20 = 0.057 mg NH_3/L), and Rainbow Trout (early life stage survival[2]; EC20 = 0.09 mg NH_3/L). Based on the 28 studies included in the SSD, un-ionized ammonia concentrations of 0.041 mg/L (95% confidence intervals 0.019 and 0.063 mg NH_3/L) could result in a 20% reduction in growth or reproduction for 5% of the invertebrate, fish and amphibian species in an aquatic community. Incidentally, the 5th percentile concentration from the SSD was nearly identical to the effect threshold for tissue-related effects in Rainbow Trout, which was the most sensitive species and endpoint reviewed for the CCME WQG. During the four-month study, fish were exposed to un-ionized ammonia ranging from 0.01 to 0.07 mg/L. Concentrations greater than 0.04 mg NH_3/L were correlated with pathological lesions on the gills and kidney tissue degradation. Instead of applying a safety factor to this study, CCME adopted the lower 95th confidence interval of 0.019 mg/L from the SSD as the chronic WQG.

Acute toxicity data for freshwater fish species was also included in the ammonia assessment report (EC and HC, 2001). The acute LC50 results for species found in Canada are provided in **Table 4-1**. The data were based on studies originally included in the U.S. Environmental Protection Agency (U.S. EPA; 1985). Rainbow Trout were the fourth most sensitive species, with a geometric mean of 0.48 mg NH_3/L from 112 studies (min LC50 = 0.158 mg NH_3/L; max LC50 = 1.09 mg NH_3/L). Char, represented by Brook Trout (*Salvelinus fontinalis*), were less sensitive to un-ionized ammonia than *Oncorhynchus* species with an LC50 of 1.0 mg NH_3/L (**Table 4-1**). Lake Trout LC50 data from 1992 were included in the 2013 update to the U.S. EPA ambient aquatic life criteria (U.S. EPA, 2013). The updated U.S. EPA criteria normalized the LC50 data to pH 7 and expressed concentrations in total ammonia nitrogen (TAN). The species mean acute values for Brook Trout and Lake Trout were 156.3 and 159.3 mg TAN/L, indicating Brook Trout and Lake Trout show similar sensitivity to the effects of ammonia under short-term exposure conditions.

Risk Conclusion

Current concentrations of un-ionized ammonia in full-strength porewater (0.35 to 0.57 mg/L) are high enough to cause effects on survival for fish that transiently inhabit the bottom of the pits. However, there is low likelihood that free-swimming fish will be directly exposed to full strength porewater at the water-sediment interface given the habitat preferences of resident fish species in Third Portage Lake

[2] Geometric mean from four studies. Min EC20 = 0.018 mg NH_3/L; max EC20 = 0.181 mg NH_3/L. See Table 6 in EC and HC, 2001.

and the effect of dilution (i.e., porewater has a negligible effect on surface water quality in Goose Pit [AtkinsRéalis, 2024b]). In the Goose Pit hydrodynamic model for simulation 3-B2 (final water cover depth of 8 m), the predicted concentration of total ammonia at the end of closure (November 2043) is 0.5 mg/L (**Appendix D**). Approximately 1.23% of total ammonia occurs in the un-ionized form at pH 8 and a water temperature of 5°C (estimated conditions at depth during closure). Under these conditions, the concentration of un-ionized ammonia at closure would be approximately 0.006 mg NH_3/L. If we conservatively assume 1:10 dilution of porewater (0.57 mg/L) with surface water (0.006 mg/L), the predicted un-ionized ammonia concentration at the sediment-water interface is 0.062 mg/L. At this concentration, we would not expect un-ionized ammonia to cause effects to survival for fish transiently coming in contact with the tailings. Porewater will likely be diluted more than 1:10 in the benthic zone that could plausibly be occupied by fish after the dikes are breached, which will provide an added level of protection for fish.

Table 4-1. Un-ionized ammonia LC50 results for freshwater fish species in Canada (adapted from EC and HC, 2001).

Common name	Species name	No. of studies	LC50 (mg NH_3/L)		
			Geometric Mean	Minimum	Maximum
White perch	*Morone americana*	2	0.279	0.150	0.520
Mountain whitefish	*Prosopium williamsoni*	3	0.289	0.143	0.473
Chinook salmon	*Oncorhynchus tshawytscha*	3	0.442	0.399	0.476
Rainbow trout	*Oncorhynchus mykiss*	112	0.481	0.158	1.090
Pumpkinseed	*Lepomis gibbosus*	4	0.489	0.140	0.860
Coho salmon	*Oncorhynchus kisutch*	8	0.520	0.272	0.880
Cutthroat trout	*Oncorhynchus clarki*	4	0.642	0.520	0.800
Brown trout	*Salmo trutta*	3	0.657	0.597	0.701
Mountain sucker	*Catostomus platyrhynchus*	3	0.685	0.668	0.819
Walleye	*Stizostedion vitreum*	4	0.706	0.510	1.100
Golden shiner	*Notemigonus crysoleucas*	1	0.720	-	-
Golden trout	*Oncorhynchus aguabonita*	1	0.755	-	-
Brook trout	*Salvelinus fontinalis*	2	1.005	0.962	1.050
Smallmouth bass	*Micropterus dolomieu*	4	1.105	0.690	1.780
Largemouth bass	*Micropterus salmoides*	2	1.304	1.000	1.700
Fathead minnow	*Pimephales promelas*	45	1.344	0.240	3.440
White sucker	*Catostomus commersoni*	7	1.349	0.760	2.220
Mottled sculpin	*Cottus bairdi*	1	1.390	-	-
Bluegill	*Lepomis macrochirus*	15	1.406	0.260	2.970
Spotfin shiner	*Cyprinella spiloptera*	3	1.479	1.200	1.620
Channel catfish	*Ictalurus punctatus*	14	1.707	0.500	4.200
Stoneroller	*Comostoma anonalum*	1	1.720	-	-
Green sunfish	*Lepomis cyanellus*	6	1.860	0.590	2.110

4.1.2 Cyanide

Cyanides are organic and/or inorganic compounds that contain the cyano group (CN). Cyanide can occur in various forms in aquatic environments, and each form has unique chemical properties that influence toxicity to aquatic organisms. The form of cyanide in water is largely dependent upon pH but is also influenced by temperature, dissolved oxygen, salinity, and the presence of other ions (B.C. ENV, 2021). The following information describing the relevant cyanide species in aquatic environments was adapted from the B.C. WQG (B.C. ENV, 2021).

- Cyanide ion refers to the single free anion CN^-. Chemically, CN^- behaves similarly to the halide ions chloride (Cl^-), fluoride (F^-), and iodide (I^-).
- Molecular cyanide refers to cyanide in the form of the uncharged, undissociated molecule (HCN). HCN is infinitely soluble in water. Because of its volatility, HCN tends to vaporize into the atmosphere.
- Free cyanide refers to the sum of molecular cyanide and the cyanide ion ($HCN+CN^-$). Equilibrium between the two forms is dependent mainly upon pH and, to a lesser degree, upon temperature. Under normal conditions in freshwater systems, free cyanide is mostly in the form of HCN.
- Cyanate compounds contain the ^-OCN group. Cyanates are produced when alkaline wastewater containing cyanide is treated with chlorine. Cyanate is considerably less toxic than HCN.
- Thiocyanate compounds contain the ^-SCN group. Thiocyanate is considerably less toxic than HCN.

HCN and CN^- are the principal toxic forms of cyanide that are relevant for aquatic life (B.C. ENV, 2021). HCN is more toxic because it is able to cross biological membranes. Inside the cell, cyanide causes toxicity by binding to iron and inhibiting cellular respiration.

Exposure Data

There was not enough porewater in the tailings samples collected and processed in 2022 and 2023 to analyze for the full suite of parameters, including cyanide species. A greater mass of tailings was collected in 2024, which yielded a higher volume of porewater. Free cyanide (HCN) concentrations ranged from 2.1 µg/L to 15 µg/L in the five porewater samples collected in 2024 (three samples exceeded the CCME chronic WQG). Total cyanide concentrations ranged from 85 µg/L to 245 µg/L.

Water Quality Guideline and Relevant Toxicity Data

The CCME WQG of 5 µg/L applies to free cyanide. CCME did not produce a fact sheet for cyanide. Instead, the CCME WQG refers to the original WQG included in the Canadian Council of Resource and Environment Ministers (CCREM) 1987 report. That document referenced toxicity tests that were used to derive the 1984 U.S. EPA acute and chronic criteria of 22 µg/L and 5.2 µg/L, respectively. Ultimately, the Ontario Ministry of Environment guideline of 5 µg/L was adopted based on “more recent literature”.

Information on the recent literature was not provided in CCREM (1987), so our review focused on studies that were cited in technical guidance from the U.S. EPA (1984) and B.C. ENV (2021, reformatted from 1988).

Rainbow Trout were the most sensitive of the 10 freshwater fish species used to derive the U.S. EPA criteria. The species mean acute value (SMAV[3]) was 44.73 µg/L based on 11 tests. Brook Trout (char) were the next most sensitive species (SMAV = 85.80 µg/L; N = 20), followed by Yellow Perch (SMAV = 92.64 µg/L; N = 9) (U.S. EPA, 1984). The SMAV for Rainbow Trout was adopted as the final acute value (FAV) rather than using the 5th percentile from the four most sensitive genus mean acute values because Rainbow Trout is an important recreational and commercial species. The FAV of 44.73 µg/L is divided by two to determine the criterion maximum concentration (CMC), commonly referred to as the "acute criterion". There were insufficient data to derive a chronic criterion using the same methods as CMC; therefore, the chronic criterion of 5.2 µg/L was derived by dividing the FAV (44.73 µg/L) by the acute-to-chronic ratio (ACR) of 8.568[4].

Among different life stages, juvenile fish are more sensitive than embryos/sac-fry. The LC50s (as CN) range from 105 to 507 µg/L for sac-fry compared to approximately 50 to 150 µg/L for swim-up and juvenile fish (B.C. ENV, 2021). Greater sensitivity to cyanide for free-swimming life stages is consistent with the route of exposure (gill) and mode of toxicity (inhibition of cellular respiration). There is also evidence that cyanide toxicity depends on water temperature. A study conducted by Kovacs and Leduc (1982) exposed juvenile Rainbow Trout to HCN at 6, 12, and 18°C in flow-through bioassays, and the 96-hour LC50s were 27 µg/L at 6°C, 40 µg/L at 12°C, and 65 µg/L at 18°C. The lowest no observed effect concentration (NOEC) reported in the same study was 17 µg/L at 6°C (U.S. EPA, 1984). Most acute toxicity tests are conducted in water that is not representative of conditions in northern freshwater environments, so the findings from Kovacs and Leduc (1982) are particularly relevant for assessing risks to fish inhabiting the pits.

The technical appendix to the B.C. WQG included a compilation of guidelines, criteria, and standards from various jurisdictions. The maximum acceptable levels to protect freshwater aquatic life from the long-term effects of cyanide was fairly consistent at about 5 µg/L (B.C. ENV, 2021). B.C. ENV adopted 5 µg/L as the chronic WQG based on the 30-day period the average concentration (a minimum of 5 weekly samples). B.C. ENV concluded that cyanide concentrations below 5 µg/L would result in relatively minor impairment of freshwater fish based on studies used to derive the U.S. EPA (1984) criteria. B.C.

[3] The species mean acute value is the geometric mean of available 48 to 96-hr LC/EC50s for each species.

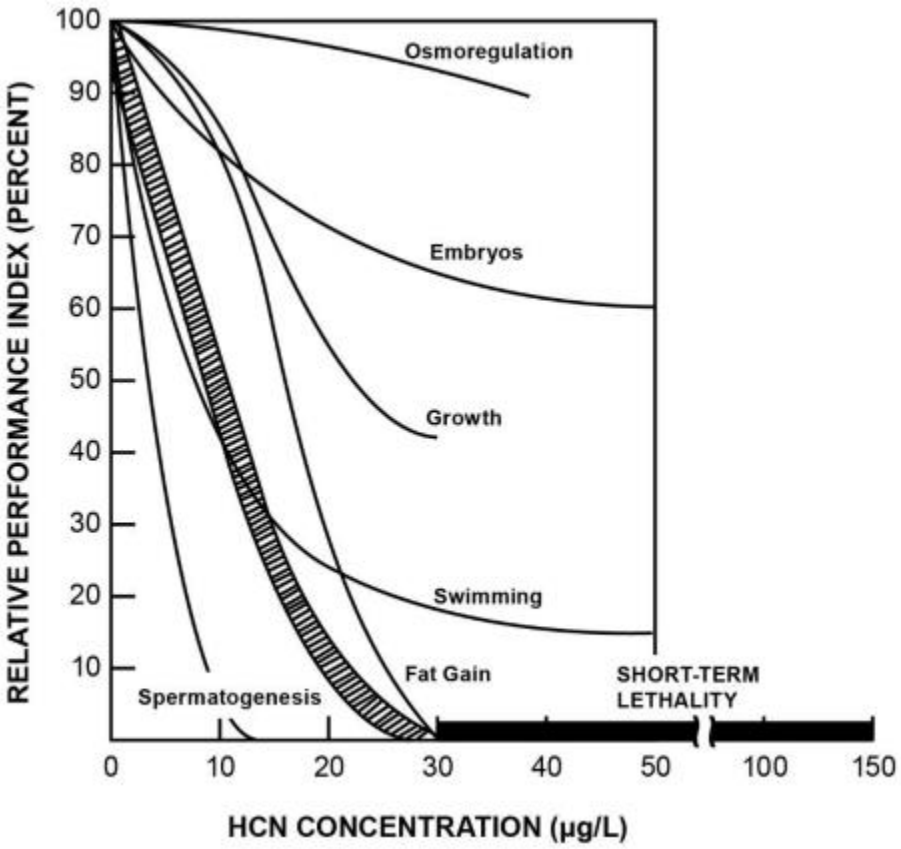
[4] To derive a chronic criterion using an ACR, chronic toxicity test data for longer-term survival, growth, or reproduction must be available for at least three taxa. Chronic toxicity data from four species were used to calculate the ACR of 8.568: *Gammarus* (amphipod), Brook Trout, Fathead Minnow, and Bluegill Sunfish.

ENV also cited the "Relative Performance Index" (Leduc et al., 1982) as justification for the 5 µg/L chronic WQG. The Relative Performance Index attempted to quantify the cumulative sublethal effects to fish from chronic exposure to cyanide. The authors concluded that fish exposed to 10 µg/L free cyanide for 20 to 30 days at 10 to 13°C would see a 50% reduction in "relative performance", but 3 to 5 µg/L free cyanide would result in relatively minimal impairment (B.C. ENV, 2021).

Risk Conclusion

At free cyanide concentrations from 3 to 15 µg/L, fish transiently in contact with the tailings are at low risk of acute and chronic effects from exposure to cyanide in porewater. Ignoring dilution at the sediment-water interface, the maximum concentration of free cyanide measured in porewater was less than the 96-hour NOEC of 17 µg/L for Rainbow Trout at 6°C. Assuming some degree of dilution of porewater at the sediment-water interface, free cyanide concentrations are unlikely to exceed 5 µg/L.

Figure 4-1. Relative Performance Index from Leduc et al. (1982) showing the combined sublethal effects of free cyanide (adapted from B.C. ENV, 2021).



4.1.3 Sulphate

Exposure Data

Sulphate concentrations in the nine porewater samples ranged from 1,040 to 1,290 mg/L (N = 4 in 2022 and N = 5 in 2024). The average sulphate concentration in the 9 samples was 1,187 mg/L. Water hardness in the porewater samples ranged from approximately 550 mg/L to 800 mg/L.

Water Quality Guideline and Relevant Toxicity Data

British Columbia is the only jurisdiction in Canada with a WQG for sulphate. The B.C. WQG for sulphate was updated in 2013 and incorporated hardness as a modifying factor between hardness concentrations of 0 and 250 mg/L. The B.C. WQGs are 128, 218, 309 and 429 mg/L for hardness conditions ranging from 0 to 30, 31 to 75, 76 to 180, and 180 to 250 mg/L, respectively. The B.C. WQG for the different hardness ranges correspond to the LC20 results from a 21-day Rainbow Trout early life stage development test with a two-fold safety factor applied (B.C. ENV, 2013; **Table 4-2**). A sulphate WQG was not established for hardness exceeding 250 mg/L because there were insufficient data to support its calculation at higher hardnesses. The text of the WQG indicated that: "It is recommended that additional toxicity testing on several species is required if natural background water hardness is greater than 250 mg/L".

Table 4-2. Modelled average sulphate effect concentrations for the 21-day Rainbow Trout eyed-egg test (adapted from B.C. ENV, 2013).

Species and Endpoint	Water Hardness (mg/L)	Effect Concentrations in mg/L (confidence intervals in parentheses)		
		EC10	EC20	EC50
Rainbow Trout 21-day early life stage survival (eyed egg to alevin)	6	176 (161 – 192)	255 (238 – 274)	484 (459 – 511)
	50	315 (290 – 341)	435 (408 – 464)	761 (724 – 799)
	100	444 (409 – 482)	618 (580 – 659)	1,093 (1,037 – 1,151)
	250	654 (615 – 695)	857 (819 to 896)	1,379 (1,329 to 1,433)

B.C. ENV also reviewed other sulphate toxicity tests as part of the WQG update. Elphick et al (2011) conducted 7-day tests with Fathead Minnow (growth and survival) in water with hardness of 40, 80, 160, and 320 mg/L. In the very hard water treatment (320 mg/L), the LC10 for early life Fathead Minnow survival was 2,516 mg/L (CI = 1,548 to 4,089). The LC25 for larval Fathead Minnow survival was 6,376 mg/L (lower CI = 2,910; upper confidence interval was not calculated because extrapolation was outside the dataset). The LC50 for effects to growth (dry weight biomass) was 4,304 mg/L (lower CI = 1,584).

Other than the toxicity data reviewed in the B.C. WQG, there are few data on the toxicity of sulphate to fish. The technical appendix for the B.C. WQG referenced a study by Mount et al. (1997) that daphnids

and Fathead Minnow are relatively tolerant to sulphate compared to other major ions (potassium > bicarbonate = magnesium > chloride > sulphate). In that same study, the 96-hour LC50 for Fathead Minnow was 7,960 (6,800–10,000) mg/L (B.C. ENV, 2013).

Risk Conclusion

Sulphate concentrations in undiluted porewater were in the range of 1,000 to 1,300 mg/L. These concentrations are roughly 6- to 8-fold lower than the 96-hour LC50 for Fathead Minnow. Based on the available acute toxicity data, early life stages of resident fish species are at low risk of mortality when exposed to undiluted porewater for short periods.

Early life stages of the resident fish species are unlikely to be exposed to full strength porewater based on habitat preferences (**Section 2.2**). Dilution will also result in lower exposure for fish transiently inhabiting the sediment-water interface. At closure, the concentration of sulphate at depth in Goose Pit is predicted to be 200 mg/L (AtkinsRéalis, 2024b). Using a very conservative dilution scenario of one-part porewater (1,300 mg/L) to 10 parts surface water (200 mg/L), sulphate concentrations at the sediment-water interface would equal 310 mg/L. Dilution will likely be greater than 1:10 based on results of the consolidation model (AtkinsRéalis, 2024a). Therefore, sulphate concentrations at the sediment-water interface are unlikely to exceed the EC20 for early life stage Rainbow Trout survival (857 mg/L). A 20 % effect is widely considered the lowest level that can be reliably distinguished from controls using commonly available statistical methods (Gensemer et al., 2006). An EC20 is also the recommended level of protection for common aquatic species or communities in ecological risk assessment guidance published by B.C. ENV (2023).

4.1.4 Arsenic

Exposure Data

Dissolved arsenic concentrations ranged from 160 to 690 mg/L in the 15 samples collected from 2022 to 2024. The average arsenic concentration for the 15 samples was 0.39 mg/L.

Porewater samples were not collected for arsenic speciation due to limited sample volume and the need to prioritize analyzing other parameters. However, arsenic speciation analysis was conducted on surface water samples from Goose Pit (ST-20i) in April 2024. Arsenate (AsV) was the only form of arsenic detected at 2 m (420 µg/L) and 9 m (428 µg/L), but near the bottom of the pit (38 m), arsenite (AsIII) was the dominant species (69%; 477 µg/L) compared to arsenate (31%, 219 µg/L). The higher proportion of arsenite at depth is due to low oxygen conditions, which favor the reduction of arsenate to arsenite. Of the two arsenic species, arsenite is more mobile and toxic (Kumari et al., 2017). Our assumption is the low oxygen environment in the benthic zone would also lead to a higher proportion of arsenite in porewater compared to arsenate.

Water Quality Guideline and Relevant Toxicity Data

The CCME WQG of 5 µg/L is based on an EC50 of 50 µg/L for effects to *Scenedesmus* (green algae) growth (CCME, 2001). A 10-fold safety factor was applied to lower the CCME WQG to 5 µg/L. Compared to algae and invertebrates, fish are relatively tolerant to the effects of arsenic from surface water exposure. The following toxicity data for fish were included in the CCME factsheet: a 28-d LC50 of 550 µg/L for Rainbow Trout, a 7-day lowest observed effect concentration (LOEC) of 500 µg/L for climbing perch (*A. testudineus*), and a 7-day LOEC of 970 µg/L for catfish (*Clarias batrachus*). Other relevant arsenic toxicity data, presented in **Table 4-3**, were obtained from a pre-consultation report prepared by the United Kingdom Technical Advisory Group in 2007 as part of the derivation process for predicted no-effect concentrations (Lepper et al., 2007). The 96-hour LC50s for Rainbow Trout and Fathead Minnow based on exposure to arsenite were 12,100 µg/L and 12,600 µg/L, respectively. Arctic Grayling are more sensitive to the effects of arsenic based on an LC50 for arsenate of 4,760 µg/L.

As part of the consultation report prepared by Lepper et al (2007), the authors reviewed toxicity studies on coal fly ash from the late 1970's that were cited in the CCME WQG. The technical experts concluded that the data derived from these studies, including the Rainbow Trout 28-d LC50 of 550 µg/L cited in the CCME WQG, was not reliable for setting predicted no-effect concentrations.

Risk Conclusion

Arsenic concentrations in porewater samples from Goose Pit (160 to 690 µg/L) are less than concentrations associated with short-term effects on survival for cold water species (LC50s between 4,760 and 12,600 µg/L). Under longer exposure conditions (28-d), no effect to juvenile Rainbow Trout survival was observed at arsenic (as arsenite) concentrations as high as 961 µg/L, which was the highest concentration in the study (Spehar et al., 1980). Based on the available laboratory toxicity data, arsenic concentrations in undiluted porewater are not expected to cause effects to the survival of early life stage fish under short-term or long-term exposure conditions.

Table 4-3. Arsenic toxicity data for cold water fish species (adapted from Lepper et al. 2007).

Fish Species	Endpoint	Duration	Effect Conc. (µg/L)	Test Substance	Test Conditions
Coho salmon	Significant reduction in migration success	6 months	LOEC = 300	As_2O_3 (III)	pH 8.2; 3.8–13.8°C; hardness 69 mg/L;
Rainbow trout	Mortality	28 days	NOEC = 961 (unbounded)	As_2O_3 (III)	pH 6.9–7.3; 14–16°C; hardness 42–45 mg/L
Rainbow trout	Mortality (egg)	28 days	LC10 = 134 LC50 = 540	$AsNaO_2$ (III)	pH 7.2–7.8; 12–13°C; hardness 93–105 mg/L
Fathead Minnow	Growth ELS test	30 days	NOEC = 530 LOEC = 1,500	As_2O_5 (V)	pH 6.9–7.8; 25°C; hardness 45–48 mg/L;
Fathead Minnow	Growth	29 days	NOEC = 2,130 LOEC = 4,300	$AsNaO_2$ (III)	pH 7.2-8.1; 23–25.8°C; hardness 46–50 mg/L;
Fathead Minnow	Mortality/growth/reproduction	32 days	MATC = 3,330	$AsNaO_2$ (III)	pH 7.4; 25°C; hardness 43.9 mg/L
Fathead Minnow	Weight/no. of young per female	32 days	EC50 = 7,080	$AsNaO_2$ (III)	pH 7.4; 25°C; hardness 43.9 mg/L
Arctic grayling	Mortality (juvenile)	96 hours	LC50 = 4,760	As_2O_5 (V)	pH 7.1– 8; 12°C; hardness 41.3 mg/L;
Rainbow trout	Mortality	96 hours	LC50 = 12,100	As_2O_3 (III)	pH 8.4; 12°C; hardness 250 mg/L
Fathead Minnow	Mortality	96 hours	LC50 = 12,600	$AsNaO_2$ (III)	pH 7.4; 25°C; hardness 43.9 mg/L

Notes

Refer to Lepper et al. (2017) for original study references for these toxicity data.

NOEC = no observed effect concentration; LOEC = lowest observed effect concentration; MATC = maximum acceptable toxicant concentration.

4.1.5 Cobalt

Exposure Data

Dissolved cobalt concentrations ranged from 24 to 131 µg/L in the 15 samples collected from 2022 to 2024. The average concentration across all 15 samples was 55 µg/L (**Table 3-1**).

Water Quality Guideline and Relevant Toxicity Data

Environment and Climate Change Canada (ECCC 2017; ECCC and HC 2017a) developed a long-term (chronic) WQG for dissolved cobalt in freshwater using a species sensitivity distribution (SSD) method. Thirteen toxicity values were included in the SSD: three fish, six invertebrates and four plant/algae species. The three fish species were Rainbow Trout, Fathead Minnow, and Zebrafish (*Brachydanio rerio*). The ECCC WQG incorporated the modifying effect of hardness on cobalt toxicity using a ln-ln regression model. The WQG is valid between hardness 52 and 396 mg/L. Over this hardness range, the WQG ranges from 0.78 to 1.80 µg/L. Under chronic exposure conditions, fish are less sensitive than other receptor

groups. *Hyalella azteca* was the most sensitive species. Rainbow Trout was the least sensitive aquatic species in the SSD with an 81-day EC10 for effects to growth of 2,049 µg/L (ECCC, 2017).

Data on the toxicity of cobalt to 12 aquatic species was recently published by Stubblefield et al. in 2020. The purpose of this study was to produce freshwater cobalt toxicity data that could be used by both the European Union and the United States to develop predicted no-effect concentrations (Europe) and water quality criteria (U.S.). The SSD approach was used to derive acute and chronic effect concentrations similar to ECCC (2017). The acute and chronic SSDs included toxicity test results for Rainbow Trout, Fathead Minnow, and Zebrafish, and the chronic toxicity data for Rainbow Trout and Fathead Minnow came from the same study (Parametrix, 2010) that was included in the ECCC WQG. One of the interesting findings was that fish are comparatively more sensitive to cobalt than other aquatic receptors under short-term exposure (i.e., 96-hour). Of the 11 species included in the acute SSD, Rainbow Trout was the most sensitive non-plant species with an LC50 of 1,512 µg/L (95% CI = 1,343–1,704). *Lemna minor* (duckweed) and *Pseudokirchneriella subcapitata* (green algae) ranked first and second for acute (short-term) effects to growth. The discrepancy between acute and chronic sensitivities for Rainbow Trout is likely due, at least in part, to differences in life-stage sensitivities. The acute test was performed with juvenile Rainbow Trout, whereas the chronic test was conducted with newly fertilized eggs.

Acute and chronic toxicity test results that were reported in EC and HC (2017) and Stubblefield et al. (2020) are provided in **Table 4-4**. Rainbow Trout and Fathead Minnow are cold water species, so the results for these species are the most relevant for comparing against measured cobalt concentrations in porewater samples from Goose Pit.

Risk Conclusion

The maximum porewater concentration measured in Goose Pit of 131 µg/L is approximately 2.5 times lower than the 28-day EC10 of 336 µg/L for effects to growth for early life stage Fathead Minnow, which was the most sensitive fish chronic endpoint included in the review by EC and HC (2017a). Compared to the most sensitive acute endpoint (Rainbow Trout LC50 = 1,500 µg/L), cobalt concentrations in undiluted porewater are more than 10-fold lower than concentrations associated with effects on survival. Assuming current concentrations of cobalt in porewater are representative of future conditions, early life stages of fish are not at risk of effects on survival or growth.

Table 4-4. Relevant data on effects to fish from aqueous exposure to cobalt.

Reported in	Species	Test Duration and Endpoint		Life Stage	Effect Conc. (µg/L) (95% confidence intervals)
EC and HC (2017)	Rainbow trout	81-d EC10	Biomass	Embryo-larval	2,049 [a,b]
	Fathead minnow	34-d EC10	Survival	Larval	339 [a,b]
		28-d EC10	Growth	Larval	336 [b]
	Zebrafish	MATC 16-d	Survival	Embryo-larval	340 [a,b]
		33-d EC10	Biomass	Embryo-larval	1,016 [b]
Stubblefield et al. (2020)	Rainbow trout	96-h LC50	Survival	Juvenile	1,512 (1,343–1,704)
		81-d EC10	Biomass	Embryo-larval	2,171 (1,658–2,842) [c]
		81-d EC20	Biomass	Embryo-larval	2,495 (1,995–3,120)
	Fathead minnow	96-h LC50	Survival	Larval	3,090 (2,720–3,520)
		96-h LC50	Survival	Juvenile	54,100 (45,500–64,300)
		34-d EC10	Survival	Embryo-larval	351.4 (210.6–586.5) [c]
		34-d EC20	Survival	Embryo-larval	409.0 (268.1–623.9)
	Zebrafish	34-d EC10	Survival	Embryo-larval	1,085 (569–2,068) [c]
		33-d EC20	Biomass	Embryo-larval	1,593 (946–2,682)

Notes

Refer to EC and HC (2017) and Stubblefield et al. (2020) for original study references for these toxicity data.

[a] These studies were included in the SSD for the ECCC WQG.

[b] Effect concentrations are normalized to 100 mg/L hardness.

[c] EC10 results in Stubblefield et al. (2020) were also reported in EC and HC (2017). The ECxx values were not normalized to 100 mg/L.

MATC = maximum acceptable toxicant concentration.

4.1.6 Selenium

Exposure Data

Dissolved selenium concentrations ranged from 1.8 to 25 µg/L in the 15 porewater samples collected from 2022 to 2024. The average concentration across all 15 samples was 8.9 µg/L (**Table 3-1**).

The selenium concentration in the bulk tailings samples from Goose Pit ranged from 0.40 to 0.86 µg/g (average 6.2 µg/g; **Table A-2**). We included the selenium concentration data for the tailings samples from Goose Pit because B.C. ENV has a "sediment alert concentration" that is meant to provide an early indication of increased risk of impacts to aquatic organisms.

Relevant Information on Selenium Toxicity for Fish

An extensive amount of research has been published in the last 30 years regarding the effects of selenium in freshwater ecosystems. A thorough overview of the literature was conducted by ECCC and

Health Canada in 2017 as a precursor to derivation of the federal WQG in August 2022 (ECCC and HC, 2017b). The key aspects of selenium ecotoxicology for fish that are relevant for this scope of work are as follows:

- Selenium is an essential micronutrient for all vertebrates, including fish. However, there is a narrow range between essentiality and toxicity of selenium for fish. Freshwater fish are generally considered the most sensitive receptor to adverse effects of selenium.
- Fish accumulate selenium almost entirely from their diet. Inorganic forms of selenium (selenate and selenite) are taken up by microbes and primary producers that form the base of aquatic food webs. These organisms convert selenium into organic forms, which are transferred to successive trophic levels.
- Selenium is maternally transferred to the eggs during development. The most sensitive life stages are egg and larvae and the most common effects are reduced hatching and increased incidence of deformities and edema.

Selenium Guidelines

Selenium concentrations in reproductive tissue (egg or ovary) provide the most accurate data for assessing risks to fish. For this reason, ECCC, B.C. ENV, and the U.S. EPA have all adopted tissue-based guidelines/criteria for assessing risks to fish. In 2022, ECCC derived federal tissue guidelines for egg/ovary (14.7 µg/g dry weight) and whole-body fish tissue (6.7 µg/g dry weight). The guidelines were derived using the SSD approach based on early life stage effects (e.g., EC10 values for hatching success, edema, deformities) for 11 species. Whole-body tissue concentrations were extrapolated from the early life stage results using species-specific egg-ovary to whole-body conversion factors developed by the U.S. EPA. For more information on the fish tissue guidelines derivation, please refer to ECCC (2022).

ECCC did not derive a WQG for selenium because the bioaccumulation and toxicity of selenium to organisms is difficult to accurately predict from the concentration of selenium in water (B.C. ENV, 2014). However, ECCC noted that water quality guidelines from B.C ENV (2014) and U.S. EPA (2016) could be used to assess risks to aquatic life when fish tissue chemistry data are unavailable. The B.C. WQG of 2 µg/L was originally derived in 2001 based on applying an uncertainty factor of 5 to a concentration of 10 µg/L, which represented a LOEC for several fish species and an EC50 for *Daphnia magna*. B.C. ENV validated the WQG of 2 µg/L in 2014 and concluded that it is protective of very sensitive environments and/or species.

In addition to the tissue-based guidelines that B.C. ENV derived in 2014, the 2001 interim sediment quality guideline of 2 µg/g[5] was adopted as an "alert concentration" (B.C. ENV, 2014). Full or interim sediment quality guidelines were not approved in the 2014 ambient WQG update because of insufficient data and uncertainty about the level of protection for fish and birds. Ultimately, the alert concentration of 2 µg/g was considered protective of the most sensitive organisms and therefore suitable for identifying increased risk of impacts to aquatic organisms.

Risk Conclusions

Fish are at low risk of adverse effects from selenium in porewater and tailings for the following reasons. First, the selenium concentrations in porewater and tailings are relatively low compared to concentrations associated with potential effects on fish. The average porewater selenium concentration (8.9 µg/L) exceeds the B.C. ENV WQG of 2 µg/L. However, selenium concentrations in the tailings samples from Goose Pit ranged from 0.40 to 0.86 µg/g (**Table A-4**), which is less than the B.C. ENV alert concentration of 2 µg/. The sediment alert concentration is considered protective of sensitive receptors (i.e., fish and birds) in most aquatic environments (BC ENV, 2014).

It is unlikely that the tailings will support a functionally diverse and abundant benthic invertebrate community in the foreseeable future. Therefore, even if elevated porewater selenium concentrations result in the enrichment of selenium in the benthic food web in Goose Pit and Portage Pit, the low rate of primary and secondary productivity will mean a low dose of selenium based on limited food availability. As noted in the Environmental Assessment (Azimuth, 2005b), "productivity of fish in the project lakes in the Meadowbank region is limited by nutrient availability and [. . .] existing habitat could support many more fish than currently exist if there was the food base to support them." Lake Trout and other large-bodied species forage throughout Third Portage Lake, so the dose of selenium from prey originating in the pits will ultimately be diluted with prey items from other areas of Third Portage Lake.

4.2 LOE 2: Laboratory Toxicity Tests

This LOE evaluates the effects on fish from direct exposure to contaminants in porewater. Water toxicity tests were conducted using Fathead Minnow and Rainbow Trout. Methods and results for each test are discussed below. The lab reports from Nautilus Environmental are provided in **Appendix B-3** (Fathead Minnow) and **Appendix B-4** (Rainbow Trout).

[5] Based on the average of 5 samples collected within an area.

4.2.1 Fathead Minnow: 7-day test for survival and growth

Reclaim water from Goose Pit was collected through the ice between 2 and 3 m at ST-20ii on May 8, 2024, and was sent to Nautilus Environmental (Burnaby, B.C.) for toxicity testing with Fathead Minnow. Water was also collected from the same depth and sent to ALS Environmental (Burnaby, B.C.). The 7-day test for effects on early life stage Fathead Minnow survival and growth was carried out according to the standard protocol (Environment Canada, 2011). Survival and dry weight were measured in each of the treatments (dilutions) at the end of the test and the results were used to calculate the median lethal concentration (7-day LC50) and concentrations which inhibited growth (7-day IC25 and IC50). No quality control issues were reported in the test and the results are considered accurate and reliable.

Mortality was 100 % in undiluted reclaim water and all of the fish perished within the first 48 hours. No effects on survival or growth were observed in any of the other treatments compared to the laboratory control (**Table 4-5**). The concentration of reclaim water associated with a 50% reduction in survival was 69.1 %. The IC50 for effects on growth was 67.4%, which indicates survival was just as sensitive an endpoint as growth.

After reviewing the water chemistry data, senior project advisors at Nautilus concluded that the cause of mortality was likely un-ionized ammonia based on the total ammonia concentration of 31.3 mg/L in the reclaim water sample and the pH of the water (~8). Based on the test conditions (25°C and pH = 8), the predicted concentration of un-ionized ammonia in the undiluted sample of reclaim water was 1.68 mg/L, which corresponds to an LC50 of 1.16 mg/L (**Table 4-5**). The 7-day LC50 value reported here is similar to the 96-hour LC50 value of 1.34 mg/L reported in EC and HC (2001; **Table 4-1**).

4.2.2 Fathead Minnow: 96-hour test for survival

After reviewing the 7-day Fathead Minnow results, a second 96-hour Fathead Minnow test was conducted using the same batch of water to verify that un-ionized ammonia was the cause of mortality in the 7-day test. The 96-hour test included two treatments: (1) an undiluted sample prepared the same as the 100 % treatment from the 7-day test and (2) a treatment where the pH was artificially lowered and stabilized at 7.1 (± 0.3). The pH of the water in this treatment was lowered by pumping mixed air containing 1.0 to 1.5 % CO_2 into the headspace of a semi-enclosed chamber for the duration of the test. This is a standard method for reducing the toxicity of un-ionized ammonia. No quality control issues were reported in the test and the results were considered accurate and reliable.

The pH adjustment and stabilization test confirmed that un-ionized ammonia in undiluted reclaim water is toxic to larval Fathead Minnow (**Table 4-6**). In the 100 % treatment without pH adjustment, the mortality rate was 100 % after 48 hours in 3 of the 4 replicates, and only two fish survived in the fourth replicate at the end of the 96-hour test. When the pH of the water was lowered to 7.1, Fathead Minnow survival increased to 95% at the end of 96-hour test.

Table 4-5. Results of the 7-day Fathead Minnow survival and growth test.

Dilution Series (%)	Mean ± SD		Total Ammonia (mg/L as N)	Un-ionized Ammonia (mg/L as N)
	7-day Survival (%)	7-day Biomass		
Laboratory Control	100 ± 0.0	0.70 ± 0.05	not analyzed	not analyzed
1.56	100 ± 0.0	0.74 ± 0.01	0.49	0.026
3.12	100 ± 0.0	0.89 ± 0.01	0.98	0.053
6.25	100 ± 0.0	0.76 ± 0.02	1.96	0.11
12.5	100 ± 0.0	0.75 ± 0.03	3.91	0.21
25	96.7 ± 6.0	0.75 ± 0.06	7.83	0.42
50	100 ± 0.0	0.68 ± 0.11	15.7	0.84
100	0.0 ± 0.0	0.0 ± 0.00	31.3 (measured)	1.68[a]
LC50 (95% CI)	69.1 (66.0 – 72.3)	--	21.6	1.16
IC25 (95 % CI)	--	55.2 (46.5 – 62.9)	17.3	0.93
IC50 (95% CI)	--	67.4 (60.2 – 73.5)	21.1	1.13

Notes:

[a] According to CCME (2010), un-ionized ammonia accounts for 5.38% of the total ammonia concentration at water temperature of 25°C and pH = 8 (test conditions for the Fathead Minnow tests). 31.3 mg/L total ammonia x 5.38% = 1.68 mg NH_3/L. pH drifted from 8 to 7.5 between water changes (**Appendix B-3**).

Table 4-6. Results of the 96-hour Fathead Minnow test with and without pH adjustment.

pH Adjustment	Concentration (v/v)	96-hour Survival (%)
No	Laboratory Control	100 ± 0.0
No	100	5.0 ± 10.0
Yes	Laboratory Control	97.5 ± 5.0
Yes	100	95.0 ± 5.8

4.2.3 Rainbow Trout: 96-hour test for survival

Additional toxicity testing with Rainbow Trout was conducted in September 2024. The 96-hour Rainbow Trout toxicity test was undertaken to validate the Fathead Minnow test results and compare the relative sensitivity of the two species to reclaim water (surrogate for porewater). Reclaim water was collected on August 10, 2024, from 7 m below the surface at ST-20ii and sent to Nautilus Environmental (Puslinch, Ontario). Water was collected from the same depth and sent to ALS Environmental for chemistry analyses. The 96-hour test used the same method for adjusting and stabilizing pH as the Fathead Minnow Test. The 96-hour Rainbow Trout method uses swim-up fry that have been actively feeding for at least two weeks. Other than the delay between sample collection and test initiation, no quality control issues were identified that have the potential to affect the accuracy and reliability of the toxicity test results. The results of the Rainbow Trout test are provided in **Table 4-7** along with the *in-situ* water quality results collected during the test.

Because of uncertainty about the effect of the extended hold time on the concentrations of POPC, particularly ammonia, we instructed the lab to submit a subsample of water from each test to ALS Environmental for analysis. The results for the sample collected on August 10 and the samples collected by Nautilus in mid-September are provided in **Table 4-8**. Ammonia concentrations were roughly 10 mg/L higher in the samples collected from the test vessels compared to the concentration measured in the sample on August 10 (27 mg/L). The concentrations of sulphate, arsenic, and cobalt in the samples collected by Nautilus were approximately 20 to 30% higher in the samples collected in mid-September compared to results for the sample collected on August 10. The difference in concentration between the two sets of samples could be related to sample handling procedures; field-collected samples were processed immediately whereas the water sent to Nautilus was stored in plastic pails at 4°C for approximately three weeks before the tests. The most important consideration for the risk assessment is that conditions in the laboratory did not underestimate exposure compared to measured porewater concentrations from Goose Pit. The concentrations of cyanide, sulphate, and arsenic in the reclaim water samples were within the range of concentrations measured in porewater; the concentrations of ammonia and cobalt were higher in the reclaim water compared to porewater (**Table 4-8**).

Survival was 100% in the standard 96-hour test and the pH adjustment + stabilization test and no impaired fish were observed in any of the treatments. The results of the standard Rainbow Trout test were somewhat surprising because the predicted concentration of un-ionized ammonia was 1.0 mg/L[6], which is close to the upper limit of 96-hour LC50 values for Rainbow Trout (**Table 4-1**). The pH of the

[6] At 15°C and pH 8, un-ionized ammonia accounts for 2.67% of the total ammonia in solution (CCME, 2010). 2.67% of 37 mg/L total ammonia equals 0.99 mg NH_3/L.

reclaim water was 7.2 at the start of the standard test, so it is plausible that un-ionized ammonia may have comprised a smaller percentage of total ammonia during the first few hours of the test.

4.2.4 Summary

The results from the Fathead Minnow test indicate early life stage fish may be at an increased risk of mortality from exposure to un-ionized ammonia, but only under the highly unlikely scenario of continuous, short-term (1-2 day) exposure to marginally diluted or undiluted porewater (i.e., the LC50 for survival was 69.1%). When test conditions were altered to lower the toxicity of ammonia, Fathead Minnow survival in the full-strength test was similar to the laboratory control treatment.

No reduction in Rainbow Trout survival was observed when early life stage fish were exposed to full-strength reclaim water collected in August 2024. The concentration of total ammonia in this test was approximately 37 mg/L. There is some uncertainty about the concentration of un-ionized ammonia at the beginning of the test. Notwithstanding the uncertainty about un-ionized ammonia, the fact that survival was 100 % in the single concentration test after 96-hours indicates early life stage salmonids are at low risk of effects to survival if future porewater quality is similar to reclaim water quality in August 2024 (**Table A-5**).

Table 4-7. Results of the 96-hour Rainbow Trout test with and without pH adjustment.

Test	Treatment	Survival (%) at 96-hours	Parameter	0 hr	24 hr	48 hr	72 hr	96 hr
Without pH Adjustment	Full strength water	100%	Temp (°C)	14	15	15	15	15
			DO (mg/L)	8.4	-	-	-	9.3
			pH	7.2	8	7.8	7.9	7.8
			Sp Cond (µS/cm)	2406	-	-	-	2415
	Lab Control	100%	Temp (°C)	14	15	15	15	15
			DO (mg/L)	9.7	-	-	-	9.6
			pH	8	8.2	8.1	8.1	8
			Sp Cond (µS/cm)	741	-	-	-	710
With pH Adjustment	Full strength water	100%	Temp (°C)	14	15	15	15	15
			DO (mg/L)	8.4	-	-	-	9.1
			pH	7.2	7.2	7.3	7.1	7.3
			Sp Cond (µS/cm)	2400	-	-	-	2418
	Lab Control	100%	Temp (°C)	14	15	15	15	15
			DO (mg/L)	9.7	-	-	-	9.6
			pH	8	8.1	8.1	8	8
			Sp Cond (µS/cm)	741	-	-	-	719

Table 4-8. Concentrations of parameters of potential concern in reclaim water from the 96-hour Rainbow Trout test compared to concentrations in porewater samples from Goose Pit.

Sample Date	Aug 10, 2024	Sept 9, 2024	Sept 13, 2024		2022-2024
POPC	Reclaim water collected from ST-20ii (7 m)	Water collected at the start of the 96-h test	Standard protocol; water collected at the end of the 96-h test	pH adjustment + stabilization; water collected at the end of the 96-h test	Mean concentration in porewater (min – max)
Ammonia (as N; mg/L)	27.0	37.0	37.0	39.2	24.9 (17.7-28.5)
Cyanide (free; mg/L)	<0.005	0.0046	0.0031	0.0031	0.0067 (0.0021-0.015)
Sulphate (mg/L)	840	1,030	1,040	1,040	1,187 (1,040-1,290)
Arsenic (D) (mg/L)	0.265	0.339	0.332	0.326	0.39 (0.16-0.69)
Cobalt (D) (mg/L)	0.205	0.272	0.268	0.270	0.055 (0.024-0.131)

4.3 Summary and Conclusions

Results from the two lines of evidence indicate that fish are at low risk of effects on survival from transient, short-term exposure to contaminants in porewater. Our assessment is based on the following considerations:

- Under natural conditions, free-swimming life stages for most species are not likely exposed to undiluted porewater in the tailings based on (1) some degree of dilution at the sediment-water interface (conservatively assumed 1:10 for this report), and (2) habitat preferences/movement. Slimy Sculpin and Ninespine Stickleback are the only resident species that may live in close contact with sediment for parts of their life history. However, neither species is prone to inhabiting areas where fine particles are the dominant substrate.
- No effects to Rainbow Trout survival were observed compared to the laboratory control when juvenile fish were exposed to full-strength reclaim water for 96 hours.
- Fathead Minnow showed an increased risk of mortality when exposed to full-strength reclaim water (a surrogate for porewater) for 24 to 48 hours. When the concentration of reclaim water was diluted to approximately 50%, no effects to Fathead Minnow survival or growth were detected compared to laboratory controls.
- Indirect effects on individual fish from dietary exposure within the pits are unknown but unlikely, given that the benthic area is expected to remain devoid of a functional lower trophic level aquatic community for decades or longer. Even if a functional benthic community is established on the tailings, benthic fish/life histories are not expected to forage exclusively within the surface area of the tailings.

Based on the available information, rockfill cover over the tailings is not required to mitigate risks to fish using the pits post-closure after the dikes are breached. Fish are unlikely to come in direct contact with the tailings because the tailings offer poor habitat for foraging and cover. Furthermore, AtkinsRéalis (2024a) predicted that flux of porewater to the overlying water would be negligible after the initial consolidation period (2-3 years). If porewater advection to surface water is nil, then there is no need to promote porewater dilution, especially given the concentrations of POPC in porewater are generally below concentrations associated with short-term effects to survival.

5 REFERENCES

Agnico Eagle. 2020. Addendum to the 2012 No Net Loss Plan for the Meadowbank Site: Implementation of Contingency Option 3 – Construction of Arctic Grayling Spawning Pads. Version 1. December 2020.

Agnico Eagle. 2020. Meadowbank Pore Water Quality Monitoring Program, version 2. Appendix 23 to the Meadowbank Complex 2019 Annual Report. March 2020.

AtkinsRéalis. 2024a. 1D Tailings Consolidation Modelling of Goose Pit. Technical Note. April 30, 2024.

AtkinsRéalis. 2024b. Goose Pit Hydrodynamic Water Quality Forecast. Preliminary Report. October 16, 2024.

Azimuth. 2022. Conditions where mitigation may be required to minimize impacts to aquatic life from disposal of tailings in Goose Pit and Portage Pits. Technical Memorandum prepared for Agnico Eagle Mines Ltd – Meadowbank Division. December 2022.

Azimuth. 2005a. Baseline Aquatic Ecosystem Report. Meadowbank study area lakes, Nunavut. Prepared by Azimuth Consulting Group for Cumberland Resources. October 2005.

Azimuth. 2005b. Aquatic Ecosystem/Fish Habitat Assessment. Meadowbank study area lakes, Nunavut. Prepared by Azimuth Consulting Group for Cumberland Resources. October 2005.

B.C. ENV (B.C. Ministry of Environment and Climate Change Strategy). (2023). Protocol 1 for Contaminated Sites. Detailed Risk Assessment. Version 4. March 20, 2023.

B.C. ENV (B.C. Ministry of Environment and Climate Change Strategy). 2021. Cyanide Water Quality Guidelines (Reformatted from: British Columbia Ministry of Environments and Parks, 1988. Water quality criteria for cyanide). Water Quality Guideline Series, WQG-11. Prov. B.C., Victoria B.C.

B.C. ENV (B.C. Ministry of Environment). 2014. Ambient Water Quality Guidelines for Selenium Technical Report Update. Water Protection and Sustainability Branch. Environmental Sustainability and Strategic Policy Division.

B.C. ENV (B.C. Ministry of Environment). 2013. Ambient Water Quality Guidelines For Sulphate Technical Appendix Update. Water Protection and Sustainability Branch. Environmental Sustainability and Strategic Policy Division.

CCME (Canadian Council of Ministers of the Environment). 2010. Canadian Water Quality Guidelines for the Protection of Aquatic Life – Ammonia.

CCME (Canadian Council of Ministers of the Environment). 2001. Canadian Water Quality Guidelines for the Protection of Aquatic Life – Arsenic.

CCREM (Canadian Council of Resource and Environment Ministers). 1987. Canadian water quality guidelines. Prepared by the Task Force on Water Quality Guidelines.

Edwards, D.A. 2019. Fish Sediment Exposure Workshop – Summary of the proceedings from the Sediment Management Working Group workshop on May 30-31, 2018.

Eldridge, R.J., de Jourdan, B.P. and Hanson, M.L., 2022. A critical review of the availability, reliability, and ecological relevance of Arctic species toxicity tests for use in environmental risk assessment. Environmental Toxicology and Chemistry, 41(1), pp.46-72.

Environment Canada. 2012. Federal Contaminated Sites Action Plan (FCSAP) – Ecological Risk Assessment Guidance. Report prepared for Environment Canada by Azimuth Consulting Group Inc.

Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. Environmental Protection Series, Report EPS 1/RM/22, February 2011. Environment Canada, Environmental Protection, Conservation and Protection, Ottawa, ON. 73 pp.

Environment Canada. 2008. Procedure for pH stabilization during the testing of acute lethality of wastewater effluent to rainbow trout. Environmental Protection Series. Report EPS 1/RM/50. Environment Canada, Science and Technology Branch, Environmental Science and Technology Centre, Ottawa, ON.

EC and HC (Environment Canada and Health Canada). 2001. Ammonia in the Aquatic Environment. Priority Substances List Assessment Report. Canadian Environmental Protection Act, 1999.

ECCC and HC (Environment and Climate Change Canada, and Health Canada). 2017. Screening assessment: cobalt and cobalt-containing substances. May 2017.

ECCC and HC (Environment and Climate Change Canada and Health Canada). 2017. Screening Assessment: Selenium and its Compounds. December 2017.

ECCC (Environment and Climate Change Canada). 2022. Federal environmental quality guidelines: selenium. August 2022.

ECCC (Environment and Climate Change Canada). 2017. Federal environmental quality guidelines: cobalt. May 2017.

Gammons, C.H., Harris, L.N., Castro, J.M., Cott, P.A. and Hanna, B.W., 2009. Creating lakes from open pit mines: processes and considerations, emphasis on northern environments. Can. Tech. Rep. Fish. Aquat. Sci. 2826: iX + 106 p.

Gensemer, R.W., DeForest, D.K., Cardwell, R.D., Dzombak, D., Santore, R. and Stewart, M., 2006. Reassessment of cyanide ambient water quality criteria: An integrated approach to the protection of the aquatic environment. Water Environment Foundation, WEFTEC, 6, pp.5709-5718.

Jezierska, B. and Witeska, M., 2006. The metal uptake and accumulation in fish living in polluted waters. In Soil and water pollution monitoring, protection and remediation (pp. 107-114). Springer Netherlands.

Kovacs, T.G. and Leduc, R., 1982. Effects of pH and temperature on the toxicity of cyanide to rainbow trout. Environmental Pollution, 29(3), pp.179-188.

Kumari, B., Kumar, V., Sinha, A.K., Ahsan, J., Ghosh, A.K., Wang, H. and DeBoeck, G., 2017. Toxicology of arsenic in fish and aquatic systems. Environmental chemistry letters, 15, pp.43-64.

Leduc, G., Pierce, R. C., and McCracken, I. R. 1982. The Effects of Cyanides on Aquatic Organisms with Emphasis Upon Freshwater Fishes. National Research Council Canada No. 19246. Associate Committee on Scientific Criteria for Environmental Quality, Ottawa.

Léger, J.A., Athanasio, C.G., Zhera, A., Chauhan, M.F. and Simmons, D.B., 2021. Hypoxic responses in Oncorhynchus mykiss involve angiogenesis, lipid, and lactate metabolism, which may be triggered by the cortisol stress response and epigenetic methylation. Comparative Biochemistry and Physiology Part D: Genomics and Proteomics, 39, p.100860.

Lepper P, Sorokin N, Maycock D, Crane M, Atkinson C, Hope S-J, Comber S. 2007. Preconsultation report: Proposed EQS for water framework directive annex VIII substances: arsenic (total dissolved). Science report: SC040038/SR3. SNIFFER Report: WFD52(iii). (Environment Agency: Bristol, UK) p. 91. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291226/scho0407blvu-e-e.pdf

Lund, M.A. and Blanchette, M.L., 2023. Closing pit lakes as aquatic ecosystems: Risk, reality, and future uses. Wiley Interdisciplinary Reviews: Water, 10(4), p.e1648.

Randall, D.J. and Tsui, T.K.N., 2002. Ammonia toxicity in fish. Marine pollution bulletin, 45(1-12), pp.17-23.

Richardson, E. S., Reist, J. D., & Minns, C. K. 2001. Life history characteristics of freshwater fishes occurring in the Northwest Territories and Nunavut, with major emphasis on lake habitat requirements. Fisheries and Oceans.

Rohr, J.R., Salice, C.J. and Nisbet, R.M., 2016. The pros and cons of ecological risk assessment based on data from different levels of biological organization. Critical Reviews in Toxicology, 46(9), pp.756-784.

Spehar, R.L., Fiandt, J.T., Anderson, R.L. and DeFoe, D.L., 1980. Comparative toxicity of arsenic compounds and their accumulation in invertebrates and fish. Archives of environmental contamination and toxicology, 9, pp.53-63.

Stubblefield, W.A., Van Genderen, E., Cardwell, A.S., Heijerick, D.G., Janssen, C.R. and De Schamphelaere, K.A., 2020. Acute and chronic toxicity of cobalt to freshwater organisms: using a species sensitivity distribution approach to establish international water quality standards. Environmental toxicology and chemistry, 39(4), pp.799-811.

Uddin, M.H., Ritu, J.R., Putnala, S.K., Rachamalla, M., Chivers, D.P. and Niyogi, S., 2024. Selenium toxicity in fishes: A current perspective. Chemosphere, p.143214.

U.S. EPA (United States Environmental Protection Agency). Water Quality Criteria for Cyanide. Office of Water, 1984.

APPENDICES

APPENDIX A
POREWATER AND TAILINGS CHEMISTRY RESULTS

Table A-1. Porewater chemistry results, 2022

Media and Year							Porewater - 2022				
Sample ID	**Lowest Detection Limit**	**Units**	**Aquatic Life Guideline - Long Term Chronic[a]**				**BG-1**	**BG-2**	**BG-3**	**BG-4**	**BG-5**
Sampling Depth			**Value**	**Source**	**Year**	**Notes**	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm
Water Depth at Station (m)							23	16	10	9	16
Date Sampled							12-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22
Lab Sample ID							VA22B9759-011	VA22B9759012	VA22B9759013	VA22B9759014	VA22B9759015
Physical Tests											
Conductivity	2	µS/cm					NA	NA	NA	NA	NA
Alkalinity - Bicarbonate	1	mg/L					NA	49	110	116	104
Alkalinity - Carbonate	1	mg/L					NA	*<1*	*<1*	*<1*	*<1*
Alkalinity - Hydroxide	1	mg/L					NA	*<1*	*<1*	*<1*	*<1*
Alkalinity - Total (as $CaCO_3$)	1	mg/L					NA	49	110	116	104
Hardness (as $CaCO_3$), dissolved	0.6	mg/L					705	681	633	551	629
Turbidity	0.1	NTU					NA	NA	NA	NA	NA
pH (Laboratory)	0.1	pH units	6.5-9.0	CCME	1987		NA	7.53	7.94	7.98	7.92
Anions and Nutrients (mg/L)											
Ammonia (as N)	0.005	mg/L	0.855	CCME	2010	WQG is for pH = 8.0 and temperature = 10 °C; converted to ammonia (as N) using the formula in the fact sheet	NA	NA	NA	NA	NA
Bromide	0.05	mg/L					NA	*<1*	1.24	1.06	1.03
Chloride	0.1	mg/L	120	CCME	2011		NA	100	95	83.7	81.1
Fluoride	0.4	mg/L	0.12	CCME	2002		NA	*<0.4*	*<0.4*	*<0.4*	*<0.4*
Nitrate (as N)	0.1	mg/L	3	CCME	2012		NA	0.926	*<0.1*	*<0.1*	1.05
Nitrite (as N)	0.02	mg/L	0.06	CCME	1987		NA	**0.0747**	*<0.02*	*<0.02*	*<0.02*
Ortho Phosphate (as P)	0.001	mg/L					NA	NA	NA	NA	NA
Phosphorus (P) - Total Diss.	0.002	mg/L					NA	NA	NA	NA	NA
Reactive Silica (as SiO_2)	0.5	mg/L					NA	NA	NA	NA	NA
Sulphate (SO_4)	0.3	mg/L	429	BC ENV	2013	WQG applies when hardness is 181 - 250 mg/L; For hardness > 250 mg/L WQG needs to be determined based on site water	NA	**1180**	**1170**	**1040**	**1070**
Cyanides (mg/L)											
Free Cyanide	0.001	mg/L	0.005	CCME	1987		NA	NA	NA	NA	NA
Total Cyanide	0.001	mg/L					NA	NA	NA	NA	NA
Total Cyanate (CNO-)	0.2	mg/L					NA	NA	NA	NA	NA
Thiocyanate	0.5	mg/L					NA	NA	NA	NA	NA
Organic / Inorganic Carbon (mg/L)											
Dissolved Organic Carbon	0.5	mg/L					25.9	30.3	24.9	20.6	12.2
Dissolved Metals (mg/L)											
Aluminum	0.001	mg/L	2.0	ECCC	2024	FWQG (µg/L) = exp([0.645 × ln(DOC)] + [2.255 × ln(hardness)] + [1.995 × pH] + [-0.284 × (ln(hardness) × pH)] -9.898) WQG applies to the total fraction valid for water between hardness 10 and 430 mg/L, pH 6 and 8.7, and DOC 0.08 and 12.3 mg/L Value is for pH = 8.0, DOC = 12.3 mg /L, and hardness = 430 mg/L	0.0169	0.0115	0.01	0.0131	0.012
Antimony	0.0001	mg/L	0.07	BC ENV	2023		0.0104	0.0133	0.0242	0.0381	0.0208
Arsenic	0.0001	mg/L	0.005	CCME	1997		**0.689**	**0.636**	**0.439**	**0.235**	**0.385**
Barium	0.0001	mg/L	1	BC ENV	2017		0.0197	0.0224	0.0252	0.0213	0.0302
Beryllium	0.0001	mg/L	0.00013	BC ENV	2000		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth	0.00005	mg/L					*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Boron	0.01	mg/L	1.5	CCME	2009		0.226	0.308	0.282	0.202	0.214

Table A-1. Porewater chemistry results, 2022

Media and Year							Porewater - 2022				
Sample ID	**Lowest Detection Limit**	**Units**	**Aquatic Life Guideline - Long Term Chronic[a]**				**BG-1**	**BG-2**	**BG-3**	**BG-4**	**BG-5**
Sampling Depth			**Value**	**Source**	**Year**	**Notes**	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm
Water Depth at Station (m)							23	16	10	9	16
Date Sampled							12-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22
Lab Sample ID							VA22B9759-011	VA22B9759012	VA22B9759013	VA22B9759014	VA22B9759015
Cadmium	0.000005	mg/L	0.00037	CCME	2014	WQG applies at hardness > 280 mg/L	0.000116	*<0.000155*	*<0.0001*	*<0.00015*	*<0.000065*
Calcium	0.05	mg/L					233	232	217	189	222
Cesium	0.00001	mg/L					0.000046	0.000049	0.000028	0.00003	0.000072
Chromium	0.0005	mg/L	0.005	ECCC	2018	CCME 1997 WQG for CrVI = 0.001 mg/L	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Cobalt	0.0001	mg/L	0.0018	ECCC	2017	WQG = exp((0.414[ln(hardness)] – 1.887); valid for water with hardness between 52-396 mg/L	**0.0235**	**0.0428**	**0.0476**	**0.067**	**0.131**
Copper	0.0002	mg/L	0.045 - 0.14	ECCC	2021	Biotic ligand model	0.066	0.0649	0.00518	0.00349	0.0009
Iron	0.01	mg/L	0.76	ECCC	2024	Guideline for water with pH = 8 and DOC = 10.8 mg/L	*<0.02*	*<0.02*	0.022	*<0.02*	0.021
Lead	0.00005	mg/L	0.02 - 0.034	BC ENV	2024	WQG (µg/L) = exp(0.514 [ln(DOC)] + 0.214[ln(hardness)] + 0. 4354)/1000; WQG applies to the dissolved fraction	0.0013	0.0008	0.0001	0.0011	0.00050
Lithium	0.001	mg/L					0.0054	0.0074	0.0058	0.0139	0.0104
Magnesium	0.005	mg/L					30	24.8	22.2	19.3	18.2
Manganese	0.0001	mg/L	0.32 - 0.86	CCME	2019	WQG is pH and hardness-dependent	0.104	0.0819	0.086	0.0889	0.0831
Mercury	0.000005	mg/L	0.000020	BC ENV	2021	CCME 2003 WQG = 0.000026 mg/L	*<0.000025*	*<0.000005*	*<0.000005*	*<0.000005*	*<0.000005*
Molybdenum	0.00005	mg/L	7.6	BC ENV	2021		0.106	0.108	0.0923	0.0869	0.1
Nickel	0.0005	mg/L	0.15	CCME	1987	WQG when hardness > 180 mg/L	0.0266	0.0345	0.0531	0.0427	0.0282
Phosphorus	0.05	mg/L					*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Potassium	0.05	mg/L					175	150	142	128	139
Rubidium	0.0002	mg/L					0.106	0.0742	0.0883	0.0731	0.0741
Selenium	0.00005	mg/L	0.002	BC ENV	2014	CCME 1987 WQG = 0.001 mg/L	**0.020**	**0.025**	**0.0095**	**0.0033**	**0.0060**
Silicon	0.05	mg/L					4.39	4.2	5.14	4.6	5.14
Silver	0.00001	mg/L	0.00025	CCME	2015	WQG applies to total (unfiltered) fraction	0.000071	**0.000418**	*<0.00002*	*<0.00002*	*<0.00002*
Sodium	0.05	mg/L					273	237	230	197	216
Strontium	0.0002	mg/L	2.5	ECCC	2020		0.714	0.649	0.681	0.619	0.703
Sulfur	0.5	mg/L					535	467	446	350	408
Tellurium	0.0002	mg/L					*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*
Thallium	0.00001	mg/L	0.0008	CCME	1999		0.000028	0.000033	*<0.00002*	*<0.00002*	*<0.00002*
Thorium	0.0001	mg/L					*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Tin	0.0001	mg/L					0.00241	0.00096	0.0002	*<0.0002*	*<0.0002*
Titanium	0.0003	mg/L					*<0.0006*	*<0.0006*	*<0.0006*	*<0.0006*	*<0.0006*
Tungsten	0.0001	mg/L					0.00224	0.00339	0.00337	0.00335	0.0044
Uranium	0.00001	mg/L	0.015	CCME	2011		0.00377	0.00316	0.0141	0.011	0.0079
Vanadium	0.0005	mg/L	0.12	ECCC	2016		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc	0.001	mg/L	0.17 - 0.29	CCME	2018	WQG = exp(0.947[ln(hardness)] - 0.815[pH] + 0.398[ln(DOC)] + 4.625). The WQG equation is valid between hardness 23.4 and 399 mg $CaCO_3$/L, pH 6.5 and 8.13 and DOC 0.3 - 22.9 mg/L.	0.0047	0.0024	*<0.002*	*<0.002*	*<0.002*
Zirconium	0.0002	mg/L					*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*

[a] CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life. FEQG (Federal Environmental Quality Guidelines). BC MOE (British Columbia Ministry of Environment and Climate Change Strategy).

Shaded and bold values exceed the Aquatic Life Guideline.

Italicized numbers are below detection limits.

NA = not analyzed

Table A-2. Porewater chemistry results, 2023

Media and Year							Porewater - 2023				
Sample ID	**Lowest Detection Limit**	**Units**	**Aquatic Life Guideline - Long Term Chronic[a]**				**BG-1**	**BG-4**	**BG-5**	**PW_ST-20i**	**PW_ST-20ii**
Sampling Depth							top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm
Water Depth at Station (m)							27	13	12	44	32
Date Sampled							23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23
Lab Sample ID			**Value**	**Source**	**Year**	**Notes**	VA23C0590-001	VA23C0590-002	VA23C0590-003	VA23C0590-004	VA23C0590-005
Physical Tests											
Conductivity	2	µS/cm					NA	NA	NA	NA	NA
Alkalinity - Bicarbonate	1	mg/L					NA	NA	NA	NA	NA
Alkalinity - Carbonate	1	mg/L					NA	NA	NA	NA	NA
Alkalinity - Hydroxide	1	mg/L					NA	NA	NA	NA	NA
Alkalinity - Total (as $CaCO_3$)	1	mg/L					NA	NA	NA	NA	NA
Hardness (as $CaCO_3$), dissolved	0.6	mg/L					732	768	682	663	640
Turbidity	0.1	NTU					NA	NA	NA	NA	NA
pH (Laboratory)	0.1	pH units	6.5-9.0	CCME	1987		NA	NA	NA	NA	NA
Anions and Nutrients (mg/L)											
Ammonia (as N)	0.005	mg/L	0.855	CCME	2010	WQG is for pH = 8.0 and temperature = 10 °C; converted to ammonia (as N) using the formula in the fact sheet	NA	NA	NA	NA	NA
Bromide	0.05	mg/L					NA	NA	NA	NA	NA
Chloride	0.1	mg/L	120	CCME	2011		NA	NA	NA	NA	NA
Fluoride	0.4	mg/L	0.12	CCME	2002		NA	NA	NA	NA	NA
Nitrate (as N)	0.1	mg/L	3	CCME	2012		NA	NA	NA	NA	NA
Nitrite (as N)	0.02	mg/L	0.06	CCME	1987		NA	NA	NA	NA	NA
Ortho Phosphate (as P)	0.001	mg/L					NA	NA	NA	NA	NA
Phosphorus (P) - Total Diss.	0.002	mg/L					NA	NA	NA	NA	NA
Reactive Silica (as SiO_2)	0.5	mg/L					NA	NA	NA	NA	NA
Sulphate (SO_4)	0.3	mg/L	429	BC ENV	2013	WQG applies when hardness is 181 - 250 mg/L; For hardness > 250 mg/L WQG needs to be determined based on site water	NA	NA	NA	NA	NA
Cyanides (mg/L)											
Free Cyanide	0.001	mg/L	0.005	CCME	1987		NA	NA	NA	NA	NA
Total Cyanide	0.001	mg/L					NA	NA	NA	NA	NA
Total Cyanate (CNO-)	0.2	mg/L					NA	NA	NA	NA	NA
Thiocyanate	0.5	mg/L					NA	NA	NA	NA	NA
Organic / Inorganic Carbon (mg/L)											
Dissolved Organic Carbon	0.5	mg/L					29.7	27.5	25.1	15.3	10.8
Dissolved Metals (mg/L)											
Aluminum	0.001	mg/L	1.7	ECCC	2024	FWQG (µg/L) = exp([0.645 × ln(DOC)] + [2.255 × ln(hardness)] + [1.995 × pH] + [-0.284 × (ln(hardness) × pH)] -9.898) WQG applies to the total fraction valid for water between hardness 10 and 430 mg/L, pH 6 and 8.7, and DOC 0.08 and 12.3 mg/L Value is for pH = 8.0, DOC = 12.3 mg /L, and hardness = 430 mg/L	0.0105	0.0069	0.012	0.011	0.0114
Antimony	0.0001	mg/L	0.07	BC ENV	2023		0.0266	0.00608	0.0202	0.0184	0.0115
Arsenic	0.0001	mg/L	0.005	CCME	1997		**0.216**	**0.346**	**0.603**	**0.158**	**0.347**
Barium	0.0001	mg/L	1	BC ENV	2017		0.0223	0.0228	0.0206	0.0224	0.0221
Beryllium	0.0001	mg/L	0.00013	BC ENV	2000		*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Bismuth	0.00005	mg/L					*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Boron	0.01	mg/L	1.5	CCME	2009		0.231	0.24	0.287	0.192	0.212

Table A-2. Porewater chemistry results, 2023

Media and Year							Porewater - 2023				
Sample ID	Lowest Detection Limit	Units	Aquatic Life Guideline - Long Term Chronic[a]				BG-1	BG-4	BG-5	PW_ST-20i	PW_ST-20ii
Sampling Depth							top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm
Water Depth at Station (m)							27	13	12	44	32
Date Sampled							23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23
Lab Sample ID			Value	Source	Year	Notes	VA23C0590-001	VA23C0590-002	VA23C0590-003	VA23C0590-004	VA23C0590-005
Cadmium	0.000005	mg/L	0.00037	CCME	2014	WQG applies at hardness > 280 mg/L	*<0.000425*	*<0.000075*	*<0.00066*	*<0.000085*	*<0.000335*
Calcium	0.05	mg/L					235	262	227	213	219
Cesium	0.00001	mg/L					0.000024	0.000031	0.000044	0.000031	0.000046
Chromium	0.0005	mg/L	0.005	ECCC	2018		*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Cobalt	0.0001	mg/L	0.0018	ECCC	2017	WQG = exp((0.414[ln(hardness)] – 1.887); valid for water with hardness between 52-396 mg/L	**0.0448**	**0.0439**	**0.0432**	**0.062**	**0.0816**
Copper	0.0002	mg/L	0.045 - 0.14	ECCC	2021	Biotic ligand model	0.00133	0.00057	0.012	0.00084	0.00247
Iron	0.01	mg/L	0.76	ECCC	2024	Guideline for water with pH = 8 and DOC = 10.8 mg/L	0.036	0.119	*<0.02*	*<0.02*	*<0.02*
Lead	0.00005	mg/L	0.02 - 0.034	BC ENV	2024	WQG (µg/L) = exp(0.514 [ln(DOC)] + 0.214[ln(hardness)] + 0. 4354)/1000; WQG applies to the dissolved fraction	0.00063	0.00022	0.0026	0.0004	0.0045
Lithium	0.001	mg/L					0.0064	0.0044	0.0085	0.0109	0.0149
Magnesium	0.005	mg/L					35.3	27.6	28.1	31.9	22.7
Manganese	0.0001	mg/L	0.32 - 0.86	CCME	2019	WQG is pH and hardness-dependent	0.113	0.155	0.0752	0.137	0.126
Mercury	0.000005	mg/L	0.000020	BC ENV	2021	CCME 2003 WQG = 0.000026 mg/L	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Molybdenum	0.00005	mg/L	7.6	BC ENV	2021		0.127	0.236	0.106	0.132	0.104
Nickel	0.0005	mg/L	0.15	CCME	1987	WQG when hardness > 180 mg/L	0.0675	0.033	0.0335	0.0654	0.0663
Phosphorus	0.05	mg/L					*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Potassium	0.05	mg/L					153	129	143	140	132
Rubidium	0.0002	mg/L					0.107	0.0611	0.0924	0.0724	0.0753
Selenium	0.00005	mg/L	0.002	BC ENV	2014	CCME 1987 WQG = 0.001 mg/L	**0.0058**	**0.0080**	**0.015**	**0.0028**	**0.0070**
Silicon	0.05	mg/L					4.21	4.37	4.68	4.95	4.91
Silver	0.00001	mg/L	0.00025	CCME	2015	WQG applies to total (unfiltered) fraction	*<0.00002*	*<0.00002*	*<0.00002*	*<0.00002*	*<0.00002*
Sodium	0.05	mg/L					275	252	238	231	222
Strontium	0.0002	mg/L	2.5	ECCC	2020		0.764	0.764	0.674	0.774	0.714
Sulfur	0.5	mg/L					496	462	436	427	411
Tellurium	0.0002	mg/L					*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*
Thallium	0.00001	mg/L	0.0008	CCME	1999		*<0.00002*	*<0.00002*	0.000023	*<0.00002*	0.000034
Thorium	0.0001	mg/L					*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Tin	0.0001	mg/L					0.00046	0.00033	*<0.0002*	*<0.0002*	*<0.0002*
Titanium	0.0003	mg/L					*<0.0006*	*<0.0006*	*<0.0006*	*<0.0006*	*<0.0006*
Tungsten	0.0001	mg/L					0.00217	0.0033	0.00278	0.00189	0.00374
Uranium	0.00001	mg/L	0.015	CCME	2011		0.0138	0.0108	0.00706	0.0132	0.0103
Vanadium	0.0005	mg/L	0.12	ECCC	2016		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc	0.001	mg/L	0.17 - 0.29	CCME	2018	WQG = exp(0.947[ln(hardness)] - 0.815[pH] + 0.398[ln(DOC)] + 4.625). The WQG equation is valid between hardness 23.4 and 399 mg $CaCO_3$/L, pH 6.5 and 8.13 and DOC 0.3 - 22.9 mg/L.	0.0035	*<0.002*	0.0034	*<0.002*	0.0023
Zirconium	0.0002	mg/L					*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*

[a] CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life. FEQG (Federal Environmental Quality Guidelines). BC MOE (British Columbia Ministry of Environment and Climate Change Strategy).

Shaded and bold values exceed the Aquatic Life Guideline.

Italicized numbers are below detection limits.

NA = not analyzed

Table A-3. Porewater chemistry results, 2024

Media and Year							Porewater - 2024				
Sample ID	**Lowest Detection Limit**	**Units**	**Aquatic Life Guideline - Long Term Chronic[a]**				**PW-BG-1**	**PW-BG-4**	**PW-BG-5**	**PW-ST-20i**	**PW-ST-20ii**
Sampling Depth							top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm
Water Depth at Station (m)							30	19	44	48	38
Date Sampled							10-Aug-2024	10-Aug-2024	10-Aug-2024	11-Aug-2024	10-Aug-2024
Lab Sample ID			**Value**	**Source**	**Year**	**Notes**	VA24C2005-003	VA24C2005-004	VA24C2005-005	VA24C2005-001	VA24C2005-002
Physical Tests											
Conductivity	2	µS/cm					3090	2940	3050	3040	2900
Alkalinity - Bicarbonate	1	mg/L					87.8	89	86	112	54.9
Alkalinity - Carbonate	1	mg/L					*<1*	*<1*	*<1*	*<1*	*<1*
Alkalinity - Hydroxide	1	mg/L					*<1*	*<1*	*<1*	*<1*	*<1*
Alkalinity - Total (as $CaCO_3$)	1	mg/L					87.8	89	86	112	54.9
Hardness (as $CaCO_3$), dissolved	0.6	mg/L					684	803	693	707	762
Turbidity	0.1	NTU					0.12	0.4	0.29	0.28	0.54
pH (Laboratory)	0.1	pH units	6.5-9.0	CCME	1987		8.11	8.11	8.08	8.19	7.88
Anions and Nutrients (mg/L)											
Ammonia (as N)	0.005	mg/L	0.855	CCME	2010	WQG is for pH = 8.0 and temperature = 10 °C; converted to ammonia (as N) using the formula in the fact sheet	**28.3**	**23.5**	**26.4**	**28.5**	**17.7**
Bromide	0.05	mg/L					*<1*	*<1*	1.15	*<1*	*<1*
Chloride	0.1	mg/L	120	CCME	2011		97.7	97.7	98.1	97.4	94.4
Fluoride	0.4	mg/L	0.12	CCME	2002		*<0.4*	*<0.4*	*<0.4*	*<0.4*	*<0.4*
Nitrate (as N)	0.1	mg/L	3	CCME	2012		*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Nitrite (as N)	0.02	mg/L	0.06	CCME	1987		*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.02*
Ortho Phosphate (as P)	0.001	mg/L					0.0079	0.003	0.0038	0.0074	0.0045
Phosphorus (P) - Total Diss.	0.002	mg/L					0.015	0.0079	0.0108	0.0174	0.0154
Reactive Silica (as SiO_2)	0.5	mg/L					12	11.1	12.3	13	8.27
Sulphate (SO_4)	0.3	mg/L	429	BC ENV	2013	WQG applies when hardness is 181 - 250 mg/L; For hardness > 250 mg/L WQG needs to be determined based on site water	**1270**	**1200**	**1290**	**1220**	**1240**
Cyanides (mg/L)											
Free Cyanide	0.001	mg/L	0.005	CCME	1987		0.0036	**0.0054**	**0.0146**	**0.008**	0.0021
Total Cyanide	0.001	mg/L					0.0847	0.245	0.112	0.223	0.129
Total Cyanate (CNO-)	0.2	mg/L					*<2*	*<2*	*<2*	3.6	*<2*
Thiocyanate	0.5	mg/L					95.8	69.3	87.3	95.8	69.4
Organic / Inorganic Carbon (mg/L)											
Dissolved Organic Carbon	0.5	mg/L					22.3	19.8	28	23.5	18.7
Dissolved Metals (mg/L)											
Aluminum	0.001	mg/L	1.7	ECCC	2024	FWQG (µg/L) = exp([0.645 × ln(DOC)] + [2.255 × ln(hardness)] + [1.995 × pH] + [-0.284 × (ln(hardness) × pH)] -9.898) WQG applies to the total fraction valid for water between hardness 10 and 430 mg/L, pH 6 and 8.7, and DOC 0.08 and 12.3 mg/L Value is for pH = 8.0, DOC = 12.3 mg /L, and hardness = 430 mg/L	0.0129	0.011	0.0086	0.0132	0.0104
Antimony	0.0001	mg/L	0.07	BC ENV	2023		0.0111	0.0133	0.0243	0.0242	0.00494
Arsenic	0.0001	mg/L	0.005	CCME	1997		**0.61**	**0.235**	**0.177**	**0.346**	**0.423**
Barium	0.0001	mg/L	1	BC ENV	2017		0.0236	0.0259	0.0209	0.0212	0.0255
Beryllium	0.0001	mg/L	0.00013	BC ENV	2000		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth	0.00005	mg/L					*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Boron	0.01	mg/L	1.5	CCME	2009		0.317	0.304	0.241	0.267	0.215

Table A-3. Porewater chemistry results, 2024

Media and Year							Porewater - 2024				
Sample ID	**Lowest Detection Limit**	**Units**	**Aquatic Life Guideline - Long Term Chronic[a]**				**PW-BG-1**	**PW-BG-4**	**PW-BG-5**	**PW-ST-20i**	**PW-ST-20ii**
Sampling Depth							top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm	top 3-5 cm
Water Depth at Station (m)							30	19	44	48	38
Date Sampled							10-Aug-2024	10-Aug-2024	10-Aug-2024	11-Aug-2024	10-Aug-2024
Lab Sample ID			**Value**	**Source**	**Year**	**Notes**	VA24C2005-003	VA24C2005-004	VA24C2005-005	VA24C2005-001	VA24C2005-002
Cadmium	0.000005	mg/L	0.00037	CCME	2014	WQG applies at hardness > 280 mg/L	0.000106	*<0.000045*	*<0.00004*	*<0.000045*	*<0.000085*
Calcium	0.05	mg/L					228	261	235	239	271
Cesium	0.00001	mg/L					0.000034	*<0.00002*	0.000032	0.000034	0.00005
Chromium	0.0005	mg/L	0.005	ECCC	2018		*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Cobalt	0.0001	mg/L	0.0018	ECCC	2017	WQG = exp((0.414[ln(hardness)] – 1.887); valid for water with hardness between 52-396 mg/L	**0.0408**	**0.069**	**0.0473**	**0.0478**	**0.033**
Copper	0.0002	mg/L	0.045 - 0.14	ECCC	2021	Biotic ligand model	0.00487	0.00051	0.00226	*<0.0004*	0.00046
Iron	0.01	mg/L	0.76	ECCC	2024	Guideline for water with pH = 8 and DOC = 10.8 mg/L	0.023	0.078	0.034	0.097	0.053
Lead	0.00005	mg/L	0.02 - 0.034	BC ENV	2024	WQG (µg/L) = exp(0.514 [ln(DOC)] + 0.214[ln(hardness)] + 0. 4354)/1000; WQG applies to the dissolved fraction	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.00017
Lithium	0.001	mg/L					0.0098	0.0048	0.0054	0.004	0.0044
Magnesium	0.005	mg/L					27.8	36.7	25.7	26.7	20.8
Manganese	0.0001	mg/L	0.32 - 0.86	CCME	2019	WQG is pH and hardness-dependent	0.089	0.142	0.0771	0.09	0.0643
Mercury	0.000005	mg/L	0.000020	BC ENV	2021	CCME 2003 WQG = 0.000026 mg/L	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Molybdenum	0.00005	mg/L	7.6	BC ENV	2021		0.0778	0.126	0.149	0.151	0.166
Nickel	0.0005	mg/L	0.15	CCME	1987	WQG when hardness > 180 mg/L	0.0454	0.0546	0.0464	0.0339	0.0097
Phosphorus	0.05	mg/L					*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Potassium	0.05	mg/L					168	147	136	145	135
Rubidium	0.0002	mg/L					0.142	0.0688	0.0621	0.102	0.0552
Selenium	0.00005	mg/L	0.002	BC ENV	2014	CCME 1987 WQG = 0.001 mg/L	**0.0062**	**0.0025**	**0.0074**	**0.014**	0.0018
Silicon	0.05	mg/L					5.46	5.35	4.7	4.73	3.62
Silver	0.00001	mg/L	0.00025	CCME	2015	WQG applies to total (unfiltered) fraction	*<0.00002*	*<0.00002*	*<0.00002*	*<0.00002*	*<0.00002*
Sodium	0.05	mg/L					251	251	244	254	246
Strontium	0.0002	mg/L	2.5	ECCC	2020		0.794	0.891	0.787	0.803	0.956
Sulfur	0.5	mg/L					448	482	427	442	447
Tellurium	0.0002	mg/L					*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*
Thallium	0.00001	mg/L	0.0008	CCME	1999		0.000027	*<0.00002*	*<0.00002*	*<0.00002*	*<0.00002*
Thorium	0.0001	mg/L					*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Tin	0.0001	mg/L					*<0.0002*	0.0004	0.00035	0.00077	*<0.0002*
Titanium	0.0003	mg/L					*<0.0006*	*<0.0006*	*<0.0006*	*<0.0006*	*<0.0006*
Tungsten	0.0001	mg/L					0.00197	0.00198	0.00349	0.00503	0.00151
Uranium	0.00001	mg/L	0.015	CCME	2011		0.00715	0.00794	0.00674	0.012	0.00186
Vanadium	0.0005	mg/L	0.12	ECCC	2016		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc	0.001	mg/L	0.17 - 0.29	CCME	2018	WQG = exp(0.947[ln(hardness)] - 0.815[pH] + 0.398[ln(DOC)] + 4.625). The WQG equation is valid between hardness 23.4 and 399 mg $CaCO_3$/L, pH 6.5 and 8.13 and DOC 0.3 - 22.9 mg/L.	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*
Zirconium	0.0002	mg/L					*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*	*<0.0004*

[a] CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life. FEQG (Federal Environmental Quality Guidelines). BC MOE (British Columbia Ministry of Environment and Climate Change Strategy).

Shaded and bold values exceed the Aquatic Life Guideline.

Italicized numbers are below detection limits.

NA = not analyzed

Table A-4. Tailings chemistry results from Goose Pit, 2022 and 2023

Client Sample ID	Lowest Detection Limit	Units	CCME Sediment Quality Guidelines[a]		Goose Pit Tailings Samples - 2022					Goose Pit Tailings Samples - 2023				
					BG-1	BG-2	BG-3	BG-4	BG-5	BG-1	BG-4	BG-5	ST-20i	ST-20ii
Date Sampled			ISQG	PEL	12-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22	23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23
Physical Tests														
Moisture	0.25	%	-	-	26.4	26.4	28.2	29.1	40.3	39.1	36.4	34.5	36.8	32.3
pH	0.1	pH units	-	-	8.3	8.57	8.4	8.42	8.32	9.59	8.41	8.37	8.56	8.46
Particle Size & Total Organic Carbon														
Clay (<4 um)	1	%	-	-	13.3	18.3	19.3	19.9	22.1	22.7	22.5	22.4	14.5	15.1
Silt (4-63 um)	1	%	-	-	86.4	81.7	80.6	79.9	77.6	77.1	77.2	77.2	84.4	80.2
Sand (63 um - 2mm)	1	%	-	-	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1*	*<1*	*<1*	1.1	4.7
Total organic carbon	0.114	%	-	-	0.413	0.283	0.351	0.238	0.232	0.209	0.168	0.158	0.339	0.314
Metals														
Aluminum	50	mg/kg	-	-	29500	31900	32200	29200	28600	33900	31000	30700	26900	27000
Antimony	0.1	mg/kg	-	-	2.09	2.23	2.14	2.51	2.08	5.96	2.47	2.3	2.16	2.5
Arsenic*	0.36	mg/kg	5.9	17	**1060**	**903**	**855**	**624**	**811**	**796**	**691**	**856**	**1240**	**1280**
Barium	0.5	mg/kg	-	-	135	120	128	109	116	189	114	115	115	110
Beryllium	0.1	mg/kg	-	-	0.83	0.76	0.79	0.64	0.65	0.7	0.71	0.61	0.7	0.63
Bismuth	0.2	mg/kg	-	-	0.32	0.3	0.31	0.25	0.28	0.7	0.25	0.25	0.27	0.3
Boron	5	mg/kg	-	-	5.9	6.6	6.3	5.5	6	15.6	5.7	5.1	5.1	5.5
Cadmium*	0.02	mg/kg	0.6	3.5	**0.858**	**0.732**	**0.803**	0.134	0.401	**1.05**	0.168	0.271	**0.751**	**0.632**
Calcium	50	mg/kg	-	-	20800	21800	21300	19300	17200	26400	21800	20000	21400	22200
Chromium*	1.8	mg/kg	37.3	90	**1100**	**1350**	**1360**	**1230**	**1120**	**1440**	**1360**	**1340**	**1010**	**1120**
Cobalt	0.1	mg/kg	-	-	28.4	33.2	30.2	36.5	28.7	32.3	37.5	40.1	34.6	42.3
Copper*	0.5	mg/kg	35.7	197	**468**	**384**	**1300**	**143**	**140**	**332**	**127**	**126**	**236**	**190**
Iron	50	mg/kg	-	-	81000	85100	86400	85900	82700	88400	91000	83700	75300	81800
Lead	0.5	mg/kg	35	91.3	**143**	**162**	**171**	**92.3**	**163**	**216**	**101**	**115**	**97.6**	**122**
Lithium	2	mg/kg	-	-	24.5	27.5	26.2	25	24.7	23.4	24.8	24	20.1	20.7
Magnesium	20	mg/kg	-	-	29600	31500	32500	25200	27200	32100	27800	28600	28000	26500
Manganese	1	mg/kg	-	-	2160	2540	2560	2550	2330	2800	3140	2900	2160	2480
Mercury	0.005	mg/kg	0.17	0.486	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*
Molybdenum	0.1	mg/kg	-	-	1.82	1.62	1.73	1.44	1.77	2.34	1.63	1.51	1.48	1.73
Nickel	0.5	mg/kg	-	-	424	537	514	551	464	577	629	622	483	577
Phosphorus	50	mg/kg	-	-	534	421	418	407	397	663	404	414	494	404
Potassium	100	mg/kg	-	-	12600	12800	12400	11200	10800	11900	11000	10900	10200	9440
Selenium	0.2	mg/kg	-	-	0.63	0.5	0.7	0.65	0.56	0.4	0.5	0.79	0.61	0.86
Silver	0.1	mg/kg	-	-	0.73	0.56	1.2	0.5	0.23	0.7	0.31	0.27	0.56	0.6
Sodium	50	mg/kg	-	-	419	423	401	447	490	1050	615	503	414	463
Strontium	0.5	mg/kg	-	-	62.6	54.2	55.2	43.6	43.8	65.9	54.6	47.6	66.9	64.3
Sulfur	1000	mg/kg	-	-	8000	8400	7800	8400	8100	8000	8900	8700	9500	12100
Thallium	0.05	mg/kg	-	-	0.494	0.471	0.482	0.428	0.425	0.45	0.427	0.409	0.414	0.415

Table A-4. Tailings chemistry results from Goose Pit, 2022 and 2023

Client Sample ID	Lowest Detection Limit	Units	CCME Sediment Quality Guidelines[a]		Goose Pit Tailings Samples - 2022					Goose Pit Tailings Samples - 2023				
					BG-1	BG-2	BG-3	BG-4	BG-5	BG-1	BG-4	BG-5	ST-20i	ST-20ii
Date Sampled			ISQG	PEL	12-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22	21-Aug-22	23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23	23-Aug-23
Tin	2	mg/kg	-	-	*<2*	*<2*	*<2*	*<2*	*<2*	3.2	*<2*	*<2*	*<2*	*<2*
Titanium	1	mg/kg	-	-	1230	1250	1300	1140	1100	1480	1340	1260	1110	1130
Tungsten	0.5	mg/kg	-	-	6.1	7.81	6.89	5.97	4.95	8.09	6.25	4.25	5.5	7.28
Uranium	0.05	mg/kg	-	-	0.845	0.671	0.73	0.697	0.815	0.885	0.719	0.682	0.732	0.755
Vanadium	0.2	mg/kg	-	-	81.5	91.4	93.3	79.8	76.8	96.6	89.4	86	76.1	77.4
Zinc	2	mg/kg	123	315	62.6	59.4	60.2	55.8	58.4	**160**	58.5	55.4	55.9	56.6
Zirconium	1	mg/kg	-	-	11	7.6	8.5	7.5	8.7	7.4	7.1	5.3	7.2	6.8

[a] CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002.

ISQG = interim sediment quality guideline; PEL = probable effect level

Bold values exceed the ISQG

Shaded and bold values exceed the PEL

Italicized numbers are below detection limits.

Table A-5. Chemistry results from the reclaim water samples submitted for toxicity testing compared to porewater chemistry results from Goose Pit.

Media	Detection Limit	Units	Reclaim Water for the RBT Test	Reclaim Water for the FHM Test	Goose Pit Porewater Chemistry	
Sample ID			ST-20i B	ST-20ii A		
Sampling Depth			7 m	2 m		
Date Sampled			10-Aug-2024	8-May-23	Minimum	Maximum
Physical Tests						
Conductivity	2	µS/cm	1940	2290	2900	3090
Alkalinity - Bicarbonate	1	mg/L	91.8	122	49	116
Alkalinity - Carbonate	1	mg/L	*<1.0*	*<1*	*<1*	*<1*
Alkalinity - Hydroxide	1	mg/L	*<1.0*	*<1*	*<1*	*<1*
Alkalinity - Total (as $CaCO_3$)	1	mg/L	91.8	122	49	116
Hardness (as $CaCO_3$), dissolved	0.6	mg/L	466	611	551	803
Total Dissolved Solids	3	mg/L	1490	1670	na	na
Total Suspended Solids	1	mg/L	6.8	5	1.8	2.6
Turbidity	0.1	NTU	2.66	3.09	0.12	0.54
pH (Laboratory)	0.1	pH units	8.13	7.82	7.53	8.19
Anions and Nutrients (mg/L)						
Ammonia (as N)	0.005	mg/L	27	31.3	17.7	28.5
Bromide	0.05	mg/L	0.911	*<1*	1.03	1.24
Chloride	0.1	mg/L	69.4	72.9	81.1	100
Fluoride	0.02	mg/L	0.276	*<0.4*	*<0.4*	*<0.4*
Nitrate (as N)	0.005	mg/L	0.0811	0.106	0.926	1.05
Nitrite (as N)	0.001	mg/L	0.0112	0.773	0.0747	0.0747
Ortho Phosphate (as P)	0.001	mg/L	0.0266	0.0392	0.003	0.0079
Phosphorus (P) - Total Diss.	0.002	mg/L	0.0078	0.0117	0.0079	0.0174
Reactive Silica (as SiO_2)	0.5	mg/L	5.93	6.7	8.27	13
Sulphate (SO_4)	0.3	mg/L	840	902	1040	1290
Cyanides (mg/L)						
Free Cyanide	0.001	mg/L	*<0.0050*	0.0041	0.0021	0.0146
Total Cyanide	0.001	mg/L	0.0495	0.253	0.0847	0.245
Total Cyanate (CNO-)	0.25	mg/L	*<2.00*	na	3.6	3.6
Thiocyanate	20	mg/L	12	na	69.3	95.8
Organic / Inorganic Carbon (mg/L)						
Dissolved Organic Carbon	0.5	mg/L	7.47	9.72	10.8	30.3
Dissolved Metals (mg/L)						
Aluminum	0.001	mg/L	0.0094	0.0111	0.0069	0.0169
Antimony	0.0001	mg/L	0.00837	0.0144	0.00494	0.0381
Arsenic	0.0001	mg/L	0.265	0.511	0.158	0.689
Barium	0.0001	mg/L	0.0374	0.0498	0.0197	0.0302
Beryllium	0.0001	mg/L	*<0.000100*	*<0.00004*	*<0.0001*	*<0.0001*
Bismuth	0.00005	mg/L	*<0.000050*	*<0.0001*	*<0.0001*	*<0.0001*
Boron	0.01	mg/L	0.132	0.169	0.192	0.317
Cadmium	0.000005	mg/L	0.0000256	*<0.000025*	0.000106	0.000116
Calcium	0.05	mg/L	167	225	189	271
Cesium	0.00001	mg/L	0.000528	0.0003	0.000024	0.000072
Chromium	0.0005	mg/L	*<0.00010*	*<0.0002*	*<0.0002*	*<0.0002*
Cobalt	0.0001	mg/L	0.205	0.327	0.0235	0.131
Copper	0.0002	mg/L	0.00722	0.00488	0.00046	0.066
Iron	0.01	mg/L	0.013	*<0.02*	0.021	0.119
Lead	0.00005	mg/L	*<0.000050*	*<0.0001*	*<0.0001*	0.0045
Lithium	0.001	mg/L	0.004	0.005	0.004	0.0149
Magnesium	0.005	mg/L	11.9	12	18.2	36.7
Manganese	0.0001	mg/L	0.0992	0.0726	0.0643	0.155
Mercury	0.000005	mg/L	*<0.0000050*	*<0.000005*	*<0.00005*	*<0.00005*
Molybdenum	0.00005	mg/L	0.0627	0.0849	0.0778	0.236
Nickel	0.0005	mg/L	0.0667	0.0742	0.0097	0.0675
Phosphorus	0.05	mg/L	*<0.050*	*<0.1*	0	0
Potassium	0.05	mg/L	75.8	95.7	128	175
Rubidium	0.0002	mg/L	0.0333	0.0428	0.0552	0.142
Selenium	0.00005	mg/L	0.0249	0.0342	0.00184	0.0247
Silicon	0.05	mg/L	2.9	3.6	3.62	5.46
Silver	0.00001	mg/L	*<0.000010*	*<0.00002*	*<0.00002*	0.000418
Sodium	0.05	mg/L	156	192	197	275
Strontium	0.0002	mg/L	0.564	0.611	0.619	0.956
Sulfur	0.5	mg/L	291	398	350	535
Tellurium	0.0002	mg/L	*<0.00020*	*<0.0004*	*<0.0004*	*<0.0004*

Table A-5. Chemistry results from the reclaim water samples submitted for toxicity testing compared to porewater chemistry results from Goose Pit.

Media	Detection Limit	Units	Reclaim Water for the RBT Test	Reclaim Water for the FHM Test	Goose Pit Porewater Chemistry	
Sample ID			**ST-20i B**	**ST-20ii A**		
Sampling Depth			7 m	2 m		
Date Sampled			10-Aug-2024	8-May-23	Minimum	Maximum
Thallium	0.00001	mg/L	0.000011	*<0.00002*	*<0.00002*	0.000034
Thorium	0.0001	mg/L	*<0.00010*	*<0.0002*	*<0.0002*	*<0.0002*
Tin	0.0001	mg/L	*<0.00010*	*<0.0002*	0.0002	0.00241
Titanium	0.0003	mg/L	*<0.00030*	*<0.0006*	*<0.0006*	*<0.0006*
Tungsten	0.0001	mg/L	0.00433	0.00649	0.00151	0.00503
Uranium	0.00001	mg/L	0.00805	0.00752	0.00186	0.0141
Vanadium	0.0005	mg/L	*<0.00050*	*<0.001*	*<0.001*	*<0.001*
Zinc	0.001	mg/L	*<0.0010*	*<0.002*	*<0.002*	0.0047

APPENDIX B
ANALYTICAL LABORATORY REPORTS

Appendix B-1
Laboratory Reports for the Porewater Samples

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B9759-AB**	Page	: 1 of 5
Amendment	: **1**		
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: Vancouver - Environmental
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 24-Aug-2022 11:00
PO	: ----	Date Analysis Commenced	: 31-Aug-2022
C-O-C number	: ----	Issue Date	: 27-Sep-2022 15:30
Sampler	: ----		
Site	: ----		
Quote number	: Q39503		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anshim Anshim	Lab Assistant	Metals, Burnaby, British Columbia
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
VA22B9759-011	BG-1	Sample 11: Water sample for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
VA22B9759-012	BG-2	Samples 12-15: Water samples for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
VA22B9759-013	BG-3	Samples 12-15: Water samples for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
VA22B9759-014	BG-4	Samples 12-15: Water samples for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
VA22B9759-015	BG-5	Samples 12-15: Water samples for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*

DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BG-1	BG-2	BG-3	BG-4	BG-5
					Client sampling date / time	12-Aug-2022	21-Aug-2022	21-Aug-2022	21-Aug-2022	21-Aug-2022
						VA22B9759-011	VA22B9759-012	VA22B9759-013	VA22B9759-014	VA22B9759-015
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L		----	49.0	110	116	104
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L		----	<1.0	<1.0	<1.0	<1.0
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L		----	<1.0	<1.0	<1.0	<1.0
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		----	49.0	110	116	104
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L		705	681	633	551	629
pH	----	E108	0.10	pH units		----	7.53	7.94	7.98	7.92
Anions and Nutrients										
bromide	24959-67-9	E235.Br-L	0.050	mg/L		----	<1.00 DLDS	1.24	1.06	1.03
chloride	16887-00-6	E235.Cl	0.50	mg/L		----	100	95.0	83.7	81.1
fluoride	16984-48-8	E235.F	0.020	mg/L		----	<0.400 DLDS	<0.400 DLDS	<0.400 DLDS	<0.400 DLDS
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		----	0.926	<0.100 DLDS	<0.100 DLDS	1.05
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		----	0.0747	<0.0200 DLDS	<0.0200 DLDS	<0.0200 DLDS
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		----	1180	1170	1040	1070
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		25.9	30.3	24.9	20.6	12.2
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L		0.0169	0.0115	0.0100	0.0131	0.0120
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		0.0104	0.0133	0.0242	0.0381	0.0208
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.689	0.636	0.439	0.235	0.385
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.0197	0.0224	0.0252	0.0213	0.0302
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L		<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.226	0.308	0.282	0.202	0.214
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.000116	<0.000155 DLM	<0.000100 DLM	<0.000150 DLM	<0.0000650 DLM
calcium, dissolved	7440-70-2	E421	0.050	mg/L		233	232	217	189	222
cesium, dissolved	7440-46-2	E421	0.000010	mg/L		0.000046	0.000049	0.000028	0.000030	0.000072
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050 DLA	<0.00050 DLA	<0.00050 DLA	<0.00050 DLA	<0.00050 DLA
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		0.0235	0.0428	0.0476	0.0670	0.131
copper, dissolved	7440-50-8	E421	0.00020	mg/L		0.0660	0.0649	0.00518	0.00349	0.00090
iron, dissolved	7439-89-6	E421	0.010	mg/L		<0.020 DLA	<0.020 DLA	0.022	<0.020 DLA	0.021
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.00131	0.000751	0.000106	0.00112	0.000499

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BG-1	BG-2	BG-3	BG-4	BG-5
					Client sampling date / time	12-Aug-2022	21-Aug-2022	21-Aug-2022	21-Aug-2022	21-Aug-2022
						VA22B9759-011	VA22B9759-012	VA22B9759-013	VA22B9759-014	VA22B9759-015
						Result	Result	Result	Result	Result
Dissolved Metals										
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		0.0054	0.0074	0.0058	0.0139	0.0104
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L		30.0	24.8	22.2	19.3	18.2
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.104	0.0819	0.0860	0.0889	0.0831
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L		<0.0000250 DLM	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.106	0.108	0.0923	0.0869	0.100
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.0266	0.0345	0.0531	0.0427	0.0282
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L		<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA
potassium, dissolved	7440-09-7	E421	0.050	mg/L		175	150	142	128	139
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L		0.106	0.0742	0.0883	0.0731	0.0741
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.0204	0.0247	0.00948	0.00334	0.00598
silicon, dissolved	7440-21-3	E421	0.050	mg/L		4.39	4.20	5.14	4.60	5.14
silver, dissolved	7440-22-4	E421	0.000010	mg/L		0.000071	0.000418	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA
sodium, dissolved	7440-23-5	E421	0.050	mg/L		273	237	230	197	216
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.714	0.649	0.681	0.619	0.703
sulfur, dissolved	7704-34-9	E421	0.50	mg/L		535	467	446	350	408
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		0.000028	0.000033	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA
thorium, dissolved	7440-29-1	E421	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
tin, dissolved	7440-31-5	E421	0.00010	mg/L		0.00241	0.00096	0.00020	<0.00020 DLA	<0.00020 DLA
titanium, dissolved	7440-32-6	E421	0.00030	mg/L		<0.00060 DLA	<0.00060 DLA	<0.00060 DLA	<0.00060 DLA	<0.00060 DLA
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L		0.00224	0.00339	0.00337	0.00335	0.00440
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.00377	0.00316	0.0141	0.0110	0.00790
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
zinc, dissolved	7440-66-6	E421	0.0010	mg/L		0.0047	0.0024	<0.0020 DLA	<0.0020 DLA	<0.0020 DLA
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
dissolved mercury filtration location	----	EP509	-	-		Field	Field	Field	Field	Field
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL REPORT

Work Order	: **VA22B9759-AB**	Page	: 1 of 18
Amendment	: **1**		
Client	: Azimuth Consulting Group Inc.	Laboratory	: Vancouver - Environmental
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 24-Aug-2022 11:00
PO	: ----	Date Analysis Commenced	: 31-Aug-2022
C-O-C number	: ----	Issue Date	: 27-Sep-2022 15:30
Sampler	: ----		
Site	: ----		
Quote number	: Q39503		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anshim Anshim	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Caitlin Macey	Team Leader - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 654207)											
VA22C2182-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	104	99.7	4.32%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	104	99.7	4.32%	20%	----
Physical Tests (QC Lot: 654208)											
VA22C2182-001	Anonymous	pH	----	E108	0.10	pH units	8.08	8.07	0.0991%	4%	----
Anions and Nutrients (QC Lot: 654210)											
VA22B9759-012	BG-2	fluoride	16984-48-8	E235.F	0.400	mg/L	<0.400	<0.400	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 654211)											
VA22B9759-012	BG-2	chloride	16887-00-6	E235.Cl	10.0	mg/L	100	102	1.90%	20%	----
Anions and Nutrients (QC Lot: 654212)											
VA22B9759-012	BG-2	bromide	24959-67-9	E235.Br-L	1.00	mg/L	<1.00	1.45	0.446	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 654213)											
VA22B9759-012	BG-2	nitrate (as N)	14797-55-8	E235.NO3-L	0.100	mg/L	0.926	0.946	0.0203	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 654214)											
VA22B9759-012	BG-2	nitrite (as N)	14797-65-0	E235.NO2-L	0.0200	mg/L	0.0747	0.0710	0.0037	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 654215)											
VA22B9759-012	BG-2	sulfate (as SO4)	14808-79-8	E235.SO4	6.00	mg/L	1180	1210	2.17%	20%	----
Organic / Inorganic Carbon (QC Lot: 629402)											
FJ2202341-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.55	1.74	0.19	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 654838)											
VA22B9759-012	BG-2	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	30.3	31.4	3.46%	20%	----
Dissolved Metals (QC Lot: 626187)											
CG2211434-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 631469)											
VA22B7110-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	178 µg/L	0.199	11.1%	20%	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.20 µg/L	0.00020	0.000003	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.62 µg/L	0.00060	0.00003	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	498 µg/L	0.486	2.46%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.100 µg/L	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.050 µg/L	<0.000050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 631469) - continued											
VA22B7110-001	Anonymous	boron, dissolved	7440-42-8	E421	0.010	mg/L	75 µg/L	0.074	0.002	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0984 µg/L	0.000112	12.4%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	185000 µg/L	182	1.69%	20%	----
		cesium, dissolved	7440-46-2	E421	0.000010	mg/L	0.011 µg/L	0.000012	0.000001	Diff <2x LOR	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	0.51 µg/L	<0.00050	0.00001	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	1.33 µg/L	0.00136	2.50%	20%	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	2.26 µg/L	0.00239	5.67%	20%	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	254 µg/L	0.256	0.835%	20%	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.113 µg/L	0.000115	0.000002	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	15.2 µg/L	0.0145	4.42%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	62800 µg/L	63.1	0.413%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	623 µg/L	0.618	0.785%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	2.96 µg/L	0.00305	2.92%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	7.33 µg/L	0.00730	0.386%	20%	----
		phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<50 µg/L	<0.050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	7640 µg/L	7.54	1.36%	20%	----
		rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	1.02 µg/L	0.00104	0.00002	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.181 µg/L	0.000175	0.000006	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	11500 µg/L	11.6	1.23%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.010 µg/L	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	53400 µg/L	53.0	0.760%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	613 µg/L	0.626	2.20%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	9700 µg/L	9.63	0.723%	20%	----
		tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.20 µg/L	<0.00020	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.035 µg/L	0.000033	0.000002	Diff <2x LOR	----
		thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	9.30 µg/L	0.00841	10.1%	20%	----
		tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	3.17 µg/L	0.00308	2.76%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	1.02 µg/L	0.00103	0.00001	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	3.2 µg/L	0.0031	0.00007	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	0.44 µg/L	0.00050	0.00005	Diff <2x LOR	----
Dissolved Metals (QC Lot: 660708)											
VA22B9759-012	BG-2	aluminum, dissolved	7429-90-5	E421	0.0020	mg/L	0.0115	0.0101	0.0014	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 660708) - continued											
VA22B9759-012	BG-2	antimony, dissolved	7440-36-0	E421	0.00020	mg/L	0.0133	0.0132	1.12%	20%	----
		arsenic, dissolved	7440-38-2	E421	0.00020	mg/L	0.636	0.652	2.53%	20%	----
		barium, dissolved	7440-39-3	E421	0.00020	mg/L	0.0224	0.0233	4.02%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.020	mg/L	0.308	0.313	1.59%	20%	----
		cadmium, dissolved	7440-43-9	E421	0.000155	mg/L	<0.000155	<0.000155	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.100	mg/L	232	233	0.375%	20%	----
		cesium, dissolved	7440-46-2	E421	0.000020	mg/L	0.000049	0.000047	0.000002	Diff <2x LOR	----
		chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00020	mg/L	0.0428	0.0445	3.88%	20%	----
		copper, dissolved	7440-50-8	E421	0.00040	mg/L	0.0649	0.0674	3.73%	20%	----
		iron, dissolved	7439-89-6	E421	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000100	mg/L	0.000751	0.000745	0.000006	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0020	mg/L	0.0074	0.0076	0.0002	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0100	mg/L	24.8	25.5	2.70%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00020	mg/L	0.0819	0.0849	3.58%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000100	mg/L	0.108	0.108	0.366%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00100	mg/L	0.0345	0.0355	2.86%	20%	----
		phosphorus, dissolved	7723-14-0	E421	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.100	mg/L	150	155	3.22%	20%	----
		rubidium, dissolved	7440-17-7	E421	0.00040	mg/L	0.0742	0.0760	2.40%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000100	mg/L	0.0247	0.0242	2.02%	20%	----
		silicon, dissolved	7440-21-3	E421	0.100	mg/L	4.20	4.36	3.62%	20%	----
		silver, dissolved	7440-22-4	E421	0.000020	mg/L	0.000418	0.000412	1.53%	20%	----
		sodium, dissolved	7440-23-5	E421	0.100	mg/L	237	246	3.92%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00040	mg/L	0.649	0.664	2.19%	20%	----
		sulfur, dissolved	7704-34-9	E421	1.00	mg/L	467	474	1.62%	20%	----
		tellurium, dissolved	13494-80-9	E421	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000020	mg/L	0.000033	0.000032	0.0000007	Diff <2x LOR	----
		thorium, dissolved	7440-29-1	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00020	mg/L	0.00096	0.00096	0.000002	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		tungsten, dissolved	7440-33-7	E421	0.00020	mg/L	0.00339	0.00355	4.43%	20%	----
		uranium, dissolved	7440-61-1	E421	0.000020	mg/L	0.00316	0.00311	1.52%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 660708) - continued											
VA22B9759-012	BG-2	vanadium, dissolved	7440-62-2	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0020	mg/L	0.0024	0.0022	0.0002	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E421	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 667376)											
VA22B9759-012	BG-2	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 654207)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 654210)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 654211)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 654212)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 654213)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 654214)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 654215)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Organic / Inorganic Carbon (QCLot: 629402)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 654838)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Dissolved Metals (QCLot: 626187)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 631469)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 631469) - continued						
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	<0.00020	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	<0.00010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	<0.00010	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----
Dissolved Metals (QCLot: 660708)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 660708) - continued						
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	<0.000010	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	<0.00020	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	<0.00010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	<0.00010	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----
Dissolved Metals (QCLot: 667376)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 654207)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	110	85.0	115	----
Physical Tests (QCLot: 654208)									
pH	----	E108	----	pH units	7 pH units	99.5	98.0	102	----
Anions and Nutrients (QCLot: 654210)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 654211)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 654212)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 654213)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 654214)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 654215)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Organic / Inorganic Carbon (QCLot: 629402)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 654838)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	109	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	99.2	80.0	120	----
Dissolved Metals (QCLot: 631469)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	95.0	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	102	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.1	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	96.5	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	104	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	95.3	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	100	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	0.05 mg/L	101	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 631469) - continued									
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	100	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	103	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	103	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	97.2	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	95.9	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	0.1 mg/L	101	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	102	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	105	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	97.3	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	107	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	94.3	80.0	120	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	0.1 mg/L	95.3	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	105	80.0	120	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	0.1 mg/L	100	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.5	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	94.8	80.0	120	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	0.1 mg/L	96.6	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	105	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	101	80.0	120	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 660708)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	100	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	97.2	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.3	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	102	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	99.9	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	93.9	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 660708) - continued									
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.4	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	98.2	80.0	120	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	0.05 mg/L	94.6	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	98.8	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	96.4	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	95.8	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	93.2	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	97.9	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	108	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	95.8	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	96.9	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	96.3	80.0	120	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	99.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	99.4	80.0	120	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	0.1 mg/L	99.2	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	101	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	101	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	93.2	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	98.2	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	94.9	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	90.0	80.0	120	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	0.1 mg/L	93.6	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.8	80.0	120	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	0.1 mg/L	86.8	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.0	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	92.1	80.0	120	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	0.1 mg/L	96.6	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	98.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	98.3	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	96.0	80.0	120	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	92.3	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	97.4	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 654210)										
VA22B9759-013	BG-3	fluoride	16984-48-8	E235.F	21.0 mg/L	20 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 654211)										
VA22B9759-013	BG-3	chloride	16887-00-6	E235.Cl	2090 mg/L	2000 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 654212)										
VA22B9759-013	BG-3	bromide	24959-67-9	E235.Br-L	10.8 mg/L	10 mg/L	108	75.0	125	----
Anions and Nutrients (QCLot: 654213)										
VA22B9759-013	BG-3	nitrate (as N)	14797-55-8	E235.NO3-L	52.6 mg/L	50 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 654214)										
VA22B9759-013	BG-3	nitrite (as N)	14797-65-0	E235.NO2-L	10.2 mg/L	10 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 654215)										
VA22B9759-013	BG-3	sulfate (as SO4)	14808-79-8	E235.SO4	2050 mg/L	2000 mg/L	103	75.0	125	----
Organic / Inorganic Carbon (QCLot: 629402)										
FJ2202341-002	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.65 mg/L	5 mg/L	113	70.0	130	----
Organic / Inorganic Carbon (QCLot: 654838)										
VA22B9759-013	BG-3	carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	5 mg/L	ND	70.0	130	----
Dissolved Metals (QCLot: 626187)										
CG2211434-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.000100 mg/L	0.0001 mg/L	100	70.0	130	----
Dissolved Metals (QCLot: 631469)										
VA22B7110-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.211 mg/L	0.2 mg/L	105	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0207 mg/L	0.02 mg/L	103	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0402 mg/L	0.04 mg/L	100	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00812 mg/L	0.01 mg/L	81.2	70.0	130	----
		boron, dissolved	7440-42-8	E421	ND mg/L	0.1 mg/L	ND	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00381 mg/L	0.004 mg/L	95.3	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		cesium, dissolved	7440-46-2	E421	0.0100 mg/L	0.01 mg/L	100	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0391 mg/L	0.04 mg/L	97.8	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0184 mg/L	0.02 mg/L	92.1	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 631469) - continued										
VA22B7110-002	Anonymous	copper, dissolved	7440-50-8	E421	0.0176 mg/L	0.02 mg/L	87.8	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.81 mg/L	2 mg/L	90.6	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0180 mg/L	0.02 mg/L	89.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0212 mg/L	0.02 mg/L	106	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0359 mg/L	0.04 mg/L	89.8	70.0	130	----
		phosphorus, dissolved	7723-14-0	E421	10.4 mg/L	10 mg/L	104	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		rubidium, dissolved	7440-17-7	E421	0.0204 mg/L	0.02 mg/L	102	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0420 mg/L	0.04 mg/L	105	70.0	130	----
		silicon, dissolved	7440-21-3	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00391 mg/L	0.004 mg/L	97.7	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	22.0 mg/L	20 mg/L	110	70.0	130	----
		tellurium, dissolved	13494-80-9	E421	0.0379 mg/L	0.04 mg/L	94.8	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00360 mg/L	0.004 mg/L	90.1	70.0	130	----
		thorium, dissolved	7440-29-1	E421	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0190 mg/L	0.02 mg/L	95.2	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0414 mg/L	0.04 mg/L	103	70.0	130	----
		tungsten, dissolved	7440-33-7	E421	0.0190 mg/L	0.02 mg/L	95.2	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00389 mg/L	0.004 mg/L	97.4	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.371 mg/L	0.4 mg/L	92.9	70.0	130	----
		zirconium, dissolved	7440-67-7	E421	0.0427 mg/L	0.04 mg/L	107	70.0	130	----
Dissolved Metals (QCLot: 660708)										
VA22B9759-013	BG-3	aluminum, dissolved	7429-90-5	E421	0.382 mg/L	0.4 mg/L	95.5	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0388 mg/L	0.04 mg/L	97.0	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.0386 mg/L	0.04 mg/L	96.6	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0787 mg/L	0.08 mg/L	98.4	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0173 mg/L	0.02 mg/L	86.5	70.0	130	----
		boron, dissolved	7440-42-8	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00750 mg/L	0.008 mg/L	93.8	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 660708) - continued										
VA22B9759-013	BG-3	calcium, dissolved	7440-70-2	E421	ND mg/L	8 mg/L	ND	70.0	130	----
		cesium, dissolved	7440-46-2	E421	0.0182 mg/L	0.02 mg/L	90.9	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.0757 mg/L	0.08 mg/L	94.7	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0360 mg/L	0.04 mg/L	90.1	70.0	130	----
		iron, dissolved	7439-89-6	E421	3.70 mg/L	4 mg/L	92.4	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0354 mg/L	0.04 mg/L	88.6	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0719 mg/L	0.08 mg/L	89.9	70.0	130	----
		phosphorus, dissolved	7723-14-0	E421	19.2 mg/L	20 mg/L	96.2	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	8 mg/L	ND	70.0	130	----
		rubidium, dissolved	7440-17-7	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0808 mg/L	0.08 mg/L	101	70.0	130	----
		silicon, dissolved	7440-21-3	E421	20.2 mg/L	20 mg/L	101	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00768 mg/L	0.008 mg/L	96.0	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		tellurium, dissolved	13494-80-9	E421	0.0744 mg/L	0.08 mg/L	93.0	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00697 mg/L	0.008 mg/L	87.1	70.0	130	----
		thorium, dissolved	7440-29-1	E421	0.0374 mg/L	0.04 mg/L	93.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0757 mg/L	0.08 mg/L	94.6	70.0	130	----
		tungsten, dissolved	7440-33-7	E421	0.0370 mg/L	0.04 mg/L	92.5	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.008 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.198 mg/L	0.2 mg/L	99.0	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.746 mg/L	0.8 mg/L	93.2	70.0	130	----
		zirconium, dissolved	7440-67-7	E421	0.0796 mg/L	0.08 mg/L	99.4	70.0	130	----
Dissolved Metals (QCLot: 667376)										
VA22B9759-013	BG-3	mercury, dissolved	7439-97-6	E509	0.0000867 mg/L	0.0001 mg/L	86.7	70.0	130	----

CERTIFICATE OF ANALYSIS

Work Order	: **VA23C0590**	Page	: 1 of 4
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 31-Aug-2023 11:00
PO	: ----	Date Analysis Commenced	: 03-Sep-2023
C-O-C number	: ----	Issue Date	: 08-Sep-2023 16:12
Sampler	: ----		
Site	: ----		
Quote number	: Q39503		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Sam Silveira	Lab Assistant	Metals, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BG-1	BG-4	BG-5	PW_ST-20i	PW_ST-20ii
					Client sampling date / time	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00
						VA23C0590-001	VA23C0590-002	VA23C0590-003	VA23C0590-004	VA23C0590-005
						Result	Result	Result	Result	Result
Physical Tests										
Hardness (as CaCO3), dissolved	----	EC100/VA	0.60	mg/L		732	768	682	663	640
Organic / Inorganic Carbon										
Carbon, dissolved organic [DOC]	----	E358-L/VA	0.50	mg/L		29.7	27.5	25.1	15.3	10.8
Dissolved Metals										
Aluminum, dissolved	7429-90-5	E421/VA	0.0010	mg/L		0.0105	0.0069	0.0120	0.0110	0.0114
Antimony, dissolved	7440-36-0	E421/VA	0.00010	mg/L		0.0266	0.00608	0.0202	0.0184	0.0115
Arsenic, dissolved	7440-38-2	E421/VA	0.00010	mg/L		0.216	0.346	0.603	0.158	0.347
Barium, dissolved	7440-39-3	E421/VA	0.00010	mg/L		0.0223	0.0228	0.0206	0.0224	0.0221
Beryllium, dissolved	7440-41-7	E421/VA	0.000100	mg/L		<0.000200 DLA	<0.000200 DLA	<0.000200 DLA	<0.000200 DLA	<0.000200 DLA
Bismuth, dissolved	7440-69-9	E421/VA	0.000050	mg/L		<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
Boron, dissolved	7440-42-8	E421/VA	0.010	mg/L		0.231	0.240	0.287	0.192	0.212
Cadmium, dissolved	7440-43-9	E421/VA	0.0000050	mg/L		<0.000425 DLM	<0.0000750 DLM	<0.000660 DLM	<0.0000850 DLM	<0.000335 DLM
Calcium, dissolved	7440-70-2	E421/VA	0.050	mg/L		235	262	227	213	219
Cesium, dissolved	7440-46-2	E421/VA	0.000010	mg/L		0.000024	0.000031	0.000044	0.000031	0.000046
Chromium, dissolved	7440-47-3	E421.Cr-L/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
Chromium, dissolved	7440-47-3	E421/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
Cobalt, dissolved	7440-48-4	E421/VA	0.00010	mg/L		0.0448	0.0439	0.0432	0.0620	0.0816
Copper, dissolved	7440-50-8	E421/VA	0.00020	mg/L		0.00133	0.00057	0.0120	0.00084	0.00247
Iron, dissolved	7439-89-6	E421/VA	0.010	mg/L		0.036	0.119	<0.020 DLA	<0.020 DLA	<0.020 DLA
Lead, dissolved	7439-92-1	E421/VA	0.000050	mg/L		0.000625	0.000216	0.00260	0.000446	0.00445
Lithium, dissolved	7439-93-2	E421/VA	0.0010	mg/L		0.0064	0.0044	0.0085	0.0109	0.0149
Magnesium, dissolved	7439-95-4	E421/VA	0.0050	mg/L		35.3	27.6	28.1	31.9	22.7
Manganese, dissolved	7439-96-5	E421/VA	0.00010	mg/L		0.113	0.155	0.0752	0.137	0.126
Mercury, dissolved	7439-97-6	E509/VA	0.0000050	mg/L		<0.0000500 DLM	<0.0000500 DLM	<0.0000500 DLM	<0.0000500 DLM	<0.0000500 DLM
Molybdenum, dissolved	7439-98-7	E421/VA	0.000050	mg/L		0.127	0.236	0.106	0.132	0.104
Nickel, dissolved	7440-02-0	E421/VA	0.00050	mg/L		0.0675	0.0330	0.0335	0.0654	0.0663
Phosphorus, dissolved	7723-14-0	E421/VA	0.050	mg/L		<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA
Potassium, dissolved	7440-09-7	E421/VA	0.050	mg/L		153	129	143	140	132
Rubidium, dissolved	7440-17-7	E421/VA	0.00020	mg/L		0.107	0.0611	0.0924	0.0724	0.0753

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BG-1	BG-4	BG-5	PW_ST-20i	PW_ST-20ii
					Client sampling date / time	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00
						VA23C0590-001	VA23C0590-002	VA23C0590-003	VA23C0590-004	VA23C0590-005
						Result	Result	Result	Result	Result
Dissolved Metals										
Selenium, dissolved	7782-49-2	E421/VA	0.000050	mg/L		0.00580	0.00795	0.0147	0.00277	0.00696
Silicon, dissolved	7440-21-3	E421/VA	0.050	mg/L		4.21	4.37	4.68	4.95	4.91
Silver, dissolved	7440-22-4	E421/VA	0.000010	mg/L		<0.000020 DLA	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA
Sodium, dissolved	7440-23-5	E421/VA	0.050	mg/L		275	252	238	231	222
Strontium, dissolved	7440-24-6	E421/VA	0.00020	mg/L		0.764	0.764	0.674	0.774	0.714
Sulfur, dissolved	7704-34-9	E421/VA	0.50	mg/L		496	462	436	427	411
Tellurium, dissolved	13494-80-9	E421/VA	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
Thallium, dissolved	7440-28-0	E421/VA	0.000010	mg/L		<0.000020 DLA	<0.000020 DLA	0.000023	<0.000020 DLA	0.000034
Thorium, dissolved	7440-29-1	E421/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
Tin, dissolved	7440-31-5	E421/VA	0.00010	mg/L		0.00046	0.00033	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
Titanium, dissolved	7440-32-6	E421/VA	0.00030	mg/L		<0.00060 DLA	<0.00060 DLA	<0.00060 DLA	<0.00060 DLA	<0.00060 DLA
Tungsten, dissolved	7440-33-7	E421/VA	0.00010	mg/L		0.00217	0.00330	0.00278	0.00189	0.00374
Uranium, dissolved	7440-61-1	E421/VA	0.000010	mg/L		0.0138	0.0108	0.00706	0.0132	0.0103
Vanadium, dissolved	7440-62-2	E421/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
Zinc, dissolved	7440-66-6	E421/VA	0.0010	mg/L		0.0035	<0.0020	0.0034	<0.0020 DLA	0.0023
Zirconium, dissolved	7440-67-7	E421/VA	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
Dissolved mercury filtration location	----	EP509/VA	-	-		Field	Field	Field	Field	Field
Dissolved metals filtration location	----	EP421/VA	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA23C0590**	Page	: 1 of 7
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 31-Aug-2023 11:00
PO	: ----	Issue Date	: 08-Sep-2023 16:12
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: Q39503		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) BG-1	E421.Cr-L	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	04-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) BG-4	E421.Cr-L	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	04-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) BG-5	E421.Cr-L	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	04-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW_ST-20i	E421.Cr-L	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	04-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW_ST-20ii	E421.Cr-L	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	04-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) BG-1	E509	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	06-Sep-2023	28 days	14 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) BG-4	E509	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	06-Sep-2023	28 days	14 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
BG-5	E509	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	06-Sep-2023	28 days	14 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
PW_ST-20i	E509	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	06-Sep-2023	28 days	14 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
PW_ST-20ii	E509	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	06-Sep-2023	28 days	14 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BG-1	E421	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	05-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BG-4	E421	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	05-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
BG-5	E421	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	05-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
PW_ST-20i	E421	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	05-Sep-2023	180 days	13 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
PW_ST-20ii	E421	23-Aug-2023	03-Sep-2023	180 days	12 days	✓	05-Sep-2023	180 days	13 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
BG-1	E358-L	23-Aug-2023	07-Sep-2023	28 days	15 days	✓	07-Sep-2023	28 days	16 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
BG-4	E358-L	23-Aug-2023	07-Sep-2023	28 days	15 days	✓	07-Sep-2023	28 days	16 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
BG-5	E358-L	23-Aug-2023	07-Sep-2023	28 days	15 days	✓	07-Sep-2023	28 days	16 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
PW_ST-20i	E358-L	23-Aug-2023	07-Sep-2023	28 days	15 days	✓	07-Sep-2023	28 days	16 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
PW_ST-20ii	E358-L	23-Aug-2023	07-Sep-2023	28 days	15 days	✓	07-Sep-2023	28 days	16 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1116673	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1120674	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1116674	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1122901	1	17	5.8	5.0	✓
Laboratory Control Samples (LCS)							
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1116673	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1120674	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1116674	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1122901	1	17	5.8	5.0	✓
Method Blanks (MB)							
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1116673	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1120674	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1116674	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1122901	1	17	5.8	5.0	✓
Matrix Spikes (MS)							
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1116673	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1120674	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1116674	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1122901	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Organic Carbon by Combustion (Low Level)	E358-L ALS Environmental - Vancouver	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Dissolved Metals in Water by CRC ICPMS	E421 ALS Environmental - Vancouver	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L ALS Environmental - Vancouver	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Dissolved Mercury in Water by CVAAS	E509 ALS Environmental - Vancouver	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 ALS Environmental - Vancouver	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Dissolved Organic Carbon for Combustion	EP358 ALS Environmental - Vancouver	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Dissolved Metals Water Filtration	EP421 ALS Environmental - Vancouver	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 ALS Environmental - Vancouver	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **VA23C0590**	Page	: 1 of 10
Client	: Azimuth Consulting Group Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 31-Aug-2023 11:00
PO	: ----	Date Analysis Commenced	: 03-Sep-2023
C-O-C number	: ----	Issue Date	: 08-Sep-2023 16:12
Sampler	: ---- ----		
Site	: ----		
Quote number	: Q39503		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Sam Silveira	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Sukhman Khosa	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Organic / Inorganic Carbon (QC Lot: 1122901)											
VA23C0582-001	Anonymous	Carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.27	2.34	0.07	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1116673)											
VA23C0550-001	Anonymous	Chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1116674)											
VA23C0550-001	Anonymous	Aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0023	0.0024	0.00003	Diff <2x LOR	----
VA23C0550-001	Anonymous	Antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00021	0.00022	0.000008	Diff <2x LOR	----
		Barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00274	0.00286	4.60%	20%	----
		Beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		Cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
		Calcium, dissolved	7440-70-2	E421	0.050	mg/L	2.29	2.36	2.93%	20%	----
		Cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		Chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00040	0.00040	0.000008	Diff <2x LOR	----
		Iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		Lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		Magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	0.939	0.962	2.39%	20%	----
		Manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00108	0.00110	1.81%	20%	----
		Molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000088	0.000099	0.000012	Diff <2x LOR	----
		Nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		Potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.510	0.526	2.92%	20%	----
		Rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00071	0.00075	0.00004	Diff <2x LOR	----
		Selenium, dissolved	7782-49-2	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Silicon, dissolved	7440-21-3	E421	0.050	mg/L	0.076	0.087	0.011	Diff <2x LOR	----
		Silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 1116674) - continued											
VA23C0550-001	Anonymous	Sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.02	1.04	2.44%	20%	----
		Strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0106	0.0105	1.06%	20%	----
		Sulfur, dissolved	7704-34-9	E421	0.50	mg/L	1.44	1.53	0.09	Diff <2x LOR	----
		Tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		Thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		Thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		Tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000032	0.000032	0.0000005	Diff <2x LOR	----
		Vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		Zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1120674)											
VA23C0552-013	Anonymous	Mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organic / Inorganic Carbon (QCLot: 1122901)						
Carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Dissolved Metals (QCLot: 1116673)						
Chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 1116674)						
Aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
Antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
Arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
Barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
Beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
Bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
Boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
Cesium, dissolved	7440-46-2	E421	0.00001	mg/L	<0.000010	----
Chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
Cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
Copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
Iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
Lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
Lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
Manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
Molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
Nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
Phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
Potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
Rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	<0.00020	----
Selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
Silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
Silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
Sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
Strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 1116674) - continued						
Sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
Tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	<0.00020	----
Thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
Thorium, dissolved	7440-29-1	E421	0.0001	mg/L	<0.00010	----
Tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
Titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
Tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	<0.00010	----
Uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
Vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
Zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----
Dissolved Metals (QCLot: 1120674)						
Mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Organic / Inorganic Carbon (QCLot: 1122901)									
Carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	96.2	80.0	120	----
Dissolved Metals (QCLot: 1116673)									
Chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	95.7	80.0	120	----
Dissolved Metals (QCLot: 1116674)									
Aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	102	80.0	120	----
Antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	96.9	80.0	120	----
Arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	105	80.0	120	----
Barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
Beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	100	80.0	120	----
Bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	97.5	80.0	120	----
Boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	95.4	80.0	120	----
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	100	80.0	120	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	99.5	80.0	120	----
Cesium, dissolved	7440-46-2	E421	0.00001	mg/L	0.05 mg/L	99.2	80.0	120	----
Chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	95.7	80.0	120	----
Cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
Copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.1	80.0	120	----
Iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	101	80.0	120	----
Lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	98.6	80.0	120	----
Lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	98.6	80.0	120	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	99.1	80.0	120	----
Manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	98.8	80.0	120	----
Molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
Nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	98.6	80.0	120	----
Phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	106	80.0	120	----
Potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
Rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	0.1 mg/L	101	80.0	120	----
Selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	100	80.0	120	----
Silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	107	80.0	120	----
Silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	92.8	80.0	120	----
Sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
Strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	97.8	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 1116674) - continued									
Sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	105	80.0	120	----
Tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	0.1 mg/L	100	80.0	120	----
Thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	101	80.0	120	----
Thorium, dissolved	7440-29-1	E421	0.0001	mg/L	0.1 mg/L	98.7	80.0	120	----
Tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.7	80.0	120	----
Titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	104	80.0	120	----
Tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	0.1 mg/L	95.6	80.0	120	----
Uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	100	80.0	120	----
Vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.6	80.0	120	----
Zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	99.3	80.0	120	----
Zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	95.5	80.0	120	----
Mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	98.9	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Organic / Inorganic Carbon (QCLot: 1122901)										
VA23C0582-002	Anonymous	Carbon, dissolved organic [DOC]	----	E358-L	4.92 mg/L	5 mg/L	98.4	70.0	130	----
Dissolved Metals (QCLot: 1116673)										
VA23C0550-002	Anonymous	Chromium, dissolved	7440-47-3	E421.Cr-L	0.0384 mg/L	0.04 mg/L	96.0	70.0	130	----
Dissolved Metals (QCLot: 1116674)										
VA23C0550-002	Anonymous	Aluminum, dissolved	7429-90-5	E421	0.197 mg/L	0.2 mg/L	98.6	70.0	130	----
		Molybdenum, dissolved	7439-98-7	E421	0.0192 mg/L	0.02 mg/L	95.9	70.0	130	----
VA23C0550-002	Anonymous	Antimony, dissolved	7440-36-0	E421	0.0188 mg/L	0.02 mg/L	93.8	70.0	130	----
		Arsenic, dissolved	7440-38-2	E421	0.0199 mg/L	0.02 mg/L	99.3	70.0	130	----
		Barium, dissolved	7440-39-3	E421	0.0201 mg/L	0.02 mg/L	101	70.0	130	----
		Beryllium, dissolved	7440-41-7	E421	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		Bismuth, dissolved	7440-69-9	E421	0.00931 mg/L	0.01 mg/L	93.1	70.0	130	----
		Boron, dissolved	7440-42-8	E421	0.093 mg/L	0.1 mg/L	93.2	70.0	130	----
		Cadmium, dissolved	7440-43-9	E421	0.00399 mg/L	0.004 mg/L	99.7	70.0	130	----
		Calcium, dissolved	7440-70-2	E421	3.93 mg/L	4 mg/L	98.3	70.0	130	----
		Cesium, dissolved	7440-46-2	E421	0.00983 mg/L	0.01 mg/L	98.3	70.0	130	----
		Chromium, dissolved	7440-47-3	E421	0.0384 mg/L	0.04 mg/L	96.0	70.0	130	----
		Cobalt, dissolved	7440-48-4	E421	0.0199 mg/L	0.02 mg/L	99.6	70.0	130	----
		Copper, dissolved	7440-50-8	E421	0.0192 mg/L	0.02 mg/L	95.8	70.0	130	----
		Iron, dissolved	7439-89-6	E421	1.89 mg/L	2 mg/L	94.4	70.0	130	----
		Lead, dissolved	7439-92-1	E421	0.0189 mg/L	0.02 mg/L	94.7	70.0	130	----
		Lithium, dissolved	7439-93-2	E421	0.0983 mg/L	0.1 mg/L	98.3	70.0	130	----
		Magnesium, dissolved	7439-95-4	E421	0.924 mg/L	1 mg/L	92.4	70.0	130	----
		Manganese, dissolved	7439-96-5	E421	0.0196 mg/L	0.02 mg/L	98.3	70.0	130	----
		Nickel, dissolved	7440-02-0	E421	0.0398 mg/L	0.04 mg/L	99.6	70.0	130	----
		Phosphorus, dissolved	7723-14-0	E421	9.97 mg/L	10 mg/L	99.7	70.0	130	----
		Potassium, dissolved	7440-09-7	E421	3.90 mg/L	4 mg/L	97.4	70.0	130	----
		Rubidium, dissolved	7440-17-7	E421	0.0189 mg/L	0.02 mg/L	94.6	70.0	130	----
		Silicon, dissolved	7440-21-3	E421	9.90 mg/L	10 mg/L	99.0	70.0	130	----
		Silver, dissolved	7440-22-4	E421	0.00383 mg/L	0.004 mg/L	95.8	70.0	130	----
		Sodium, dissolved	7440-23-5	E421	1.93 mg/L	2 mg/L	96.5	70.0	130	----
		Strontium, dissolved	7440-24-6	E421	0.0195 mg/L	0.02 mg/L	97.5	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 1116674) - continued										
VA23C0550-002	Anonymous	Sulfur, dissolved	7704-34-9	E421	19.4 mg/L	20 mg/L	97.1	70.0	130	----
		Tellurium, dissolved	13494-80-9	E421	0.0414 mg/L	0.04 mg/L	103	70.0	130	----
		Thallium, dissolved	7440-28-0	E421	0.00384 mg/L	0.004 mg/L	96.0	70.0	130	----
		Thorium, dissolved	7440-29-1	E421	0.0203 mg/L	0.02 mg/L	102	70.0	130	----
		Tin, dissolved	7440-31-5	E421	0.0193 mg/L	0.02 mg/L	96.5	70.0	130	----
		Titanium, dissolved	7440-32-6	E421	0.0398 mg/L	0.04 mg/L	99.5	70.0	130	----
		Tungsten, dissolved	7440-33-7	E421	0.0181 mg/L	0.02 mg/L	90.3	70.0	130	----
		Uranium, dissolved	7440-61-1	E421	0.00381 mg/L	0.004 mg/L	95.2	70.0	130	----
		Vanadium, dissolved	7440-62-2	E421	0.0976 mg/L	0.1 mg/L	97.6	70.0	130	----
		Zinc, dissolved	7440-66-6	E421	0.403 mg/L	0.4 mg/L	101	70.0	130	----
		Zirconium, dissolved	7440-67-7	E421	0.0393 mg/L	0.04 mg/L	98.3	70.0	130	----
Dissolved Metals (QCLot: 1120674)										
VA23C0552-014	Anonymous	Mercury, dissolved	7439-97-6	E509	0.0000996 mg/L	0.0001 mg/L	99.6	70.0	130	----

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Marianna DiMauro	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	mdimauro@azimuthgroup.ca, efranz@azimuthgro	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	marie-pier.marcil@agnicoeagle.com	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	~~604-730-1220~~ Fax:	Email 3:	meadowbank.environment@agnicoeagle.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		**Analysis Request**
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank CREMP - Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		**ALS Contact:**	Brent Mack	**Sampler:**

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	TOC, Ammonia, TKN, Total P	DOC	T-CN (Low), Free CN (Low)	Total Metals & Low Cr	Dissolved Metals & Low Cr	Total Mercury	Dissolved Mercury	Chlorophyll-a	Dissolved Arsenic speciation	Dissolved Selenium speciation	Number of Containers
							P	F/P	P		F	P	F/P	F	F/P	F	
	BG-1	23-Aug-23		Surface Water				X			X		X				3
	BG-4	23-Aug-23		Surface Water				X			X		X				3
	BG-5	23-Aug-23		Surface Water				X			X		X				3
	PW_ST-20i	23-Aug-23		Surface Water				X			X		X				3
	PW-ST-20ii	23-Aug-23		Surface Water				X			X		X				3

Environmental Division
Vancouver
Work Order Reference
VA23C0590

Telephone : +1 604 253 4188

Special Instructions / I CME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4. Note these are porewater samples.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Marianna DiMauro	25-Aug-23	7:00	MG	08/31	11am	°C				

ice packs

17°C

CERTIFICATE OF ANALYSIS

Work Order	: **VA24C2005**	Page	: 1 of 9
Amendment	: **1**		
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Eric Franz	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 730 1220	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 27-Aug-2024 12:20
PO	: ----	Date Analysis Commenced	: 28-Aug-2024
C-O-C number	: ----	Issue Date	: 18-Sep-2024 08:29
Sampler	: FQS, NS, OJ		
Site	: ----		
Quote number	: VA19-ACGI100-005 (Q39503)		
No. of samples received	: 34		
No. of samples analysed	: 18		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Production/Validation Manager	Inorganics, Burnaby, British Columbia
Cindy Tang	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Daniela Ruiz	Account Manager Assistant	Administration, Burnaby, British Columbia
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Maya Urquhart	Lab Analyst	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Nik Perkio	Senior Analyst	Inorganics, Waterloo, Ontario
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
µg/L	micrograms per litre
µg/sample	micrograms per sample
µS/cm	microsiemens per centimetre
L	litres
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (18-09-2024): This report has been amended and re-released to allow the reporting of additional analytical data.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLHC	*Detection Limit Raised: Dilution required due to high concentration of test analyte(s).*

DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
DTMF	*Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.*
DTSE	*Dissolved Se concentration exceeds total. Positive bias on D-Se suspected due to signal enhancement from volatile selenium species. Contact ALS if an alternative test to address this interference is needed.*
SFT	*Sample was filtered due to turbidity interference. Result reflects soluble analyte concentration.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	PW-ST-20i	PW-ST-20ii	PW-BG-1	PW-BG-4	PW-BG-5
					Client sampling date / time	11-Aug-2024 10:35	10-Aug-2024 10:40	10-Aug-2024 10:45	10-Aug-2024 10:50	10-Aug-2024 10:55
						VA24C2005-001	VA24C2005-002	VA24C2005-003	VA24C2005-004	VA24C2005-005
						Result	Result	Result	Result	Result
Physical Tests										
Alkalinity, bicarbonate (as CaCO3)	----	E290/VA	1.0	mg/L		112	54.9	87.8	89.0	86.0
Alkalinity, carbonate (as CaCO3)	----	E290/VA	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, hydroxide (as CaCO3)	----	E290/VA	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, total (as CaCO3)	----	E290/VA	1.0	mg/L		112	54.9	87.8	89.0	86.0
Conductivity	----	E100/VA	2.0	µS/cm		3040	2900	3090	2940	3050
Hardness (as CaCO3), dissolved	----	EC100/VA	0.60	mg/L		707	762	684	803	693
Hardness (as CaCO3), from total Ca/Mg	----	EC100A/VA	0.60	mg/L		694	746	693	764	755
pH	----	E108/VA	0.10	pH units		8.19	7.88	8.11	8.11	8.08
Solids, total suspended [TSS]	----	E160-L/VA	1.0	mg/L		1.8	2.0	<1.0	2.6	1.8
Turbidity	----	E121/VA	0.10	NTU		0.28	0.54	0.12	0.40	0.29
Anions and Nutrients										
Ammonia, total (as N)	7664-41-7	E298/VA	0.0050	mg/L		28.5	17.7	28.3	23.5	26.4
Bromide	24959-67-9	E235.Br-L/VA	0.050	mg/L		<1.00 DLDS	<1.00 DLDS	<1.00 DLDS	<1.00 DLDS	1.15
Chloride	16887-00-6	E235.Cl-L/VA	0.10	mg/L		97.4	94.4	97.7	97.7	98.1
Cyanate	88402-73-7	E343/WT	0.20	mg/L		3.60	<2.00 DLHC, DLM	<2.00 DLHC, DLM	<2.00 DLHC, DLM	<2.00 DLHC, DLM
Fluoride	16984-48-8	E235.F/VA	0.020	mg/L		<0.400 DLDS	<0.400 DLDS	<0.400 DLDS	<0.400 DLDS	<0.400 DLDS
Nitrate (as N)	14797-55-8	E235.NO3-L/VA	0.0050	mg/L		<0.100 DLDS	<0.100 DLDS	<0.100 DLDS	<0.100 DLDS	<0.100 DLDS
Nitrite (as N)	14797-65-0	E235.NO2-L/VA	0.0010	mg/L		<0.0200 DLDS	<0.0200 DLDS	<0.0200 DLDS	<0.0200 DLDS	<0.0200 DLDS
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U/VA	0.0010	mg/L		0.0074	0.0045	0.0079	0.0030	0.0038
Phosphorus, total dissolved	7723-14-0	E375-T/VA	0.0020	mg/L		0.0174	0.0154	0.0150	0.0079	0.0108
Silicate (as SiO2)	7631-86-9	E392/VA	0.50	mg/L		13.0	8.27	12.0	11.1 SFT	12.3
Sulfate (as SO4)	14808-79-8	E235.SO4/VA	0.30	mg/L		1220	1240	1270	1200	1290
Cyanides										
Cyanide, free	----	E339-L/VA	0.0010	mg/L		0.0080	0.0021	0.0036	0.0054	0.0146
Cyanide, strong acid dissociable (Total)	----	E333-L/VA	0.0010	mg/L		0.223	0.129	0.0847	0.245	0.112
Thiocyanate	302-04-5	E344/VA	0.50	mg/L		95.8	69.4	95.8	69.3	87.3
Organic / Inorganic Carbon										
Carbon, dissolved organic [DOC]	----	E358-L/VA	0.50	mg/L		23.5	18.7	22.3	19.8	28.0

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	PW-ST-20i	PW-ST-20ii	PW-BG-1	PW-BG-4	PW-BG-5
					Client sampling date / time	11-Aug-2024 10:35	10-Aug-2024 10:40	10-Aug-2024 10:45	10-Aug-2024 10:50	10-Aug-2024 10:55
						VA24C2005-001	VA24C2005-002	VA24C2005-003	VA24C2005-004	VA24C2005-005
						Result	Result	Result	Result	Result
Total Metals										
Aluminum, total	7429-90-5	E420/VA	0.0030	mg/L		0.0158	0.0272	0.0306	0.0334	0.0114
Antimony, total	7440-36-0	E420/VA	0.00010	mg/L		0.0190	0.00538	0.0107	0.00960	0.0107
Arsenic, total	7440-38-2	E420/VA	0.00010	mg/L		0.502	0.316	0.585	0.219	0.241
Barium, total	7440-39-3	E420/VA	0.00010	mg/L		0.0270	0.0276	0.0256	0.0261	0.0289
Beryllium, total	7440-41-7	E420/VA	0.000100	mg/L		<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth, total	7440-69-9	E420/VA	0.000050	mg/L		<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
Boron, total	7440-42-8	E420/VA	0.010	mg/L		0.275	0.223	0.316	0.273	0.294
Cadmium, total	7440-43-9	E420/VA	0.0000050	mg/L		<0.000100 DLM	<0.000165 DLM	0.000139	<0.000130 DLM	<0.000100 DLM
Calcium, total	7440-70-2	E420/VA	0.050	mg/L		228	262	227	246	248
Cesium, total	7440-46-2	E420/VA	0.000010	mg/L		<0.000020 DLA	0.000040	0.000021	<0.000020 DLA	0.000033
Chromium, total	7440-47-3	E420.Cr-L/VA	0.00010	mg/L		<0.00020 DLA	0.00056	<0.00020 DLA	0.00068	<0.00020 DLA
Chromium, total	7440-47-3	E420/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
Cobalt, total	7440-48-4	E420/VA	0.00010	mg/L		0.0594	0.0327	0.0476	0.0586	0.0390
Copper, total	7440-50-8	E420/VA	0.00050	mg/L		0.00222	<0.00100 DLA	0.00517	0.00278	0.00226
Iron, total	7439-89-6	E420/VA	0.010	mg/L		0.090	0.080	<0.020 DLA	0.130	0.036
Lead, total	7439-92-1	E420/VA	0.000050	mg/L		<0.000100 DLA	0.000180	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
Lithium, total	7439-93-2	E420/VA	0.0010	mg/L		0.0039	0.0050	0.0086	0.0055	0.0062
Magnesium, total	7439-95-4	E420/VA	0.0050	mg/L		30.4	22.2	30.6	36.4	32.9
Manganese, total	7439-96-5	E420/VA	0.00010	mg/L		0.138	0.0931	0.122	0.132	0.184
Mercury, total	7439-97-6	E508/VA	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum, total	7439-98-7	E420/VA	0.000050	mg/L		0.176	0.192	0.0774	0.121	0.157
Nickel, total	7440-02-0	E420/VA	0.00050	mg/L		0.0368	0.0253	0.0487	0.0484	0.0494
Phosphorus, total	7723-14-0	E420/VA	0.050	mg/L		<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA
Potassium, total	7440-09-7	E420/VA	0.050	mg/L		143	137	176	139	150
Rubidium, total	7440-17-7	E420/VA	0.00020	mg/L		0.0983	0.0609	0.153	0.0768	0.0713
Selenium, total	7782-49-2	E420/VA	0.000050	mg/L		0.0244	0.00144	0.00437	0.00701	0.00887
Silicon, total	7440-21-3	E420/VA	0.10	mg/L		6.52	4.10	5.93	5.71	6.24
Silver, total	7440-22-4	E420/VA	0.000010	mg/L		<0.000020 DLA	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA
Sodium, total	7440-23-5	E420/VA	0.050	mg/L		260	238	258	250	252
Strontium, total	7440-24-6	E420/VA	0.00020	mg/L		0.819	1.00	0.778	0.815	0.895

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	PW-ST-20i	PW-ST-20ii	PW-BG-1	PW-BG-4	PW-BG-5
					Client sampling date / time	11-Aug-2024 10:35	10-Aug-2024 10:40	10-Aug-2024 10:45	10-Aug-2024 10:50	10-Aug-2024 10:55
						VA24C2005-001	VA24C2005-002	VA24C2005-003	VA24C2005-004	VA24C2005-005
						Result	Result	Result	Result	Result
Total Metals										
Sulfur, total	7704-34-9	E420/VA	0.50	mg/L		504	510	504	516	524
Tellurium, total	13494-80-9	E420/VA	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
Thallium, total	7440-28-0	E420/VA	0.000010	mg/L		<0.000020 DLA	<0.000020 DLA	0.000028	<0.000020 DLA	<0.000020 DLA
Thorium, total	7440-29-1	E420/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
Tin, total	7440-31-5	E420/VA	0.00010	mg/L		0.00044	0.00075	<0.00020 DLA	<0.00020 DLA	0.00023
Titanium, total	7440-32-6	E420/VA	0.00030	mg/L		<0.00060 DLA	0.00100	<0.00060 DLA	0.00083	<0.00060 DLA
Tungsten, total	7440-33-7	E420/VA	0.00010	mg/L		0.00369	0.00142	0.00183	0.00283	0.00208
Uranium, total	7440-61-1	E420/VA	0.000010	mg/L		0.0130	0.00255	0.00784	0.00945	0.00569
Vanadium, total	7440-62-2	E420/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
Zinc, total	7440-66-6	E420/VA	0.0030	mg/L		<0.0060 DLA	<0.0060 DLA	<0.0060 DLA	<0.0060 DLA	<0.0060 DLA
Zirconium, total	7440-67-7	E420/VA	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
Dissolved Metals										
Aluminum, dissolved	7429-90-5	E421/VA	0.0010	mg/L		0.0132	0.0104	0.0129	0.0110	0.0086
Antimony, dissolved	7440-36-0	E421/VA	0.00010	mg/L		0.0242	0.00494	0.0111	0.0133 DTMF	0.0243 DTMF
Arsenic, dissolved	7440-38-2	E421/VA	0.00010	mg/L		0.346	0.423	0.610	0.235	0.177
Barium, dissolved	7440-39-3	E421/VA	0.00010	mg/L		0.0212	0.0255	0.0236	0.0259	0.0209
Beryllium, dissolved	7440-41-7	E421/VA	0.000100	mg/L		<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
Bismuth, dissolved	7440-69-9	E421/VA	0.000050	mg/L		<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
Boron, dissolved	7440-42-8	E421/VA	0.010	mg/L		0.267	0.215	0.317	0.304	0.241
Cadmium, dissolved	7440-43-9	E421/VA	0.0000050	mg/L		<0.0000450 DLM	<0.0000850 DLM	0.000106	<0.0000450 DLM	<0.0000400 DLM
Calcium, dissolved	7440-70-2	E421/VA	0.050	mg/L		239	271	228	261	235
Cesium, dissolved	7440-46-2	E421/VA	0.000010	mg/L		0.000034 DTMF	0.000050	0.000034	<0.000020 DLA	0.000032
Chromium, dissolved	7440-47-3	E421.Cr-L/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
Chromium, dissolved	7440-47-3	E421/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
Cobalt, dissolved	7440-48-4	E421/VA	0.00010	mg/L		0.0478	0.0330	0.0408	0.0690	0.0473
Copper, dissolved	7440-50-8	E421/VA	0.00020	mg/L		<0.00040 DLA	0.00046	0.00487	0.00051	0.00226
Iron, dissolved	7439-89-6	E421/VA	0.010	mg/L		0.097	0.053	0.023	0.078	0.034
Lead, dissolved	7439-92-1	E421/VA	0.000050	mg/L		<0.000100 DLA	0.000170	<0.000100 DLA	<0.000100 DLA	<0.000100 DLA
Lithium, dissolved	7439-93-2	E421/VA	0.0010	mg/L		0.0040	0.0044	0.0098	0.0048	0.0054
Magnesium, dissolved	7439-95-4	E421/VA	0.0050	mg/L		26.7	20.8	27.8	36.7	25.7

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	PW-ST-20i	PW-ST-20ii	PW-BG-1	PW-BG-4	PW-BG-5
					Client sampling date / time	11-Aug-2024 10:35	10-Aug-2024 10:40	10-Aug-2024 10:45	10-Aug-2024 10:50	10-Aug-2024 10:55
						VA24C2005-001	VA24C2005-002	VA24C2005-003	VA24C2005-004	VA24C2005-005
						Result	Result	Result	Result	Result
Dissolved Metals										
Manganese, dissolved	7439-96-5	E421/VA	0.00010	mg/L		0.0900	0.0643	0.0890	0.142	0.0771
Mercury, dissolved	7439-97-6	E509/VA	0.0000050	mg/L		<0.0000500 DLM	<0.0000500 DLM	<0.0000500 DLM	<0.0000500 DLM	<0.0000500 DLM
Molybdenum, dissolved	7439-98-7	E421/VA	0.000050	mg/L		0.151	0.166	0.0778	0.126	0.149
Nickel, dissolved	7440-02-0	E421/VA	0.00050	mg/L		0.0339	0.00970	0.0454	0.0546	0.0464
Phosphorus, dissolved	7723-14-0	E421/VA	0.050	mg/L		<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA	<0.100 DLA
Potassium, dissolved	7440-09-7	E421/VA	0.050	mg/L		145	135	168	147	136
Rubidium, dissolved	7440-17-7	E421/VA	0.00020	mg/L		0.102	0.0552	0.142	0.0688	0.0621
Selenium, dissolved	7782-49-2	E421/VA	0.000050	mg/L		0.0138	0.00184	0.00618 DTSE	0.00253	0.00737
Silicon, dissolved	7440-21-3	E421/VA	0.050	mg/L		4.73	3.62	5.46	5.35	4.70
Silver, dissolved	7440-22-4	E421/VA	0.000010	mg/L		<0.000020 DLA	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA	<0.000020 DLA
Sodium, dissolved	7440-23-5	E421/VA	0.050	mg/L		254	246	251	251	244
Strontium, dissolved	7440-24-6	E421/VA	0.00020	mg/L		0.803	0.956	0.794	0.891	0.787
Sulfur, dissolved	7704-34-9	E421/VA	0.50	mg/L		442	447	448	482	427
Tellurium, dissolved	13494-80-9	E421/VA	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
Thallium, dissolved	7440-28-0	E421/VA	0.000010	mg/L		<0.000020 DLA	<0.000020 DLA	0.000027	<0.000020 DLA	<0.000020 DLA
Thorium, dissolved	7440-29-1	E421/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA	<0.00020 DLA
Tin, dissolved	7440-31-5	E421/VA	0.00010	mg/L		0.00077 DTMF	<0.00020 DLA	<0.00020 DLA	0.00040 DTMF	0.00035
Titanium, dissolved	7440-32-6	E421/VA	0.00030	mg/L		<0.00060 DLA	<0.00060 DLA	<0.00060 DLA	<0.00060 DLA	<0.00060 DLA
Tungsten, dissolved	7440-33-7	E421/VA	0.00010	mg/L		0.00503 DTMF	0.00151	0.00197	0.00198	0.00349 DTMF
Uranium, dissolved	7440-61-1	E421/VA	0.000010	mg/L		0.0120	0.00186	0.00715	0.00794	0.00674
Vanadium, dissolved	7440-62-2	E421/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA	<0.00100 DLA
Zinc, dissolved	7440-66-6	E421/VA	0.0010	mg/L		<0.0020 DLA	<0.0020 DLA	<0.0020 DLA	<0.0020 DLA	<0.0020 DLA
Zirconium, dissolved	7440-67-7	E421/VA	0.00020	mg/L		<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA	<0.00040 DLA
Dissolved mercury filtration location	----	EP509/VA	-	-		Field	Field	Field	Field	Field
Dissolved metals filtration location	----	EP421/VA	-	-		Field	Field	Field	Field	Field

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	ST-20i-A	ST-20i-B	ST-20i-C	ST-20i-E	ST-20ii-A
					Client sampling date / time	10-Aug-2024 00:00	10-Aug-2024 00:00	10-Aug-2024 00:00	10-Aug-2024 00:00	10-Aug-2024 00:00
						VA24C2005-006	VA24C2005-007	VA24C2005-008	VA24C2005-010	VA24C2005-011
						Result	Result	Result	Result	Result
Field Tests										
Sampling volume, field	----	EF003/VA	0.010	L		0.250	0.250	0.250	0.250	0.250
Plant Pigments										
Chlorophyll a	479-61-8	EC870A/VA	0.010	µg/L		4.52	6.12	2.46	0.512	6.68
Chlorophyll a	479-61-8	E870A/VA	0.0020	µg/sample		1.13	1.53	0.614	0.128	1.67

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	ST-20ii-B	ST-20ii-C	ST-20ii-D	ST-20ii-E	Pit-A-A
					Client sampling date / time	10-Aug-2024 00:00	10-Aug-2024 00:00	10-Aug-2024 00:00	10-Aug-2024 00:00	19-Aug-2024 00:00
						VA24C2005-012	VA24C2005-013	VA24C2005-014	VA24C2005-015	VA24C2005-031
						Result	Result	Result	Result	Result
Field Tests										
Sampling volume, field	----	EF003/VA	0.010	L		0.250	0.250	0.250	0.250	0.250
Plant Pigments										
Chlorophyll a	479-61-8	EC870A/VA	0.010	µg/L		7.68	4.48	2.50	5.20	120
Chlorophyll a	479-61-8	E870A/VA	0.0020	µg/sample		1.92	1.12	0.624	1.30	30.1

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	Pit-A-B	Pit-A-C	ALS-TB	----	----
				Client sampling date / time	19-Aug-2024 00:00	19-Aug-2024 00:00	19-Aug-2024 00:00	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24C2005-032	VA24C2005-033	VA24C2005-034	--------	--------
					Result	Result	Result	----	----
Field Tests									
Sampling volume, field	----	EF003/VA	0.010	L	0.250	0.250	----	----	----
Anions and Nutrients									
Cyanate	88402-73-7	E343/WT	0.20	mg/L	----	----	<0.20	----	----
Cyanides									
Cyanide, free	----	E339-L/VA	0.0010	mg/L	----	----	<0.0010	----	----
Cyanide, strong acid dissociable (Total)	----	E333-L/VA	0.0010	mg/L	----	----	<0.0010	----	----
Thiocyanate	302-04-5	E344/VA	0.50	mg/L	----	----	<0.50	----	----
Plant Pigments									
Chlorophyll a	479-61-8	EC870A/VA	0.010	µg/L	1.96	1.30	----	----	----
Chlorophyll a	479-61-8	E870A/VA	0.0020	µg/sample	0.491	0.324	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA24C2005**	Page	: 1 of 27
Amendment	: 1		
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Eric Franz	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 730 1220	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 27-Aug-2024 12:20
PO	: ----	Issue Date	: 18-Sep-2024 08:30
C-O-C number	: ----		
Sampler	: FQS, NS, OJ		
Site	: ----		
Quote number	: VA19-ACGI100-005 (Q39503)		
No. of samples received	: 34		
No. of samples analysed	: 18		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water** Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (lab preserved) PW-ST-20i	E298	11-Aug-2024	29-Aug-2024	3 days	18 days	× EHTR	31-Aug-2024	28 days	2 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (lab preserved) PW-BG-1	E298	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	31-Aug-2024	28 days	2 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (lab preserved) PW-BG-4	E298	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	31-Aug-2024	28 days	2 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (lab preserved) PW-BG-5	E298	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	31-Aug-2024	28 days	2 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
HDPE PW-ST-20ii	E298	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	31-Aug-2024	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE PW-ST-20i	E235.Br-L	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	29-Aug-2024	28 days	18 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE PW-BG-1	E235.Br-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE PW-BG-4	E235.Br-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE PW-BG-5	E235.Br-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE PW-ST-20ii	E235.Br-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE PW-ST-20i	E235.Cl-L	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	29-Aug-2024	28 days	18 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE PW-BG-1	E235.Cl-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE PW-BG-4	E235.Cl-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE PW-BG-5	E235.Cl-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE PW-ST-20ii	E235.Cl-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Cyanate by Ion Selective Electrode										
UV-inhibited HDPE - total (sodium hydroxide) ALS-TB	E343	19-Aug-2024	----	----	----		11-Sep-2024	14 days	23 days	× EHT

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Cyanate by Ion Selective Electrode										
UV-inhibited HDPE - total (sodium hydroxide) PW-ST-20i	E343	11-Aug-2024	----	----	----		11-Sep-2024	14 days	31 days	× EHTR
Anions and Nutrients : Cyanate by Ion Selective Electrode										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-1	E343	10-Aug-2024	----	----	----		11-Sep-2024	14 days	32 days	× EHTR
Anions and Nutrients : Cyanate by Ion Selective Electrode										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-4	E343	10-Aug-2024	----	----	----		11-Sep-2024	14 days	32 days	× EHTR
Anions and Nutrients : Cyanate by Ion Selective Electrode										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-5	E343	10-Aug-2024	----	----	----		11-Sep-2024	14 days	32 days	× EHTR
Anions and Nutrients : Cyanate by Ion Selective Electrode										
UV-inhibited HDPE - total (sodium hydroxide) PW-ST-20ii	E343	10-Aug-2024	----	----	----		11-Sep-2024	14 days	32 days	× EHTR
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)										
HDPE PW-ST-20i	E378-U	11-Aug-2024	29-Aug-2024	3 days	18 days	× EHTR	29-Aug-2024	3 days	18 days	× EHTR
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)										
HDPE PW-BG-1	E378-U	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)										
HDPE PW-BG-4	E378-U	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)										
HDPE PW-BG-5	E378-U	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)										
HDPE PW-ST-20ii	E378-U	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Fluoride in Water by IC										
HDPE PW-ST-20i	E235.F	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	17-Sep-2024	28 days	37 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE PW-BG-1	E235.F	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	17-Sep-2024	28 days	38 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE PW-BG-4	E235.F	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	17-Sep-2024	28 days	38 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE PW-BG-5	E235.F	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	17-Sep-2024	28 days	38 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE PW-ST-20ii	E235.F	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	17-Sep-2024	28 days	38 days	× EHT
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE PW-ST-20i	E235.NO3-L	11-Aug-2024	29-Aug-2024	3 days	18 days	× EHTR	29-Aug-2024	3 days	18 days	× EHTR
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE PW-BG-1	E235.NO3-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE PW-BG-4	E235.NO3-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE PW-BG-5	E235.NO3-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE PW-ST-20ii	E235.NO3-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE PW-ST-20i	E235.NO2-L	11-Aug-2024	29-Aug-2024	3 days	18 days	× EHTR	29-Aug-2024	3 days	18 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE PW-BG-1	E235.NO2-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE PW-BG-4	E235.NO2-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE PW-BG-5	E235.NO2-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE PW-ST-20ii	E235.NO2-L	10-Aug-2024	29-Aug-2024	3 days	19 days	× EHTR	29-Aug-2024	3 days	19 days	× EHTR
Anions and Nutrients : Reactive Silica by Colourimetry										
HDPE PW-ST-20i	E392	11-Aug-2024	----	----	----		30-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Reactive Silica by Colourimetry										
HDPE PW-BG-1	E392	10-Aug-2024	----	----	----		30-Aug-2024	28 days	20 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Reactive Silica by Colourimetry										
HDPE PW-BG-4	E392	10-Aug-2024	----	----	----		30-Aug-2024	28 days	20 days	✓
Anions and Nutrients : Reactive Silica by Colourimetry										
HDPE PW-BG-5	E392	10-Aug-2024	----	----	----		30-Aug-2024	28 days	20 days	✓
Anions and Nutrients : Reactive Silica by Colourimetry										
HDPE PW-ST-20ii	E392	10-Aug-2024	----	----	----		30-Aug-2024	28 days	20 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE PW-ST-20i	E235.SO4	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	29-Aug-2024	28 days	18 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE PW-BG-1	E235.SO4	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE PW-BG-4	E235.SO4	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE PW-BG-5	E235.SO4	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE PW-ST-20ii	E235.SO4	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	29-Aug-2024	28 days	19 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) PW-ST-20i	E375-T	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	31-Aug-2024	28 days	20 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) PW-BG-1	E375-T	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) PW-BG-4	E375-T	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) PW-BG-5	E375-T	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Anions and Nutrients : Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass dissolved (sulfuric acid) PW-ST-20ii	E375-T	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Cyanides : Free Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) ALS-TB	E339-L	19-Aug-2024	01-Sep-2024	14 days	13 days	✓	01-Sep-2024	14 days	13 days	✓
Cyanides : Free Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-ST-20i	E339-L	11-Aug-2024	30-Aug-2024	14 days	19 days	× EHTR	30-Aug-2024	14 days	19 days	× EHTR
Cyanides : Free Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-1	E339-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Cyanides : Free Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-4	E339-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Cyanides : Free Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-5	E339-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Cyanides : Free Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide)										
PW-ST-20ii	E339-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Cyanides : Thiocyanate by Colourimetry										
HDPE (nitric acid)										
ALS-TB	E344	19-Aug-2024	----	----	----		29-Aug-2024	14 days	10 days	✓
Cyanides : Thiocyanate by Colourimetry										
HDPE (nitric acid)										
PW-ST-20i	E344	11-Aug-2024	----	----	----		29-Aug-2024	14 days	18 days	× EHTR
Cyanides : Thiocyanate by Colourimetry										
HDPE (nitric acid)										
PW-BG-1	E344	10-Aug-2024	----	----	----		29-Aug-2024	14 days	19 days	× EHTR
Cyanides : Thiocyanate by Colourimetry										
HDPE (nitric acid)										
PW-BG-4	E344	10-Aug-2024	----	----	----		29-Aug-2024	14 days	19 days	× EHTR
Cyanides : Thiocyanate by Colourimetry										
HDPE (nitric acid)										
PW-BG-5	E344	10-Aug-2024	----	----	----		29-Aug-2024	14 days	19 days	× EHTR
Cyanides : Thiocyanate by Colourimetry										
HDPE (nitric acid)										
PW-ST-20ii	E344	10-Aug-2024	----	----	----		29-Aug-2024	14 days	19 days	× EHTR
Cyanides : Total Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide)										
ALS-TB	E333-L	19-Aug-2024	01-Sep-2024	14 days	13 days	✓	01-Sep-2024	14 days	13 days	✓
Cyanides : Total Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide)										
PW-ST-20i	E333-L	11-Aug-2024	30-Aug-2024	14 days	19 days	× EHTR	30-Aug-2024	14 days	19 days	× EHTR

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Cyanides : Total Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-1	E333-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Cyanides : Total Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-4	E333-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Cyanides : Total Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-BG-5	E333-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Cyanides : Total Cyanide (Low Level)										
UV-inhibited HDPE - total (sodium hydroxide) PW-ST-20ii	E333-L	10-Aug-2024	30-Aug-2024	14 days	20 days	× EHTR	30-Aug-2024	14 days	20 days	× EHTR
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW-ST-20i	E421.Cr-L	11-Aug-2024	31-Aug-2024	180 days	20 days	✓	01-Sep-2024	180 days	21 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW-BG-1	E421.Cr-L	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	01-Sep-2024	180 days	22 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW-BG-4	E421.Cr-L	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	01-Sep-2024	180 days	22 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW-BG-5	E421.Cr-L	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	01-Sep-2024	180 days	22 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) PW-ST-20ii	E421.Cr-L	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	01-Sep-2024	180 days	22 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial - dissolved (lab preserved) PW-ST-20i	E509	11-Aug-2024	04-Sep-2024	28 days	24 days	✓	04-Sep-2024	28 days	24 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial - dissolved (lab preserved) PW-BG-1	E509	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial - dissolved (lab preserved) PW-BG-4	E509	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial - dissolved (lab preserved) PW-BG-5	E509	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial - dissolved (lab preserved) PW-ST-20ii	E509	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) PW-ST-20i	E421	11-Aug-2024	31-Aug-2024	180 days	20 days	✓	02-Sep-2024	180 days	22 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) PW-BG-1	E421	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	02-Sep-2024	180 days	23 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) PW-BG-4	E421	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	02-Sep-2024	180 days	23 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) PW-BG-5	E421	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	02-Sep-2024	180 days	23 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) PW-ST-20ii	E421	10-Aug-2024	31-Aug-2024	180 days	21 days	✓	02-Sep-2024	180 days	23 days	✓
Field Tests : Field Volume (L)										
Opaque HDPE tube Pit-A-A	EF003	19-Aug-2024	----	----	----		10-Sep-2024	----	22 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube Pit-A-B	EF003	19-Aug-2024	----	----	----		10-Sep-2024	----	22 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube Pit-A-C	EF003	19-Aug-2024	----	----	----		10-Sep-2024	----	22 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20i-A	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20i-B	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20i-C	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20i-E	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20ii-A	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20ii-B	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20ii-C	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20ii-D	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Field Tests : Field Volume (L)										
Opaque HDPE tube ST-20ii-E	EF003	10-Aug-2024	----	----	----		10-Sep-2024	----	31 days	
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) PW-ST-20i	E358-L	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	30-Aug-2024	28 days	19 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) PW-BG-1	E358-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	30-Aug-2024	28 days	20 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) PW-BG-4	E358-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	30-Aug-2024	28 days	20 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) PW-BG-5	E358-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	30-Aug-2024	28 days	20 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) PW-ST-20ii	E358-L	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	30-Aug-2024	28 days	20 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE PW-ST-20i	E290	11-Aug-2024	29-Aug-2024	14 days	18 days	× EHTR	31-Aug-2024	14 days	20 days	× EHTR
Physical Tests : Alkalinity Species by Titration										
HDPE PW-BG-1	E290	10-Aug-2024	29-Aug-2024	14 days	19 days	× EHTR	31-Aug-2024	14 days	21 days	× EHTR
Physical Tests : Alkalinity Species by Titration										
HDPE PW-BG-4	E290	10-Aug-2024	29-Aug-2024	14 days	19 days	× EHTR	31-Aug-2024	14 days	21 days	× EHTR
Physical Tests : Alkalinity Species by Titration										
HDPE PW-BG-5	E290	10-Aug-2024	29-Aug-2024	14 days	19 days	× EHTR	31-Aug-2024	14 days	21 days	× EHTR
Physical Tests : Alkalinity Species by Titration										
HDPE PW-ST-20ii	E290	10-Aug-2024	29-Aug-2024	14 days	19 days	× EHTR	31-Aug-2024	14 days	21 days	× EHTR
Physical Tests : Conductivity in Water										
HDPE PW-ST-20i	E100	11-Aug-2024	29-Aug-2024	28 days	18 days	✓	31-Aug-2024	28 days	20 days	✓
Physical Tests : Conductivity in Water										
HDPE PW-BG-1	E100	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Physical Tests : Conductivity in Water										
HDPE PW-BG-4	E100	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Physical Tests : Conductivity in Water										
HDPE PW-BG-5	E100	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE PW-ST-20ii	E100	10-Aug-2024	29-Aug-2024	28 days	19 days	✓	31-Aug-2024	28 days	21 days	✓
Physical Tests : pH by Meter										
HDPE PW-ST-20i	E108	11-Aug-2024	29-Aug-2024	0.25 hrs	428 hrs	× EHTR-FM	31-Aug-2024	0.25 hrs	480 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE PW-BG-1	E108	10-Aug-2024	29-Aug-2024	0.25 hrs	451 hrs	× EHTR-FM	31-Aug-2024	0.25 hrs	504 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE PW-BG-4	E108	10-Aug-2024	29-Aug-2024	0.25 hrs	451 hrs	× EHTR-FM	31-Aug-2024	0.25 hrs	504 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE PW-BG-5	E108	10-Aug-2024	29-Aug-2024	0.25 hrs	451 hrs	× EHTR-FM	31-Aug-2024	0.25 hrs	504 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE PW-ST-20ii	E108	10-Aug-2024	29-Aug-2024	0.25 hrs	452 hrs	× EHTR-FM	31-Aug-2024	0.25 hrs	504 hrs	× EHTR-FM
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE PW-ST-20i	E160-L	11-Aug-2024	----	----	----		30-Aug-2024	7 days	19 days	× EHTR
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE PW-BG-1	E160-L	10-Aug-2024	----	----	----		30-Aug-2024	7 days	20 days	× EHTR
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE PW-BG-4	E160-L	10-Aug-2024	----	----	----		30-Aug-2024	7 days	20 days	× EHTR

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE PW-BG-5	E160-L	10-Aug-2024	----	----	----		30-Aug-2024	7 days	20 days	× EHTR
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE PW-ST-20ii	E160-L	10-Aug-2024	----	----	----		30-Aug-2024	7 days	20 days	× EHTR
Physical Tests : Turbidity by Nephelometry										
HDPE PW-BG-1	E121	10-Aug-2024	----	----	----		28-Aug-2024	3 days	18 days	× EHTR
Physical Tests : Turbidity by Nephelometry										
HDPE PW-BG-4	E121	10-Aug-2024	----	----	----		28-Aug-2024	3 days	18 days	× EHTR
Physical Tests : Turbidity by Nephelometry										
HDPE PW-BG-5	E121	10-Aug-2024	----	----	----		28-Aug-2024	3 days	18 days	× EHTR
Physical Tests : Turbidity by Nephelometry										
HDPE PW-ST-20i	E121	11-Aug-2024	----	----	----		28-Aug-2024	3 days	18 days	× EHTR
Physical Tests : Turbidity by Nephelometry										
HDPE PW-ST-20ii	E121	10-Aug-2024	----	----	----		28-Aug-2024	3 days	19 days	× EHTR
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube Pit-A-B	E870A	19-Aug-2024	04-Sep-2024	28 days	17 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube Pit-A-C	E870A	19-Aug-2024	04-Sep-2024	28 days	17 days	✓	04-Sep-2024	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube Pit-A-A	E870A	19-Aug-2024	05-Sep-2024	28 days	17 days	✓	06-Sep-2024	28 days	1 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20i-A	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20i-B	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20i-C	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20i-E	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20ii-B	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20ii-C	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20ii-D	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube ST-20ii-E	E870A	10-Aug-2024	04-Sep-2024	28 days	26 days	✓	04-Sep-2024	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Pigments : Chlorophyll-a by Fluorometry (Field Filtered µg)										
Opaque HDPE tube										
ST-20ii-A	E870A	10-Aug-2024	05-Sep-2024	28 days	26 days	✓	06-Sep-2024	28 days	1 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved)										
PW-ST-20i	E420.Cr-L	11-Aug-2024	03-Sep-2024	180 days	23 days	✓	03-Sep-2024	180 days	23 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved)										
PW-BG-1	E420.Cr-L	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	03-Sep-2024	180 days	24 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved)										
PW-BG-4	E420.Cr-L	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	03-Sep-2024	180 days	24 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved)										
PW-BG-5	E420.Cr-L	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	03-Sep-2024	180 days	24 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved)										
PW-ST-20ii	E420.Cr-L	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	03-Sep-2024	180 days	24 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial - total (lab preserved)										
PW-ST-20i	E508	11-Aug-2024	04-Sep-2024	28 days	24 days	✓	04-Sep-2024	28 days	24 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial - total (lab preserved)										
PW-BG-1	E508	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial - total (lab preserved)										
PW-BG-4	E508	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Water by CVAAS										
Glass vial - total (lab preserved) PW-BG-5	E508	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial - total (lab preserved) PW-ST-20ii	E508	10-Aug-2024	04-Sep-2024	28 days	25 days	✓	04-Sep-2024	28 days	25 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) PW-ST-20i	E420	11-Aug-2024	03-Sep-2024	180 days	23 days	✓	04-Sep-2024	180 days	24 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) PW-BG-1	E420	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	04-Sep-2024	180 days	25 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) PW-BG-4	E420	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	04-Sep-2024	180 days	25 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) PW-BG-5	E420	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	04-Sep-2024	180 days	25 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) PW-ST-20ii	E420	10-Aug-2024	03-Sep-2024	180 days	24 days	✓	04-Sep-2024	180 days	25 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	1622582	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	1623884	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	1622586	1	19	5.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	1622590	1	10	10.0	5.0	✓
Conductivity in Water	E100	1622583	1	20	5.0	5.0	✓
Cyanate by Ion Selective Electrode	E343	1645308	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1624653	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1632890	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1624652	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1623887	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1622593	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	1656366	1	5	20.0	5.0	✓
Free Cyanide (Low Level)	E339-L	1626581	3	25	12.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	1622587	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	1622588	1	20	5.0	5.0	✓
pH by Meter	E108	1622581	1	19	5.2	5.0	✓
Reactive Silica by Colourimetry	E392	1626576	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1622589	1	20	5.0	5.0	✓
Thiocyanate by Colourimetry	E344	1623485	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	1624610	1	5	20.0	5.0	✓
Total Cyanide (Low Level)	E333-L	1626582	3	48	6.2	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	1623885	1	14	7.1	5.0	✓
Total Mercury in Water by CVAAS	E508	1631157	2	28	7.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1624609	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	1622461	2	40	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	1622582	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	1623884	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	1622586	1	19	5.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	1622590	1	10	10.0	5.0	✓
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	1632527	2	30	6.6	5.0	✓
Conductivity in Water	E100	1622583	1	20	5.0	5.0	✓
Cyanate by Ion Selective Electrode	E343	1645308	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1624653	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1632890	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1624652	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1623887	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1622593	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	1656366	1	5	20.0	5.0	✓
Free Cyanide (Low Level)	E339-L	1626581	3	25	12.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	1622587	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	1622588	1	20	5.0	5.0	✓
pH by Meter	E108	1622581	1	19	5.2	5.0	✓
Reactive Silica by Colourimetry	E392	1626576	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1622589	1	20	5.0	5.0	✓
Thiocyanate by Colourimetry	E344	1623485	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	1624610	1	5	20.0	5.0	✓
Total Cyanide (Low Level)	E333-L	1626582	3	48	6.2	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	1623885	1	14	7.1	5.0	✓
Total Mercury in Water by CVAAS	E508	1631157	2	28	7.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1624609	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	1626703	2	28	7.1	5.0	✓
Turbidity by Nephelometry	E121	1622461	2	40	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	1622582	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	1623884	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	1622586	1	19	5.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	1622590	1	10	10.0	5.0	✓
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A	1632527	2	30	6.6	5.0	✓
Conductivity in Water	E100	1622583	1	20	5.0	5.0	✓
Cyanate by Ion Selective Electrode	E343	1645308	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1624653	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1632890	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1624652	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1623887	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1622593	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	1656366	1	5	20.0	5.0	✓
Free Cyanide (Low Level)	E339-L	1626581	3	25	12.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	1622587	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	1622588	1	20	5.0	5.0	✓
Reactive Silica by Colourimetry	E392	1626576	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1622589	1	20	5.0	5.0	✓
Thiocyanate by Colourimetry	E344	1623485	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	1624610	1	5	20.0	5.0	✓
Total Cyanide (Low Level)	E333-L	1626582	3	48	6.2	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	1623885	1	14	7.1	5.0	✓
Total Mercury in Water by CVAAS	E508	1631157	2	28	7.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1624609	2	20	10.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	1626703	2	28	7.1	5.0	✓
Turbidity by Nephelometry	E121	1622461	2	40	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	1623884	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	1622586	1	19	5.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	1622590	1	10	10.0	5.0	✓
Cyanate by Ion Selective Electrode	E343	1645308	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	1624653	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	1632890	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1624652	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1623887	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1622593	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	1656366	1	5	20.0	5.0	✓
Free Cyanide (Low Level)	E339-L	1626581	3	25	12.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	1622587	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	1622588	1	20	5.0	5.0	✓
Reactive Silica by Colourimetry	E392	1626576	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1622589	1	20	5.0	5.0	✓
Thiocyanate by Colourimetry	E344	1623485	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	1624610	1	5	20.0	5.0	✓
Total Cyanide (Low Level)	E333-L	1626582	3	48	6.2	5.0	✓
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T	1623885	1	14	7.1	5.0	✓
Total Mercury in Water by CVAAS	E508	1631157	2	28	7.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1624609	2	20	10.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 ALS Environmental - Vancouver	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 ALS Environmental - Vancouver	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 ALS Environmental - Vancouver	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TSS by Gravimetry (Low Level)	E160-L ALS Environmental - Vancouver	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Bromide in Water by IC (Low Level)	E235.Br-L ALS Environmental - Vancouver	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L ALS Environmental - Vancouver	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F ALS Environmental - Vancouver	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L ALS Environmental - Vancouver	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L ALS Environmental - Vancouver	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Sulfate in Water by IC	E235.SO4 ALS Environmental - Vancouver	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 ALS Environmental - Vancouver	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 ALS Environmental - Vancouver	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Cyanide (Low Level)	E333-L ALS Environmental - Vancouver	Water	ISO 14403 (mod)	Total or Strong Acid Dissociable (SAD) Cyanide is determined by Continuous Flow Analyzer (CFA) with in-line UV digestion followed by colourmetric analysis. Method Limitation: High levels of thiocyanate (SCN) may cause positive interference (up to 0.5% of SCN concentration).
Free Cyanide (Low Level)	E339-L ALS Environmental - Vancouver	Water	ASTM D7237 (mod)	Free Cyanide is determined by Continuous Flow Analyzer (CFA) with in-line gas diffusion followed by colourmetric analysis.
Cyanate by Ion Selective Electrode	E343 ALS Environmental - Waterloo	Water	APHA 4500-CN L (mod)	This analysis is carried out using procedures adapted from APHA method 4500-CN "Cyanide". Cyanate is determined by the Cyanate hydrolysis method using an ammonia selective electrode
Thiocyanate by Colourimetry	E344 ALS Environmental - Vancouver	Water	APHA 4500-CN M (mod)	Thiocyanate is determined by the ferric nitrate colourimetric method. Water samples containing high levels of hexavalent chromium, cyanide (together with sulfide), reducing agents, or hydrocarbons may cause negative or positive interferences with this method.
Dissolved Organic Carbon by Combustion (Low Level)	E358-L ALS Environmental - Vancouver	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Dissolved Phosphorus by Colourimetry (0.002 mg/L)	E375-T ALS Environmental - Vancouver	Water	APHA 4500-P E (mod).	Total Dissolved Phosphorus is determined colourimetrically using a discrete analyzer after filtration through a 0.45 micron filter followed by heated persulfate digestion of the sample.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U ALS Environmental - Vancouver	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Reactive Silica by Colourimetry	E392 ALS Environmental - Vancouver	Water	APHA 4500-SiO2 E (mod)	Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method using a discrete analyzer. Method Limitation: Arsenic (5+) above 100 mg/L is a negative interference on this test
Total Metals in Water by CRC ICPMS	E420 ALS Environmental - Vancouver	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L ALS Environmental - Vancouver	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 ALS Environmental - Vancouver	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L ALS Environmental - Vancouver	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 ALS Environmental - Vancouver	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 ALS Environmental - Vancouver	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Chlorophyll-a by Fluorometry (Field Filtered µg)	E870A ALS Environmental - Vancouver	Water	EPA 445.0 (mod)	Chlorophyll-a is determined by solvent extraction followed with analysis by fluorometry using the non-acidification procedure. Sampling volume not provided by client.
Dissolved Hardness (Calculated)	EC100 ALS Environmental - Vancouver	Water	APHA 2340B	“Hardness (as CaCO3), dissolved” is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. “Total Hardness” refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Hardness (Calculated) from Total Ca/Mg	EC100A ALS Environmental - Vancouver	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
Chlorophyll-a by Fluorometry (Field Filtered µg/L)	EC870A ALS Environmental - Vancouver	Water	CALC	Convert results to sample concentration based on field information.
Field Volume (L)	EF003 ALS Environmental - Vancouver	Water		Field measurement of sampling volume provided by client and recorded on ALS report may affect the validity of results.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 ALS Environmental - Vancouver	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Dissolved Organic Carbon for Combustion	EP358 ALS Environmental - Vancouver	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Dissolved Phosphorus in water	EP375 ALS Environmental - Vancouver	Water	APHA 4500-P E (mod).	Samples are filtered through a 0.45 micron membrane filter and then heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 ALS Environmental - Vancouver	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 ALS Environmental - Vancouver	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
Chlorophyll-a Extraction (Field Filtered)	EP870A ALS Environmental - Vancouver	Water	EPA 445.0 (mod)	Chlorophyll-a solvent extraction.

QUALITY CONTROL REPORT

Work Order	: **VA24C2005**	Page	: 1 of 21
Amendment	: **1**		
Client	: Azimuth Consulting Group Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Eric Franz	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 730 1220	Telephone	: 778-370-3279
Project	: Meadowbank CREMP Surfacewater	Date Samples Received	: 27-Aug-2024 12:20
PO	: ----	Date Analysis Commenced	: 28-Aug-2024
C-O-C number	: ----	Issue Date	: 18-Sep-2024 08:30
Sampler	: FQS, NS, OJ		
Site	: ----		
Quote number	: VA19-ACGI100-005 (Q39503)		
No. of samples received	: 34		
No. of samples analysed	: 18		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Production/Validation Manager	Vancouver Inorganics, Burnaby, British Columbia
Cindy Tang	Team Leader - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Vancouver Metals, Burnaby, British Columbia
Daniela Ruiz	Account Manager Assistant	Vancouver Administration, Burnaby, British Columbia
Ghazaleh Khanmirzaei	Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia
Maya Urquhart	Lab Analyst	Vancouver Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Nik Perkio	Senior Analyst	Waterloo Inorganics, Waterloo, Ontario
Tracy Harley	Supervisor - Water Quality Instrumentation	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1622461)											
VA24C1974-005	Anonymous	Turbidity	----	E121	0.10	NTU	0.66	0.78	0.11	Diff <2x LOR	----
Physical Tests (QC Lot: 1622462)											
VA24C2005-005	PW-BG-5	Turbidity	----	E121	0.10	NTU	0.29	0.28	0.02	Diff <2x LOR	----
Physical Tests (QC Lot: 1622581)											
KS2403445-001	Anonymous	pH	----	E108	0.10	pH units	8.47	8.49	0.236%	4%	----
Physical Tests (QC Lot: 1622582)											
KS2403445-001	Anonymous	Alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	209	211	1.06%	200%	----
		Alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	12.3	13.9	12.3%	200%	----
		Alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0.00%	200%	----
		Alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	221	225	1.72%	20%	----
Physical Tests (QC Lot: 1622583)											
KS2403445-001	Anonymous	Conductivity	----	E100	2.0	µS/cm	427	429	0.467%	10%	----
Anions and Nutrients (QC Lot: 1622586)											
KS2403442-001	Anonymous	Bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1622587)											
KS2403442-001	Anonymous	Nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1622588)											
KS2403442-001	Anonymous	Nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1622589)											
KS2403442-001	Anonymous	Sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	1.89	1.86	0.04	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1622590)											
VA24C2005-001	PW-ST-20i	Chloride	16887-00-6	E235.Cl-L	2.00	mg/L	97.4	97.7	0.378%	20%	----
Anions and Nutrients (QC Lot: 1622593)											
VA24C2005-001	PW-ST-20i	Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0074	0.0073	0.0001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1623884)											
FJ2402555-001	Anonymous	Ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0452	0.0451	0.0001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1623885)											
VA24C1967-001	Anonymous	Phosphorus, total dissolved	7723-14-0	E375-T	0.0020	mg/L	0.0034	0.0035	0.00005	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1626576)											
EO2407405-001	Anonymous	Silicate (as SiO2)	7631-86-9	E392	0.50	mg/L	6.60	6.72	1.68%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 1645308)											
VA24C2005-001	PW-ST-20i	Cyanate	88402-73-7	E343	2.00	mg/L	3.60	3.00	0.60	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1656366)											
VA24C2005-001	PW-ST-20i	Fluoride	16984-48-8	E235.F	0.400	mg/L	<0.400	<0.400	0	Diff <2x LOR	----
Cyanides (QC Lot: 1623485)											
VA24C1941-002	Anonymous	Thiocyanate	302-04-5	E344	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Cyanides (QC Lot: 1626581)											
VA24C1021-006	Anonymous	Cyanide, free	----	E339-L	0.0010	mg/L	0.0037	0.0036	0.00008	Diff <2x LOR	----
Cyanides (QC Lot: 1626582)											
VA24C1021-006	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333-L	0.0010	mg/L	0.0188	0.0186	1.23%	20%	----
Cyanides (QC Lot: 1626864)											
VA24C1019-001	Anonymous	Cyanide, free	----	E339-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Cyanides (QC Lot: 1626865)											
VA24C1019-001	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Cyanides (QC Lot: 1628658)											
VA24C1379-001	Anonymous	Cyanide, free	----	E339-L	0.0010	mg/L	0.0038	0.0040	0.0001	Diff <2x LOR	----
Cyanides (QC Lot: 1628659)											
VA24C1379-001	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333-L	0.0010	mg/L	0.0209	0.0179	15.3%	20%	----
Organic / Inorganic Carbon (QC Lot: 1623887)											
VA24C1526-001	Anonymous	Carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.78	1.83	0.05	Diff <2x LOR	----
Total Metals (QC Lot: 1624609)											
VA24C2005-001	PW-ST-20i	Aluminum, total	7429-90-5	E420	0.0060	mg/L	0.0158	0.0162	0.0004	Diff <2x LOR	----
		Antimony, total	7440-36-0	E420	0.00020	mg/L	0.0190	0.0185	2.70%	20%	----
		Arsenic, total	7440-38-2	E420	0.00020	mg/L	0.502	0.502	0.0618%	20%	----
		Barium, total	7440-39-3	E420	0.00020	mg/L	0.0270	0.0268	0.752%	20%	----
		Beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Bismuth, total	7440-69-9	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Boron, total	7440-42-8	E420	0.020	mg/L	0.275	0.282	2.24%	20%	----
		Cadmium, total	7440-43-9	E420	0.0000900	mg/L	<0.000100	<0.0000900	0.0000100	Diff <2x LOR	----
		Calcium, total	7440-70-2	E420	0.100	mg/L	228	235	2.95%	20%	----
		Cesium, total	7440-46-2	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Chromium, total	7440-47-3	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		Cobalt, total	7440-48-4	E420	0.00020	mg/L	0.0594	0.0594	0.0404%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 1624609) - continued											
VA24C2005-001	PW-ST-20i	Copper, total	7440-50-8	E420	0.00100	mg/L	0.00222	0.00223	0.00001	Diff <2x LOR	----
		Iron, total	7439-89-6	E420	0.020	mg/L	0.090	0.092	0.002	Diff <2x LOR	----
		Lead, total	7439-92-1	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Lithium, total	7439-93-2	E420	0.0020	mg/L	0.0039	0.0041	0.0001	Diff <2x LOR	----
		Magnesium, total	7439-95-4	E420	0.0100	mg/L	30.4	29.9	1.74%	20%	----
		Manganese, total	7439-96-5	E420	0.00020	mg/L	0.138	0.138	0.249%	20%	----
		Molybdenum, total	7439-98-7	E420	0.000100	mg/L	0.176	0.169	4.21%	20%	----
		Nickel, total	7440-02-0	E420	0.00100	mg/L	0.0368	0.0369	0.119%	20%	----
		Phosphorus, total	7723-14-0	E420	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
		Potassium, total	7440-09-7	E420	0.100	mg/L	143	144	0.842%	20%	----
		Rubidium, total	7440-17-7	E420	0.00040	mg/L	0.0983	0.0954	3.00%	20%	----
		Selenium, total	7782-49-2	E420	0.000100	mg/L	0.0244	0.0238	2.34%	20%	----
		Silicon, total	7440-21-3	E420	0.20	mg/L	6.52	6.48	0.644%	20%	----
		Silver, total	7440-22-4	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Sodium, total	7440-23-5	E420	0.100	mg/L	260	257	0.924%	20%	----
		Strontium, total	7440-24-6	E420	0.00040	mg/L	0.819	0.798	2.57%	20%	----
		Sulfur, total	7704-34-9	E420	1.00	mg/L	504	506	0.311%	20%	----
		Tellurium, total	13494-80-9	E420	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		Thallium, total	7440-28-0	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Thorium, total	7440-29-1	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		Tin, total	7440-31-5	E420	0.00020	mg/L	0.00044	0.00043	0.0000009	Diff <2x LOR	----
		Titanium, total	7440-32-6	E420	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		Tungsten, total	7440-33-7	E420	0.00020	mg/L	0.00369	0.00367	0.584%	20%	----
		Uranium, total	7440-61-1	E420	0.000020	mg/L	0.0130	0.0130	0.254%	20%	----
		Vanadium, total	7440-62-2	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		Zinc, total	7440-66-6	E420	0.0060	mg/L	<0.0060	<0.0060	0	Diff <2x LOR	----
		Zirconium, total	7440-67-7	E420	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
Total Metals (QC Lot: 1624610)											
VA24C2005-001	PW-ST-20i	Chromium, total	7440-47-3	E420.Cr-L	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Total Metals (QC Lot: 1631157)											
VA24C1892-005	Anonymous	Mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
Total Metals (QC Lot: 1631159)											
VA24C2005-005	PW-BG-5	Mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1624652)											

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 1624652) - continued											
VA24C2005-001	PW-ST-20i	Aluminum, dissolved	7429-90-5	E421	0.0020	mg/L	0.0132	0.0115	0.0017	Diff <2x LOR	----
		Antimony, dissolved	7440-36-0	E421	0.00020	mg/L	0.0242	0.0239	1.16%	20%	----
		Arsenic, dissolved	7440-38-2	E421	0.00020	mg/L	0.346	0.351	1.50%	20%	----
		Barium, dissolved	7440-39-3	E421	0.00020	mg/L	0.0212	0.0214	0.854%	20%	----
		Beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Bismuth, dissolved	7440-69-9	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Boron, dissolved	7440-42-8	E421	0.020	mg/L	0.267	0.266	0.389%	20%	----
		Cadmium, dissolved	7440-43-9	E421	0.0000450	mg/L	<0.0000450	<0.0000450	0	Diff <2x LOR	----
		Calcium, dissolved	7440-70-2	E421	0.100	mg/L	239	239	0.177%	20%	----
		Cesium, dissolved	7440-46-2	E421	0.000020	mg/L	0.000034	0.000036	0.000002	Diff <2x LOR	----
		Chromium, dissolved	7440-47-3	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		Cobalt, dissolved	7440-48-4	E421	0.00020	mg/L	0.0478	0.0488	2.01%	20%	----
		Copper, dissolved	7440-50-8	E421	0.00040	mg/L	<0.00040	0.00040	0.000004	Diff <2x LOR	----
		Iron, dissolved	7439-89-6	E421	0.020	mg/L	0.097	0.099	0.002	Diff <2x LOR	----
		Lead, dissolved	7439-92-1	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Lithium, dissolved	7439-93-2	E421	0.0020	mg/L	0.0040	0.0040	0.00004	Diff <2x LOR	----
		Magnesium, dissolved	7439-95-4	E421	0.0100	mg/L	26.7	26.9	0.648%	20%	----
		Manganese, dissolved	7439-96-5	E421	0.00020	mg/L	0.0900	0.0908	0.807%	20%	----
		Molybdenum, dissolved	7439-98-7	E421	0.000100	mg/L	0.151	0.147	2.50%	20%	----
		Nickel, dissolved	7440-02-0	E421	0.00100	mg/L	0.0339	0.0342	0.759%	20%	----
		Phosphorus, dissolved	7723-14-0	E421	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
		Potassium, dissolved	7440-09-7	E421	0.100	mg/L	145	143	1.25%	20%	----
		Rubidium, dissolved	7440-17-7	E421	0.00040	mg/L	0.102	0.102	0.355%	20%	----
		Selenium, dissolved	7782-49-2	E421	0.000100	mg/L	0.0138	0.0146	5.34%	20%	----
		Silicon, dissolved	7440-21-3	E421	0.100	mg/L	4.73	4.72	0.146%	20%	----
		Silver, dissolved	7440-22-4	E421	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Sodium, dissolved	7440-23-5	E421	0.100	mg/L	254	257	1.16%	20%	----
		Strontium, dissolved	7440-24-6	E421	0.00040	mg/L	0.803	0.777	3.31%	20%	----
		Sulfur, dissolved	7704-34-9	E421	1.00	mg/L	442	450	1.70%	20%	----
		Tellurium, dissolved	13494-80-9	E421	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		Thallium, dissolved	7440-28-0	E421	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Thorium, dissolved	7440-29-1	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		Tin, dissolved	7440-31-5	E421	0.00020	mg/L	0.00077	0.00079	0.00002	Diff <2x LOR	----
		Titanium, dissolved	7440-32-6	E421	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 1624652) - continued											
VA24C2005-001	PW-ST-20i	Tungsten, dissolved	7440-33-7	E421	0.00020	mg/L	0.00503	0.00496	1.36%	20%	----
		Uranium, dissolved	7440-61-1	E421	0.000020	mg/L	0.0120	0.0120	0.190%	20%	----
		Vanadium, dissolved	7440-62-2	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		Zinc, dissolved	7440-66-6	E421	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
		Zirconium, dissolved	7440-67-7	E421	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1624653)											
VA24C2005-001	PW-ST-20i	Chromium, dissolved	7440-47-3	E421.Cr-L	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1632890)											
VA24C1639-007	Anonymous	Mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1622461)						
Turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 1622462)						
Turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 1622582)						
Alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
Alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
Alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
Alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 1622583)						
Conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 1626703)						
Solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 1626704)						
Solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 1622586)						
Bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 1622587)						
Nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 1622588)						
Nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 1622589)						
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 1622590)						
Chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 1622593)						
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 1623884)						
Ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 1623885)						
Phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 1626576)						
Silicate (as SiO2)	7631-86-9	E392	0.5	mg/L	<0.50	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 1645308)						
Cyanate	88402-73-7	E343	0.2	mg/L	<0.20	----
Anions and Nutrients (QCLot: 1656366)						
Fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Cyanides (QCLot: 1623485)						
Thiocyanate	302-04-5	E344	0.5	mg/L	<0.50	----
Cyanides (QCLot: 1626581)						
Cyanide, free	----	E339-L	0.001	mg/L	<0.0010	----
Cyanides (QCLot: 1626582)						
Cyanide, strong acid dissociable (Total)	----	E333-L	0.001	mg/L	<0.0010	----
Cyanides (QCLot: 1626864)						
Cyanide, free	----	E339-L	0.001	mg/L	<0.0010	----
Cyanides (QCLot: 1626865)						
Cyanide, strong acid dissociable (Total)	----	E333-L	0.001	mg/L	<0.0010	----
Cyanides (QCLot: 1628658)						
Cyanide, free	----	E339-L	0.001	mg/L	<0.0010	----
Cyanides (QCLot: 1628659)						
Cyanide, strong acid dissociable (Total)	----	E333-L	0.001	mg/L	<0.0010	----
Organic / Inorganic Carbon (QCLot: 1623887)						
Carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 1624609)						
Aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
Antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
Arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
Barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
Beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
Bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
Boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
Cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
Calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
Cesium, total	7440-46-2	E420	0.00001	mg/L	<0.000010	----
Chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
Cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
Copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
Iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
Lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	MBRR

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 1624609) - continued						
Lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
Magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
Manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
Molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
Nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
Phosphorus, total	7723-14-0	E420	0.05	mg/L	<0.050	----
Potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
Rubidium, total	7440-17-7	E420	0.0002	mg/L	<0.00020	----
Selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
Silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
Silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
Sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
Strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
Sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
Tellurium, total	13494-80-9	E420	0.0002	mg/L	<0.00020	----
Thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
Thorium, total	7440-29-1	E420	0.0001	mg/L	<0.00010	----
Tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
Titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
Tungsten, total	7440-33-7	E420	0.0001	mg/L	<0.00010	----
Uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
Vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
Zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Zirconium, total	7440-67-7	E420	0.0002	mg/L	<0.00020	----
Total Metals (QCLot: 1624610)						
Chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 1631157)						
Mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 1631159)						
Mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 1624652)						
Aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
Antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
Arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
Barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 1624652) - continued						
Beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
Bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
Boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
Cesium, dissolved	7440-46-2	E421	0.00001	mg/L	<0.000010	----
Chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
Cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
Copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
Iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
Lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
Lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
Manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
Molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
Nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
Phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
Potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
Rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	<0.00020	----
Selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
Silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
Silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
Sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
Strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
Sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
Tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	<0.00020	----
Thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
Thorium, dissolved	7440-29-1	E421	0.0001	mg/L	<0.00010	----
Tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
Titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
Tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	<0.00010	----
Uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
Vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
Zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 1624653)						
Chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 1632890)						
Mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Plant Pigments (QCLot: 1632527)						
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----
Plant Pigments (QCLot: 1634348)						
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	<0.0020	----

Qualifiers

Qualifier	Description
MBRR	*Initial MB for this submission had positive results for flagged analyte (data not shown). Low level samples were repeated with new QC (2nd MB results shown). High level results (>5x initial MB level) and non-detect results were reported and are defensible*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1622461)									
Turbidity	----	E121	0.1	NTU	200 NTU	97.0	85.0	115	----
Physical Tests (QCLot: 1622462)									
Turbidity	----	E121	0.1	NTU	200 NTU	97.0	85.0	115	----
Physical Tests (QCLot: 1622581)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 1622582)									
Alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	101	85.0	115	----
Physical Tests (QCLot: 1622583)									
Conductivity	----	E100	1	µS/cm	147 µS/cm	101	90.0	110	----
Physical Tests (QCLot: 1626703)									
Solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	85.8	85.0	115	----
Physical Tests (QCLot: 1626704)									
Solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	86.2	85.0	115	----
Anions and Nutrients (QCLot: 1622586)									
Bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	95.1	85.0	115	----
Anions and Nutrients (QCLot: 1622587)									
Nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	97.3	90.0	110	----
Anions and Nutrients (QCLot: 1622588)									
Nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	97.4	90.0	110	----
Anions and Nutrients (QCLot: 1622589)									
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	99.5	90.0	110	----
Anions and Nutrients (QCLot: 1622590)									
Chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	97.7	90.0	110	----
Anions and Nutrients (QCLot: 1622593)									
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	96.5	80.0	120	----
Anions and Nutrients (QCLot: 1623884)									
Ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 1623885)									
Phosphorus, total dissolved	7723-14-0	E375-T	0.002	mg/L	0.05 mg/L	93.9	80.0	120	----
Anions and Nutrients (QCLot: 1626576)									
Silicate (as SiO2)	7631-86-9	E392	0.5	mg/L	10 mg/L	101	85.0	115	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 1645308)									
Cyanate	88402-73-7	E343	0.2	mg/L	1 mg/L	85.3	85.0	115	----
Anions and Nutrients (QCLot: 1656366)									
Fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	98.8	90.0	110	----
Cyanides (QCLot: 1623485)									
Thiocyanate	302-04-5	E344	0.5	mg/L	10 mg/L	100	85.0	115	----
Cyanides (QCLot: 1626581)									
Cyanide, free	----	E339-L	0.001	mg/L	0.125 mg/L	99.8	80.0	120	----
Cyanides (QCLot: 1626582)									
Cyanide, strong acid dissociable (Total)	----	E333-L	0.001	mg/L	0.25 mg/L	92.3	80.0	120	----
Cyanides (QCLot: 1626864)									
Cyanide, free	----	E339-L	0.001	mg/L	0.125 mg/L	100	80.0	120	----
Cyanides (QCLot: 1626865)									
Cyanide, strong acid dissociable (Total)	----	E333-L	0.001	mg/L	0.25 mg/L	97.7	80.0	120	----
Cyanides (QCLot: 1628658)									
Cyanide, free	----	E339-L	0.001	mg/L	0.125 mg/L	99.8	80.0	120	----
Cyanides (QCLot: 1628659)									
Cyanide, strong acid dissociable (Total)	----	E333-L	0.001	mg/L	0.25 mg/L	96.8	80.0	120	----
Organic / Inorganic Carbon (QCLot: 1623887)									
Carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.8	80.0	120	----
Total Metals (QCLot: 1624609)									
Aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	113	80.0	120	----
Antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	112	80.0	120	----
Arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	110	80.0	120	----
Barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
Beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	105	80.0	120	----
Bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
Boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	100	80.0	120	----
Cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
Calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	103	80.0	120	----
Cesium, total	7440-46-2	E420	0.00001	mg/L	0.05 mg/L	108	80.0	120	----
Chromium, total	7440-47-3	E420	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
Cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
Copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1624609) - continued									
Iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	99.2	80.0	120	----
Lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	105	80.0	120	----
Lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	105	80.0	120	----
Magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	110	80.0	120	----
Manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	107	80.0	120	----
Molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	109	80.0	120	----
Nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
Phosphorus, total	7723-14-0	E420	0.05	mg/L	10 mg/L	99.0	80.0	120	----
Potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	104	80.0	120	----
Rubidium, total	7440-17-7	E420	0.0002	mg/L	0.1 mg/L	108	80.0	120	----
Selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	105	80.0	120	----
Silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	108	80.0	120	----
Silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	103	80.0	120	----
Sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	110	80.0	120	----
Strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	106	80.0	120	----
Sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	106	80.0	120	----
Tellurium, total	13494-80-9	E420	0.0002	mg/L	0.1 mg/L	113	80.0	120	----
Thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	102	80.0	120	----
Thorium, total	7440-29-1	E420	0.0001	mg/L	0.1 mg/L	98.2	80.0	120	----
Tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	107	80.0	120	----
Titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	105	80.0	120	----
Tungsten, total	7440-33-7	E420	0.0001	mg/L	0.1 mg/L	105	80.0	120	----
Uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	111	80.0	120	----
Vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	105	80.0	120	----
Zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	106	80.0	120	----
Zirconium, total	7440-67-7	E420	0.0002	mg/L	0.1 mg/L	105	80.0	120	----
Total Metals (QCLot: 1624610)									
Chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
Total Metals (QCLot: 1631157)									
Mercury, total	7439-97-6	E508	0.000005	mg/L	0 mg/L	98.4	80.0	120	----
Total Metals (QCLot: 1631159)									
Mercury, total	7439-97-6	E508	0.000005	mg/L	0 mg/L	95.6	80.0	120	----
Dissolved Metals (QCLot: 1624652)									
Aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	99.9	80.0	120	----
Antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	98.6	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 1624652) - continued									
Arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
Barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	99.4	80.0	120	----
Beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	95.4	80.0	120	----
Bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	101	80.0	120	----
Boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	97.4	80.0	120	----
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.2	80.0	120	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	98.9	80.0	120	----
Cesium, dissolved	7440-46-2	E421	0.00001	mg/L	0.05 mg/L	98.2	80.0	120	----
Chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	97.4	80.0	120	----
Cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	97.0	80.0	120	----
Copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	94.7	80.0	120	----
Iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	94.8	80.0	120	----
Lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	98.4	80.0	120	----
Lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	96.1	80.0	120	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	98.4	80.0	120	----
Manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	98.6	80.0	120	----
Molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
Nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	95.9	80.0	120	----
Phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	104	80.0	120	----
Potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	96.6	80.0	120	----
Rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	0.1 mg/L	96.7	80.0	120	----
Selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	95.1	80.0	120	----
Silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	105	80.0	120	----
Silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	91.5	80.0	120	----
Sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
Strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	98.7	80.0	120	----
Sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	87.6	80.0	120	----
Tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	0.1 mg/L	97.1	80.0	120	----
Thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	101	80.0	120	----
Thorium, dissolved	7440-29-1	E421	0.0001	mg/L	0.1 mg/L	99.3	80.0	120	----
Tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	102	80.0	120	----
Titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	94.9	80.0	120	----
Tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	0.1 mg/L	99.5	80.0	120	----
Uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	99.3	80.0	120	----
Vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	98.4	80.0	120	----
Zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 1624652) - continued									
Zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	101	80.0	120	----
Dissolved Metals (QCLot: 1624653)									
Chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	97.4	80.0	120	----
Mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0 mg/L	95.4	80.0	120	----
Plant Pigments (QCLot: 1632527)									
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	1 µg/sample	93.5	80.0	120	----
Plant Pigments (QCLot: 1634348)									
Chlorophyll a	479-61-8	E870A	0.002	µg/sample	1 µg/sample	93.9	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 1622586)										
KS2403443-001	Anonymous	Bromide	24959-67-9	E235.Br-L	0.512 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 1622587)										
KS2403443-001	Anonymous	Nitrate (as N)	14797-55-8	E235.NO3-L	2.53 mg/L	2.5 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 1622588)										
KS2403443-001	Anonymous	Nitrite (as N)	14797-65-0	E235.NO2-L	0.508 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 1622589)										
KS2403443-001	Anonymous	Sulfate (as SO4)	14808-79-8	E235.SO4	102 mg/L	100 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 1622590)										
VA24C2005-002	PW-ST-20ii	Chloride	16887-00-6	E235.Cl-L	1960 mg/L	2000 mg/L	98.0	75.0	125	----
Anions and Nutrients (QCLot: 1622593)										
VA24C2005-002	PW-ST-20ii	Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0326 mg/L	0.03 mg/L	109	70.0	130	----
Anions and Nutrients (QCLot: 1623884)										
VA24C1525-002	Anonymous	Ammonia, total (as N)	7664-41-7	E298	ND mg/L	----	ND	75.0	125	----
Anions and Nutrients (QCLot: 1623885)										
VA24C1967-002	Anonymous	Phosphorus, total dissolved	7723-14-0	E375-T	0.0471 mg/L	0.05 mg/L	94.2	70.0	130	----
Anions and Nutrients (QCLot: 1626576)										
EO2407405-002	Anonymous	Silicate (as SiO2)	7631-86-9	E392	10.2 mg/L	10 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 1645308)										
VA24C2005-001	PW-ST-20i	Cyanate	88402-73-7	E343	16.8 mg/L	20 mg/L	84.0	75.0	125	----
Anions and Nutrients (QCLot: 1656366)										
VA24C2005-002	PW-ST-20ii	Fluoride	16984-48-8	E235.F	20.1 mg/L	20 mg/L	100	75.0	125	----
Cyanides (QCLot: 1623485)										
VA24C1941-003	Anonymous	Thiocyanate	302-04-5	E344	9.77 mg/L	10 mg/L	97.7	75.0	125	----
Cyanides (QCLot: 1626581)										
VA24C1021-010	Anonymous	Cyanide, free	----	E339-L	0.208 mg/L	0.25 mg/L	83.4	75.0	125	----
Cyanides (QCLot: 1626582)										
VA24C1021-010	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333-L	0.424 mg/L	0.5 mg/L	84.8	75.0	125	----
Cyanides (QCLot: 1626864)										
VA24C1021-011	Anonymous	Cyanide, free	----	E339-L	0.120 mg/L	0.125 mg/L	96.2	75.0	125	----
Cyanides (QCLot: 1626865)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Cyanides (QCLot: 1626865) - continued										
VA24C1021-011	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333-L	0.240 mg/L	0.25 mg/L	96.0	75.0	125	----
Cyanides (QCLot: 1628658)										
VA24C1379-002	Anonymous	Cyanide, free	----	E339-L	0.120 mg/L	0.125 mg/L	96.3	75.0	125	----
Cyanides (QCLot: 1628659)										
VA24C1379-002	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333-L	0.212 mg/L	0.25 mg/L	84.7	75.0	125	----
Organic / Inorganic Carbon (QCLot: 1623887)										
VA24C1526-002	Anonymous	Carbon, dissolved organic [DOC]	----	E358-L	4.89 mg/L	5 mg/L	97.8	70.0	130	----
Total Metals (QCLot: 1624609)										
VA24C2005-002	PW-ST-20ii	Lead, total	7439-92-1	E420	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
VA24C2005-002	PW-ST-20ii	Aluminum, total	7429-90-5	E420	0.414 mg/L	0.4 mg/L	103	70.0	130	----
		Antimony, total	7440-36-0	E420	0.0401 mg/L	0.04 mg/L	100	70.0	130	----
		Arsenic, total	7440-38-2	E420	ND mg/L	----	ND	70.0	130	----
		Barium, total	7440-39-3	E420	0.0373 mg/L	0.04 mg/L	93.4	70.0	130	----
		Beryllium, total	7440-41-7	E420	0.0771 mg/L	0.08 mg/L	96.4	70.0	130	----
		Bismuth, total	7440-69-9	E420	0.0189 mg/L	0.02 mg/L	94.5	70.0	130	----
		Boron, total	7440-42-8	E420	ND mg/L	----	ND	70.0	130	----
		Cadmium, total	7440-43-9	E420	0.00794 mg/L	0.008 mg/L	99.3	70.0	130	----
		Calcium, total	7440-70-2	E420	ND mg/L	----	ND	70.0	130	----
		Cesium, total	7440-46-2	E420	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		Chromium, total	7440-47-3	E420	0.0786 mg/L	0.08 mg/L	98.2	70.0	130	----
		Cobalt, total	7440-48-4	E420	0.0381 mg/L	0.04 mg/L	95.2	70.0	130	----
		Copper, total	7440-50-8	E420	0.0366 mg/L	0.04 mg/L	91.6	70.0	130	----
		Iron, total	7439-89-6	E420	3.77 mg/L	4 mg/L	94.3	70.0	130	----
		Lithium, total	7439-93-2	E420	0.189 mg/L	0.2 mg/L	94.5	70.0	130	----
		Magnesium, total	7439-95-4	E420	ND mg/L	----	ND	70.0	130	----
		Manganese, total	7439-96-5	E420	ND mg/L	----	ND	70.0	130	----
		Molybdenum, total	7439-98-7	E420	ND mg/L	----	ND	70.0	130	----
		Nickel, total	7440-02-0	E420	0.0753 mg/L	0.08 mg/L	94.1	70.0	130	----
		Phosphorus, total	7723-14-0	E420	19.6 mg/L	20 mg/L	97.9	70.0	130	----
		Potassium, total	7440-09-7	E420	ND mg/L	----	ND	70.0	130	----
		Rubidium, total	7440-17-7	E420	ND mg/L	----	ND	70.0	130	----
		Selenium, total	7782-49-2	E420	0.0858 mg/L	0.08 mg/L	107	70.0	130	----
		Silicon, total	7440-21-3	E420	20.3 mg/L	20 mg/L	101	70.0	130	----
		Silver, total	7440-22-4	E420	0.00799 mg/L	0.008 mg/L	99.9	70.0	130	----
		Sodium, total	7440-23-5	E420	ND mg/L	----	ND	70.0	130	----
		Strontium, total	7440-24-6	E420	ND mg/L	----	ND	70.0	130	----
		Sulfur, total	7704-34-9	E420	ND mg/L	----	ND	70.0	130	----
		Tellurium, total	13494-80-9	E420	0.0843 mg/L	0.08 mg/L	105	70.0	130	----
		Thallium, total	7440-28-0	E420	0.00758 mg/L	0.008 mg/L	94.7	70.0	130	----
		Thorium, total	7440-29-1	E420	0.0282 mg/L	0.04 mg/L	70.4	70.0	130	----
		Tin, total	7440-31-5	E420	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		Titanium, total	7440-32-6	E420	0.0810 mg/L	0.08 mg/L	101	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 1624609) - continued										
VA24C2005-002	PW-ST-20ii	Tungsten, total	7440-33-7	E420	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		Uranium, total	7440-61-1	E420	0.00853 mg/L	0.008 mg/L	107	70.0	130	----
		Vanadium, total	7440-62-2	E420	0.203 mg/L	0.2 mg/L	102	70.0	130	----
		Zinc, total	7440-66-6	E420	0.783 mg/L	0.8 mg/L	97.8	70.0	130	----
		Zirconium, total	7440-67-7	E420	0.0837 mg/L	0.08 mg/L	105	70.0	130	----
Total Metals (QCLot: 1624610)										
VA24C2005-002	PW-ST-20ii	Chromium, total	7440-47-3	E420.Cr-L	0.0786 mg/L	0.08 mg/L	98.2	70.0	130	----
Total Metals (QCLot: 1631157)										
VA24C1892-006	Anonymous	Mercury, total	7439-97-6	E508	0.0000965 mg/L	0 mg/L	96.5	70.0	130	----
Total Metals (QCLot: 1631159)										
VA24C2024-001	Anonymous	Mercury, total	7439-97-6	E508	0.0000915 mg/L	0 mg/L	91.5	70.0	130	----
Dissolved Metals (QCLot: 1624652)										
VA24C2005-002	PW-ST-20ii	Aluminum, dissolved	7429-90-5	E421	0.390 mg/L	0.4 mg/L	97.4	70.0	130	----
		Antimony, dissolved	7440-36-0	E421	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
		Arsenic, dissolved	7440-38-2	E421	ND mg/L	----	ND	70.0	130	----
		Barium, dissolved	7440-39-3	E421	0.0380 mg/L	0.04 mg/L	95.0	70.0	130	----
		Beryllium, dissolved	7440-41-7	E421	0.0745 mg/L	0.08 mg/L	93.2	70.0	130	----
		Bismuth, dissolved	7440-69-9	E421	0.0176 mg/L	0.02 mg/L	88.1	70.0	130	----
		Boron, dissolved	7440-42-8	E421	ND mg/L	----	ND	70.0	130	----
		Cadmium, dissolved	7440-43-9	E421	0.00782 mg/L	0.008 mg/L	97.7	70.0	130	----
		Calcium, dissolved	7440-70-2	E421	ND mg/L	----	ND	70.0	130	----
		Cesium, dissolved	7440-46-2	E421	0.0197 mg/L	0.02 mg/L	98.7	70.0	130	----
		Chromium, dissolved	7440-47-3	E421	0.0748 mg/L	0.08 mg/L	93.5	70.0	130	----
		Cobalt, dissolved	7440-48-4	E421	0.0362 mg/L	0.04 mg/L	90.5	70.0	130	----
		Copper, dissolved	7440-50-8	E421	0.0357 mg/L	0.04 mg/L	89.4	70.0	130	----
		Iron, dissolved	7439-89-6	E421	3.69 mg/L	4 mg/L	92.2	70.0	130	----
		Lead, dissolved	7439-92-1	E421	0.0358 mg/L	0.04 mg/L	89.4	70.0	130	----
		Lithium, dissolved	7439-93-2	E421	0.187 mg/L	0.2 mg/L	93.7	70.0	130	----
		Magnesium, dissolved	7439-95-4	E421	ND mg/L	----	ND	70.0	130	----
		Manganese, dissolved	7439-96-5	E421	ND mg/L	----	ND	70.0	130	----
		Molybdenum, dissolved	7439-98-7	E421	ND mg/L	----	ND	70.0	130	----
		Nickel, dissolved	7440-02-0	E421	0.0722 mg/L	0.08 mg/L	90.3	70.0	130	----
		Phosphorus, dissolved	7723-14-0	E421	21.2 mg/L	20 mg/L	106	70.0	130	----
		Potassium, dissolved	7440-09-7	E421	ND mg/L	----	ND	70.0	130	----
		Rubidium, dissolved	7440-17-7	E421	ND mg/L	----	ND	70.0	130	----
		Selenium, dissolved	7782-49-2	E421	0.0798 mg/L	0.08 mg/L	99.8	70.0	130	----
		Silicon, dissolved	7440-21-3	E421	20.1 mg/L	20 mg/L	100	70.0	130	----
		Silver, dissolved	7440-22-4	E421	0.00709 mg/L	0.008 mg/L	88.7	70.0	130	----
		Sodium, dissolved	7440-23-5	E421	ND mg/L	----	ND	70.0	130	----
		Strontium, dissolved	7440-24-6	E421	ND mg/L	----	ND	70.0	130	----
		Sulfur, dissolved	7704-34-9	E421	ND mg/L	----	ND	70.0	130	----
		Tellurium, dissolved	13494-80-9	E421	0.0790 mg/L	0.08 mg/L	98.7	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 1624652) - continued										
VA24C2005-002	PW-ST-20ii	Thallium, dissolved	7440-28-0	E421	0.00697 mg/L	0.008 mg/L	87.1	70.0	130	----
		Thorium, dissolved	7440-29-1	E421	0.0363 mg/L	0.04 mg/L	90.8	70.0	130	----
		Tin, dissolved	7440-31-5	E421	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		Titanium, dissolved	7440-32-6	E421	0.0803 mg/L	0.08 mg/L	100	70.0	130	----
		Tungsten, dissolved	7440-33-7	E421	0.0382 mg/L	0.04 mg/L	95.4	70.0	130	----
		Uranium, dissolved	7440-61-1	E421	0.00751 mg/L	0.008 mg/L	93.9	70.0	130	----
		Vanadium, dissolved	7440-62-2	E421	0.199 mg/L	0.2 mg/L	99.4	70.0	130	----
		Zinc, dissolved	7440-66-6	E421	0.776 mg/L	0.8 mg/L	97.0	70.0	130	----
		Zirconium, dissolved	7440-67-7	E421	0.0849 mg/L	0.08 mg/L	106	70.0	130	----
Dissolved Metals (QCLot: 1624653)										
VA24C2005-002	PW-ST-20ii	Chromium, dissolved	7440-47-3	E421.Cr-L	0.0748 mg/L	0.08 mg/L	93.5	70.0	130	----
Dissolved Metals (QCLot: 1632890)										
VA24C1751-001	Anonymous	Mercury, dissolved	7439-97-6	E509	0.0000958 mg/L	0 mg/L	95.8	70.0	130	----

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 1 of 2

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca; mdimauro@azimuthgro	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	vanessa.wanie@agnicoeagle.com; Erika.Voyer@a	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	meadowbank.environment@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank CREMP - Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	VA24C2005	**ALS Contact:**	Brent Mack	**Sampler:** NS, OJ, FQS

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Routine Parameters - see quote	TOC, Ammonia, TKN, Total P	DOC	T-CN (Low), Free CN (Low)	Total Mercury	Dissolved mercury	Total Sulfide	Total Metals + low Cr	Dissolved metals + low Cr	Thiocyanate (SCN)	Cyanate (CNO)	Chlorophyll-a	Number of Containers
						P	F/P	P		F	P		F	P	P		
	PW-ST-20i	11-Aug-24	10:35	Water	X		X	X	X	X		X	X	X	X		12
	PW-ST-20ii	10-Aug-24	10:40	Water	X		X	X	X	X		X	X	X	X		12
	PW-BG-1	10-Aug-24	10:45	Water	X		X	X	X	X		X	X	X	X		12
	PW-BG-4	10-Aug-24	10:50	Water	X		X	X	X	X		X	X	X	X		12
	PW-BG-5	10-Aug-24	10:55	Water	X		X	X	X	X		X	X	X	X		12
	ST-20i-A	10-Aug-24		Water												X	1
	ST-20i-B	10-Aug-24		Water												X	1
	ST-20i-C	10-Aug-24		Water												X	1
	ST-20i-D	10-Aug-24		Water												X	1
	ST-20i-E	10-Aug-24		Water												X	1
	ST-20ii-A	10-Aug-24		Water												X	1
	ST-20ii-B	10-Aug-24		Water												X	1
	ST-20ii-C	10-Aug-24		Water												X	1
	ST-20ii-D	10-Aug-24		Water												X	1
	ST-20ii-E	10-Aug-24		Water												X	1
	BG-1-A	10-Aug-24		Water												X	1
	BG-1-B	10-Aug-24		Water												X	1
	BG-1-C	10-Aug-24		Water												X	1
	BG-1-D	10-Aug-24		Water												X	1
	BG-1-E	10-Aug-24		Water												X	1
	BG-4-A	10-Aug-24		Water												X	1
	BG-4-B	10-Aug-24		Water												X	1
	BG-4-C	10-Aug-24		Water												X	1
	BG-4-D	10-Aug-24		Water												X	1
	BG-4-E	10-Aug-24		Water												X	1

Environmental Division
Vancouver
Work Order Reference
VA24C2005

Telephone : +1 604 253 4188

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Routine parameters includes: TSS-low, TDS-low, Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Rowan Woodall	12-Aug-24	7:00		27 Aug	12:20	2.2 °C				

Warm Icepacks

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 2 of 2

Report To				**Report Format / Distribution**				**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group			☑ Standard	☐ Other			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz			☑ PDF	☑ Excel	☐ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway			Email 1:	efranz@azimuthgroup.ca; mdimauro@azimuthgrou			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8			Email 2:	vanessa.wanie@agnicoeagle.com; Erika.Voyer@a			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220	Fax:		Email 3:	meadowbank.environment@agnicoeagle.com			**Analysis Request**
Invoice To	Same as Report ?	☑ Yes	☐ No	**Client / Project Information**				Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		☐ Yes	☑ No	Job #:	Meadowbank CREMP - Surfacewater			
Company:				PO / AFE:				
Contact:				LSD:				
Address:								
Phone:		Fax:		Quote #:	Q39503			
Lab Work Order # (lab use only)				**ALS Contact:**	Brent Mack	**Sampler:**	NS, OJ, FQS	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Routine Parameters - see quote	TOC, Ammonia, TKN, Total P	DOC	T-CN (Low), Free CN (Low)	Total Mercury	Dissolved mercury	Total Sulfide	Total Metals + low Cr	Dissolved metals + low Cr	Thiocyanate (SCN)	Cyanate (CNO)	Chlorophyll-a	Number of Containers
						P	F/P	P		F	P		F	P	P		
	BG-5-A	10-Aug-24		Water												X	1
	BG-5-B	10-Aug-24		Water												X	1
	BG-5-C	10-Aug-24		Water												X	1
	BG-5-D	10-Aug-24		Water												X	1
	BG-5-E	10-Aug-24		Water												X	1
	Pit-A-A	19-Aug-24		Water												X	1
	Pit-A-B	19-Aug-24		Water												X	1
	Pit-A-C	19-Aug-24		Water												X	1
	ALS- TB	N/A		Water				X						X	X		4

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

The following chl-A samples are the result of 250 mLs filtration (rather than 500 mL): ST-20ii-C, ST-20i-D, ST-20i-A, ST-20i-C, ST-20ii-A, ST-20ii-D, ST-20i-E

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Rowan Woodall	12-Aug-24	7:00		27 Aug	12:20	22 °C				

Warm Icepacks

Updated

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 1 of 1

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: efranz@azimuthgroup.ca; mdimauro@azimuthgro	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2: vanessa.wanie@agnicoeagle.com; Erika.Voyer@	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3: meadowbank.environment@agnicoeagle.com	
Invoice To	Same as Report ? ☐ Yes ☐ No	Client / Project Information	Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☐ No	Job #: Meadowbank CREMP - Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
Lab Work Order # (lab use only)		ALS Contact: Brent Mack	Sampler: NS, OJ, FQS

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Routine Parameters - see quote	TOC, Ammonia, TKN, Total P	DOC	T-CN (Low), Free CN (Low)	Total Mercury	Dissolved mercury	Total Sulfide	Total Metals + low Cr	Dissolved metals + low Cr	Thiocyanate (SCN)	Cyanate (CNO)	*Chlorophyll-a	Number of Containers
						P	F/P	P		F	P		F	P	P		
	PW-ST-20i	11-Aug-24	10:35	Water	X		X	X	X	X		X	X	X	X		12
	PW-ST-20ii	10-Aug-24	10:40	Water	X		X	X	X	X		X	X	X	X		12
	PW-BG-1	10-Aug-24	10:45	Water	X		X	X	X	X		X	X	X	X		12
	PW-BG-4	10-Aug-24	10:50	Water	X		X	X	X	X		X	X	X	X		12
	PW-BG-5	10-Aug-24	10:55	Water	X		X	X	X	X		X	X	X	X		12
	ST-20i-A	10-Aug-24		Water												X	1
	ST-20i-B	10-Aug-24		Water												X	1
	ST-20i-C	10-Aug-24		Water												X	1
	ST-20i-D	10-Aug-24		Water												X	1
	ST-20i-E	10-Aug-24		Water												X	1
	ST-20ii-A	10-Aug-24		Water												X	1
	ST-20ii-B	10-Aug-24		Water												X	1
	ST-20ii-C	10-Aug-24		Water												X	1
	ST-20ii-D	10-Aug-24		Water												X	1
	ST-20ii-E	10-Aug-24		Water												X	1
	BG-1-A	10-Aug-24		Water												X	1
	BG-1-B	10-Aug-24		Water												X	1
	BG-1-C	10-Aug-24		Water												X	1
	BG-1-D	10-Aug-24		Water												X	1
	BG-1-E	10-Aug-24		Water												X	1
	BG-4-A	10-Aug-24		Water												X	1
	BG-4-B	10-Aug-24		Water												X	1
	BG-4-C	10-Aug-24		Water												X	1
	BG-4-D	10-Aug-24		Water												X	1
	BG-4-E	10-Aug-24		Water												X	1

Environmental Division
Vancouver
Work Order Reference
VA24C2005

Telephone : +1 604 253 4188

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

* The following chl-A samples are the result of 250 mLs filtration (rather than 500 mL): ST-20ii-C, ST-20i-D, ST-20i-A, ST-20i-C, ST-20ii-A, ST-20ii-D, ST-20i-E
** Routine parameters includes: TSS-low, TDS-low, Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Rowan Woodall	12-Aug-24	7:00				°C				

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Page 1 of 1

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: efranz@azimuthgroup.ca; mdimauro@azimuthgro	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2: vanessa.wanie@agnicoeagle.com; Erika.Voyer@	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3: meadowbank.environment@agnicoeagle.com	
Invoice To	Same as Report ? ☐ Yes ☐ No	Client / Project Information	Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☐ No	Job #: Meadowbank CREMP - Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
Lab Work Order # (lab use only)		ALS Contact: Brent Mack	Sampler: NS, OJ, FQS

Sample # (lab use only)	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Routine Parameters - see quote	TOC, Ammonia, TKN, Total P	DOC	T-CN (Low), Free CN (Low)	Total Mercury	Dissolved mercury	Total Sulfide	Total Metals + low Cr	Dissolved metals + low Cr	Thiocyanate (SCN)	Cyanate (CNO)	*Chlorophyll-a	Number of Containers
						P	F/P	P		F	P		F	P	P		
	BG-5-A	10-Aug-24		Water												X	1
	BG-5-B	10-Aug-24		Water												X	1
	BG-5-C	10-Aug-24		Water												X	1
	BG-5-D	10-Aug-24		Water												X	1
	BG-5-E	10-Aug-24		Water												X	1
	Pit-A-A	19-Aug-24		Water												X	1
	Pit-A-B	19-Aug-24		Water												X	1
	Pit-A-C	19-Aug-24		Water												X	1
	ALS- TB	N/A		Water				X						X	X		4

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

*The following chl-A samples are the result of 250 mLs filtration (rather than 500 mL): ST-20ii-C, ST-20i-D, ST-20i-A, ST-20i-C, ST-20ii-A, ST-20ii-D, ST-20i-E

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Rowan Woodall	12-Aug-24	7:00				°C				

Appendix B-2
Laboratory Reports for the Tailings Samples

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C0090**	Page	: 1 of 9
Amendment	: **2**		
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: Vancouver - Environmental
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: CREMP Sediment Grabs	Date Samples Received	: 26-Aug-2022 11:00
PO	: ----	Date Analysis Commenced	: 01-Sep-2022
C-O-C number	: ----	Issue Date	: 07-Nov-2022 17:08
Sampler	: Azimuth		
Site	: ----		
Quote number	: Q38011		
No. of samples received	: 21		
No. of samples analysed	: 21		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Metals, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Justin Kuzek	Team Leader - Organics	Organics, Saskatoon, Saskatchewan
Jwan Abdalla	Laboratory Analyst	Metals, Saskatoon, Saskatchewan
Kinny Wu	Lab Analyst	Metals, Burnaby, British Columbia
Lian Nesbitt	Laboratory Analyst	Metals, Saskatoon, Saskatchewan
Maria Painchaud	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.
Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

This report replaces the previous version and contains updated Grain Size data.

Qualifiers

Qualifier	*Description*
FR5	*As per applicable reference method(s), soil:water ratio for Fixed Ratio Leach was modified to 1:5 due to high soil organic content*

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BG-1	BG-2	BG-3	BG-4	BG-5
					Client sampling date / time	12-Aug-2022 16:55	21-Aug-2022 09:40	21-Aug-2022 13:50	21-Aug-2022 14:33	21-Aug-2022 16:30
						VA22C0090-001	VA22C0090-002	VA22C0090-003	VA22C0090-004	VA22C0090-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		26.4	26.4	28.2	29.1	40.3
pH (1:2 soil:water)	----	E108	0.10	pH units		8.30	8.57	8.40	8.42	8.32
Particle Size										
clay (<0.002mm)	----	EC184B	1.0	%		5.2	7.4	7.7	9.7	9.0
clay (<0.005mm)	----	EC184B	1.0	%		17.4	23.8	25.1	25.1	28.6
silt (0.075mm - 0.002mm)	----	EC184B	1.0	%		94.6	92.6	92.2	90.1	90.7
silt (0.075mm - 0.005mm)	----	EC184B	1.0	%		82.4	76.2	74.8	74.7	71.1
fines (<0.075mm)	----	EC184B	1.0	%		99.8	100	99.9	99.8	99.7
sand (0.425mm - 0.075mm)	----	EC184B	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
sand (2.0mm - 0.425mm)	----	EC184B	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
sand (4.75mm - 2.0mm)	----	EC184B	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
gravel (76.2mm - 4.75mm)	----	EC184B	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
cobbles (>3in)	----	EC184B	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
grain size curve	----	E185A	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184E	1.0	%		13.3	18.3	19.3	19.9	22.1
silt (0.063mm - 0.004mm)	----	EC184E	1.0	%		86.4	81.7	80.6	79.9	77.6
sand (2.0mm - 0.063mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
gravel (>2mm)	----	EC184E	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
Organic / Inorganic Carbon										
carbon, total organic [TOC]	----	EC356	0.050	%		0.413	0.283	0.351	0.238	0.232
Metals										
aluminum	7429-90-5	E440	50	mg/kg		29500	31900	32200	29200	28600
antimony	7440-36-0	E440	0.10	mg/kg		2.09	2.23	2.14	2.51	2.08
arsenic	7440-38-2	E440	0.10	mg/kg		1060	903	855	624	811
barium	7440-39-3	E440	0.50	mg/kg		135	120	128	109	116
beryllium	7440-41-7	E440	0.10	mg/kg		0.83	0.76	0.79	0.64	0.65
bismuth	7440-69-9	E440	0.20	mg/kg		0.32	0.30	0.31	0.25	0.28
boron	7440-42-8	E440	5.0	mg/kg		5.9	6.6	6.3	5.5	6.0

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	BG-1	BG-2	BG-3	BG-4	BG-5
					Client sampling date / time	12-Aug-2022 16:55	21-Aug-2022 09:40	21-Aug-2022 13:50	21-Aug-2022 14:33	21-Aug-2022 16:30
						VA22C0090-001	VA22C0090-002	VA22C0090-003	VA22C0090-004	VA22C0090-005
						Result	Result	Result	Result	Result
Metals										
cadmium	7440-43-9	E440	0.020	mg/kg		0.858	0.732	0.803	0.134	0.401
calcium	7440-70-2	E440	50	mg/kg		20800	21800	21300	19300	17200
chromium	7440-47-3	E440	0.50	mg/kg		1100	1350	1360	1230	1120
cobalt	7440-48-4	E440	0.10	mg/kg		28.4	33.2	30.2	36.5	28.7
copper	7440-50-8	E440	0.50	mg/kg		468	384	1300	143	140
iron	7439-89-6	E440	50	mg/kg		81000	85100	86400	85900	82700
lead	7439-92-1	E440	0.50	mg/kg		143	162	171	92.3	163
lithium	7439-93-2	E440	2.0	mg/kg		24.5	27.5	26.2	25.0	24.7
magnesium	7439-95-4	E440	20	mg/kg		29600	31500	32500	25200	27200
manganese	7439-96-5	E440	1.0	mg/kg		2160	2540	2560	2550	2330
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
molybdenum	7439-98-7	E440	0.10	mg/kg		1.82	1.62	1.73	1.44	1.77
nickel	7440-02-0	E440	0.50	mg/kg		424	537	514	551	464
phosphorus	7723-14-0	E440	50	mg/kg		534	421	418	407	397
potassium	7440-09-7	E440	100	mg/kg		12600	12800	12400	11200	10800
selenium	7782-49-2	E440	0.20	mg/kg		0.63	0.50	0.70	0.65	0.56
silver	7440-22-4	E440	0.10	mg/kg		0.73	0.56	1.20	0.50	0.23
sodium	7440-23-5	E440	50	mg/kg		419	423	401	447	490
strontium	7440-24-6	E440	0.50	mg/kg		62.6	54.2	55.2	43.6	43.8
sulfur	7704-34-9	E440	1000	mg/kg		8000	8400	7800	8400	8100
thallium	7440-28-0	E440	0.050	mg/kg		0.494	0.471	0.482	0.428	0.425
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		1230	1250	1300	1140	1100
tungsten	7440-33-7	E440	0.50	mg/kg		6.10	7.81	6.89	5.97	4.95
uranium	7440-61-1	E440	0.050	mg/kg		0.845	0.671	0.730	0.697	0.815
vanadium	7440-62-2	E440	0.20	mg/kg		81.5	91.4	93.3	79.8	76.8
zinc	7440-66-6	E440	2.0	mg/kg		62.6	59.4	60.2	55.8	58.4
zirconium	7440-67-7	E440	1.0	mg/kg		11.0	7.6	8.5	7.5	8.7

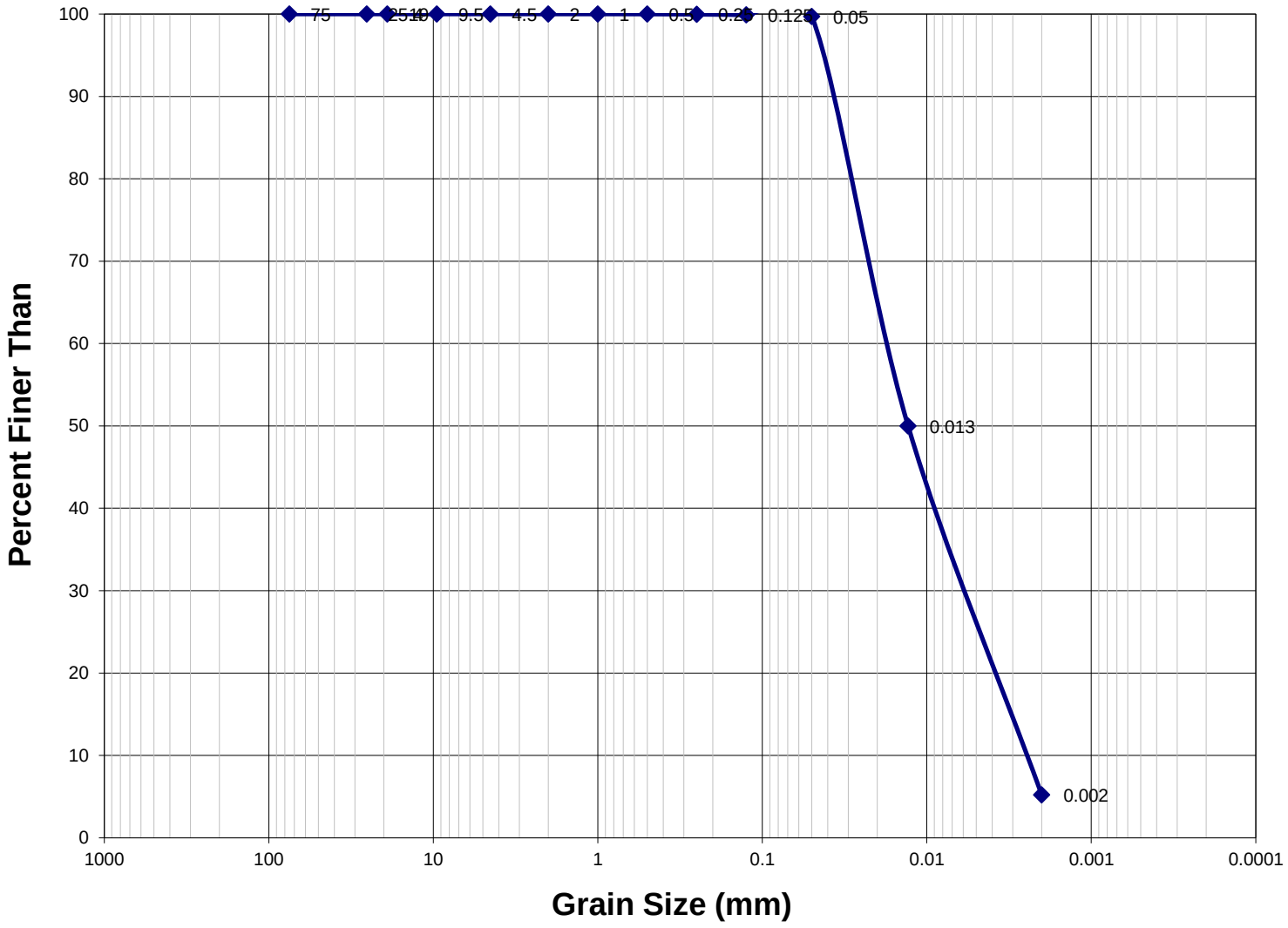
Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: ACGI100
Project:
Sample ID: BG-1
Lab ID: VA22C0090001

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	0
Coarse Sand	2.0mm - 4.75mm	0
Medium Sand	0.425mm - 2.0mm	0
Fine Sand	0.075mm - 0.425mm	0
Fines	< 0.075mm	100

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	0
Sand	0.05mm - 2mm	0
Silt	0.002mm - 0.05mm	95
Clay	< 0.002mm	5

Texture Silt

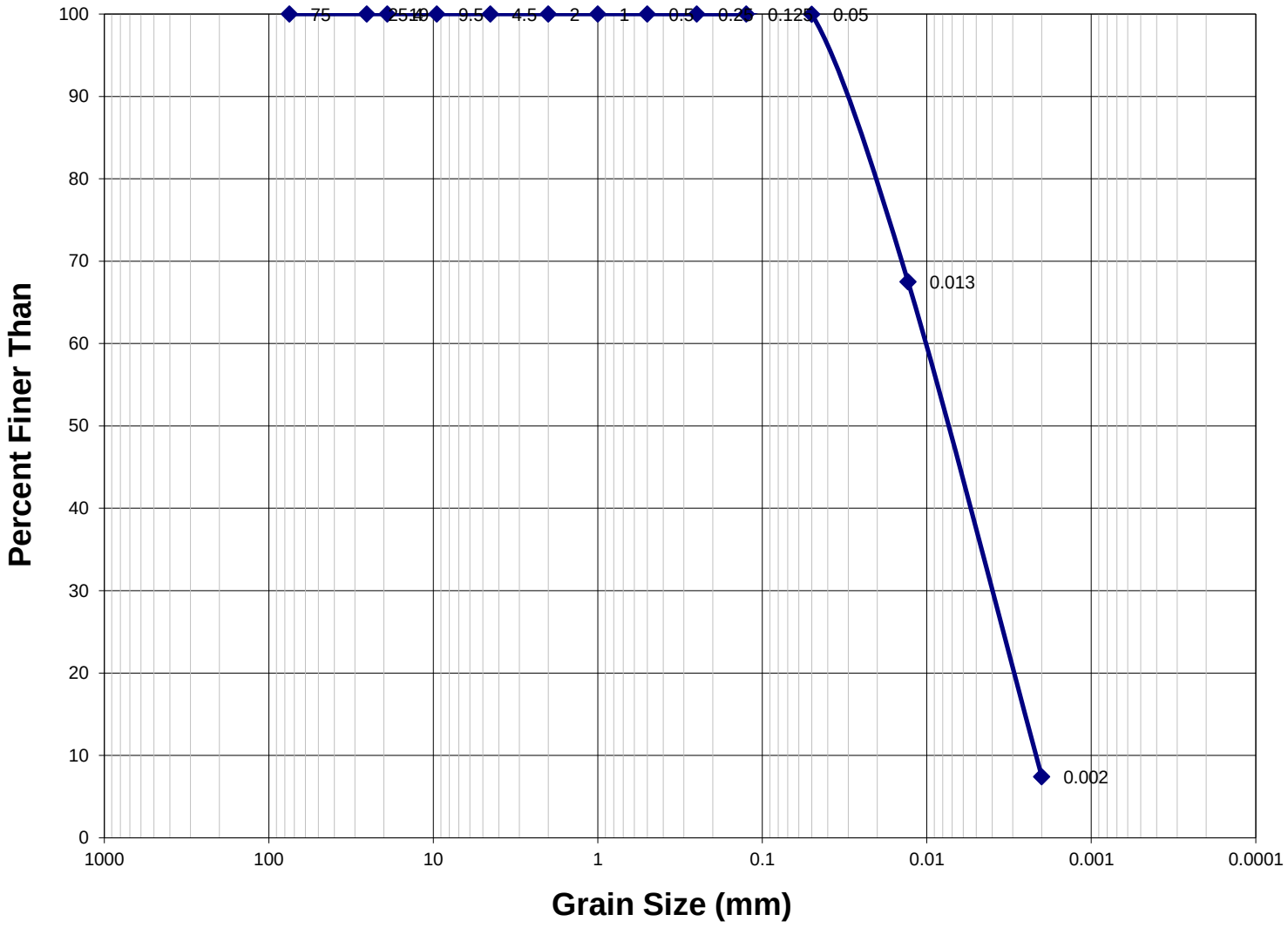
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: ACGI100
Project:
Sample ID: BG-2
Lab ID: VA22C0090002

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	0
Coarse Sand	2.0mm - 4.75mm	0
Medium Sand	0.425mm - 2.0mm	0
Fine Sand	0.075mm - 0.425mm	0
Fines	< 0.075mm	100

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	0
Sand	0.05mm - 2mm	0
Silt	0.002mm - 0.05mm	93
Clay	< 0.002mm	7

Texture Silt

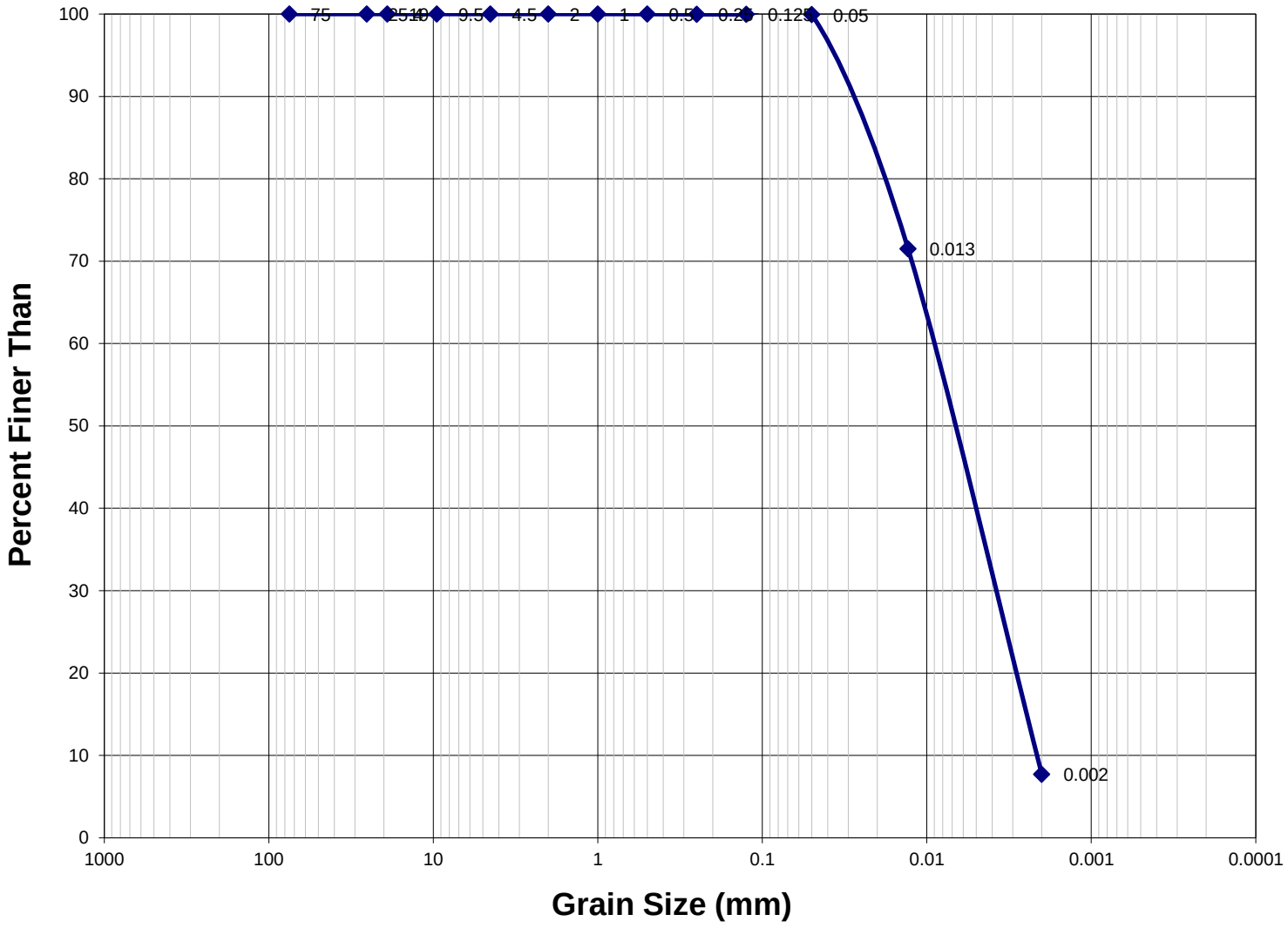
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: ACGI100
Project:
Sample ID: BG-3
Lab ID: VA22C0090003

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	0
Coarse Sand	2.0mm - 4.75mm	0
Medium Sand	0.425mm - 2.0mm	0
Fine Sand	0.075mm - 0.425mm	0
Fines	< 0.075mm	100

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	0
Sand	0.05mm - 2mm	0
Silt	0.002mm - 0.05mm	92
Clay	< 0.002mm	8

Texture Silt

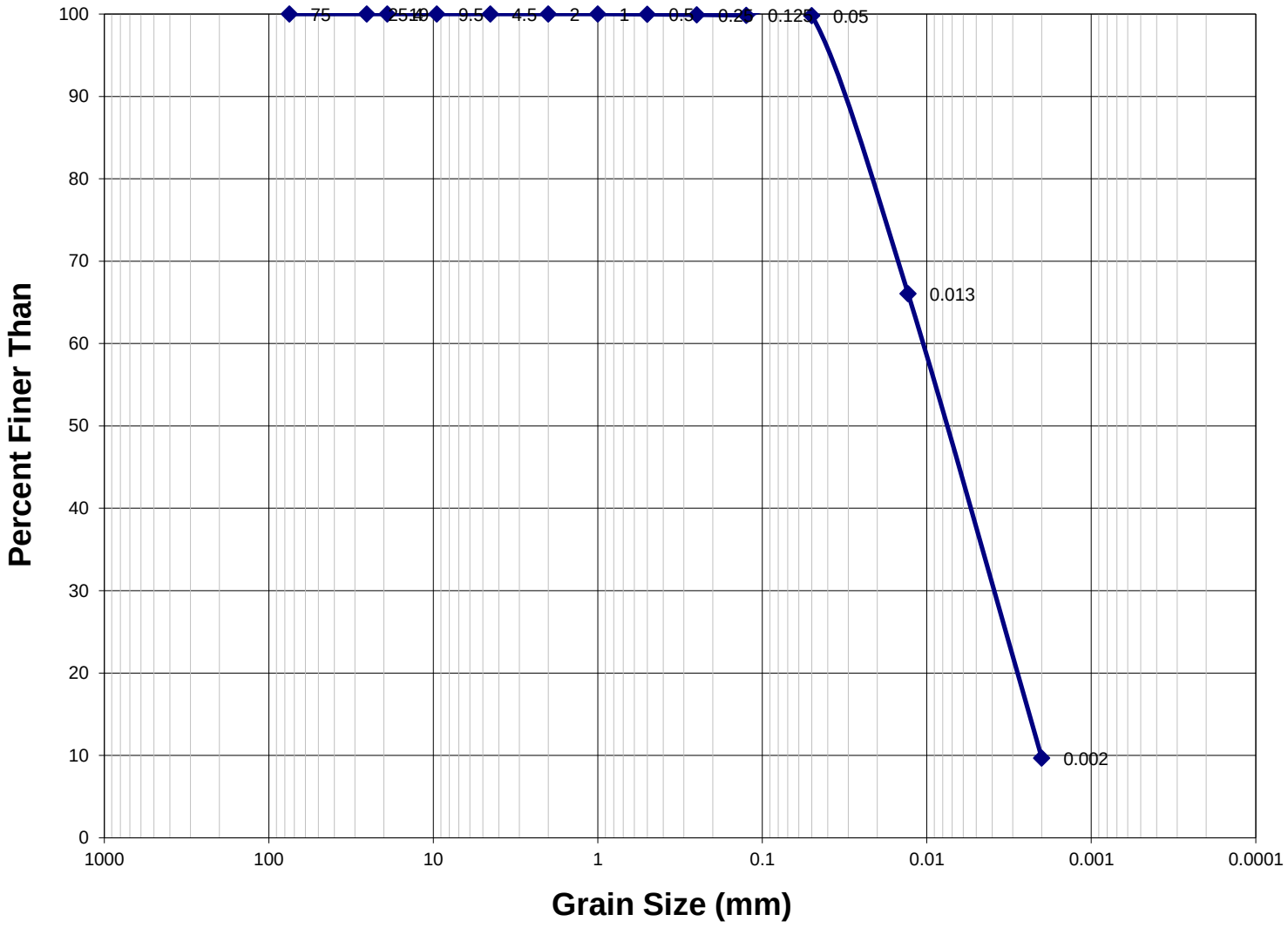
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: ACGI100
Project:
Sample ID: BG-4
Lab ID: VA22C0090004

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	0
Coarse Sand	2.0mm - 4.75mm	0
Medium Sand	0.425mm - 2.0mm	0
Fine Sand	0.075mm - 0.425mm	0
Fines	< 0.075mm	100

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	0
Sand	0.05mm - 2mm	0
Silt	0.002mm - 0.05mm	90
Clay	< 0.002mm	10

Texture Silt

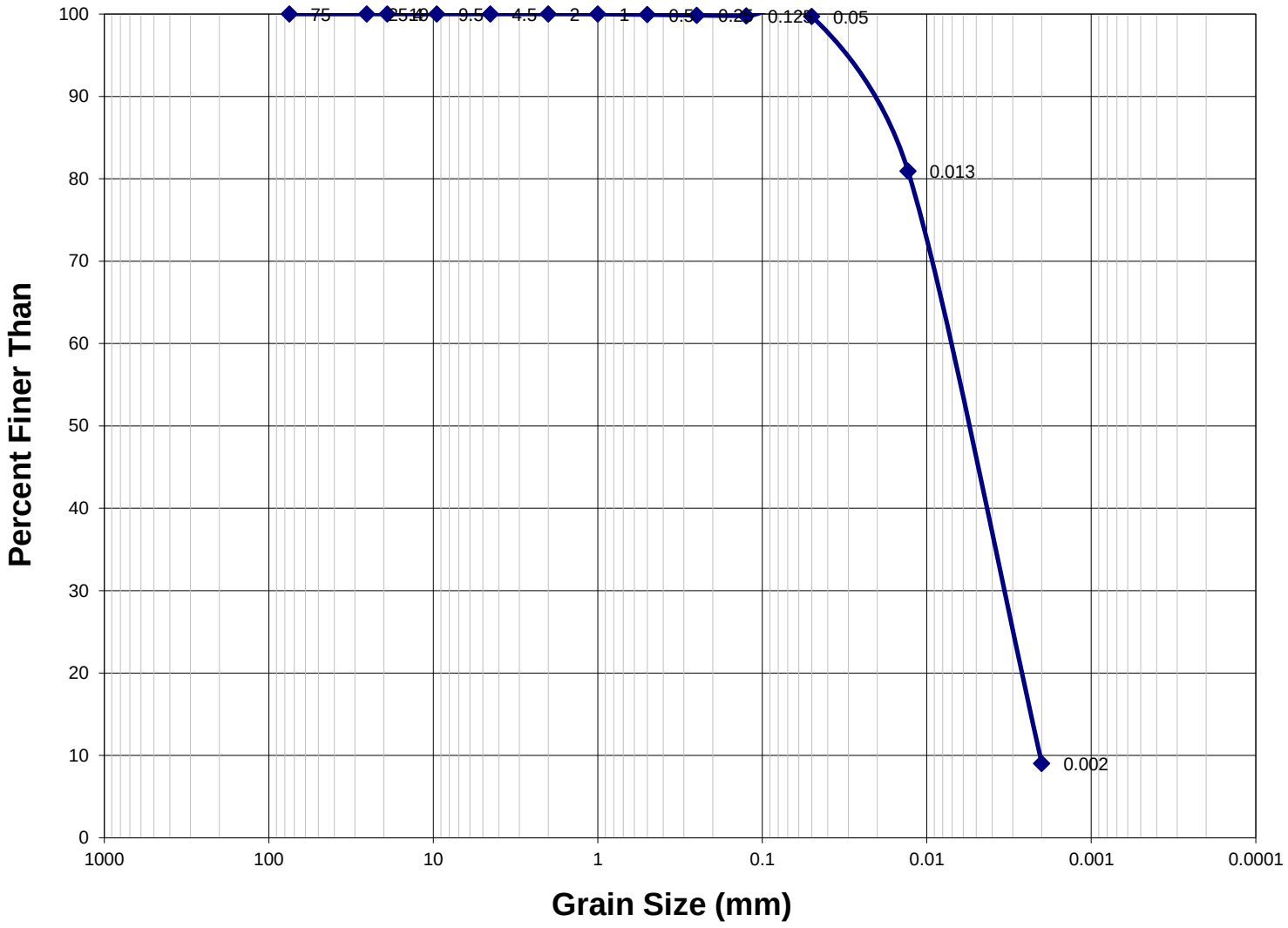
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: ACGI100
Project:
Sample ID: BG-5
Lab ID: VA22C0090005

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	0
Coarse Sand	2.0mm - 4.75mm	0
Medium Sand	0.425mm - 2.0mm	0
Fine Sand	0.075mm - 0.425mm	0
Fines	< 0.075mm	100

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	0
Sand	0.05mm - 2mm	0
Silt	0.002mm - 0.05mm	91
Clay	< 0.002mm	9

Texture Silt

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Marianna DiMauro	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: mdimauro@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2: imcivor@azimuthgroup.ca; efranz@azimuthgroup	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3: meadowbank.environment@agnicoeagle.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: CREMP Sediment Grabs	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q38011	
Lab Work Order # (lab use only)		ALS Contact: Brent Mack	Sampler: Azimuth

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals	TOC, Moisture, pH	Grain size	PAHs, LEPHs, HEPHs, MOG	Number of Containers
	BG-1	12-Aug-22	16:55	Sediment	X	X	X		1
	BG-2	21-Aug-22	9:40	Sediment	X	X	X		1
	BG-3	21-Aug-22	13:50	Sediment	X	X	X		1
	BG-4	21-Aug-22	14:33	Sediment	X	X	X		1
	BG-5	21-Aug-22	16:30	Sediment	X	X	X		1

Environmental Division
Vancouver
Work Order Reference
VA22C0090

Telephone : +1 604 253 4188

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natur

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Marianna DiMauro	23-Aug-22	7:30				°C				

CERTIFICATE OF ANALYSIS

Work Order	: **VA23C0343**	Page	: 1 of 4
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: CREMP Sediment Grabs	Date Samples Received	: 30-Aug-2023 11:00
PO	: ----	Date Analysis Commenced	: 02-Sep-2023
C-O-C number	: ----	Issue Date	: 08-Sep-2023 15:20
Sampler	: Azimuth		
Site	: ----		
Quote number	: Q38011		
No. of samples received	: 6		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Laboratory Supervisor	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BG-1	ST-20i	ST-20ii	BG-4	BG-5
					Client sampling date / time	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00
						VA23C0343-001	VA23C0343-002	VA23C0343-003	VA23C0343-004	VA23C0343-005
						Result	Result	Result	Result	Result
Physical Tests										
Moisture	----	E144/VA	0.25	%		39.1	36.8	32.3	36.4	34.5
pH (1:2 soil:water)	----	E108/VA	0.10	pH units		9.59	8.56	8.46	8.41	8.37
Particle Size										
Gravel (>2mm)	----	EC184E/SK	1.0	%		<1.0	<1.0	<1.0	<1.0	<1.0
Sand (2.0mm - 0.063mm)	----	EC184E/SK	1.0	%		<1.0	1.1	4.7	<1.0	<1.0
Silt (0.063mm - 0.004mm)	----	EC184E/SK	1.0	%		77.1	84.4	80.2	77.2	77.2
Clay (<0.004mm)	----	EC184E/SK	1.0	%		22.7	14.5	15.1	22.5	22.4
Organic / Inorganic Carbon										
Carbon, total organic [TOC]	----	EC356/SK	0.050	%		0.209	0.339	0.314	0.168	0.158
Metals										
Aluminum	7429-90-5	E440/VA	50	mg/kg		33900	26900	27000	31000	30700
Antimony	7440-36-0	E440/VA	0.10	mg/kg		5.96	2.16	2.50	2.47	2.30
Arsenic	7440-38-2	E440/VA	0.10	mg/kg		796	1240	1280	691	856
Barium	7440-39-3	E440/VA	0.50	mg/kg		189	115	110	114	115
Beryllium	7440-41-7	E440/VA	0.10	mg/kg		0.70	0.70	0.63	0.71	0.61
Bismuth	7440-69-9	E440/VA	0.20	mg/kg		0.70	0.27	0.30	0.25	0.25
Boron	7440-42-8	E440/VA	5.0	mg/kg		15.6	5.1	5.5	5.7	5.1
Cadmium	7440-43-9	E440/VA	0.020	mg/kg		1.05	0.751	0.632	0.168	0.271
Calcium	7440-70-2	E440/VA	50	mg/kg		26400	21400	22200	21800	20000
Chromium	7440-47-3	E440/VA	0.50	mg/kg		1440	1010	1120	1360	1340
Cobalt	7440-48-4	E440/VA	0.10	mg/kg		32.3	34.6	42.3	37.5	40.1
Copper	7440-50-8	E440/VA	0.50	mg/kg		332	236	190	127	126
Iron	7439-89-6	E440/VA	50	mg/kg		88400	75300	81800	91000	83700
Lead	7439-92-1	E440/VA	0.50	mg/kg		216	97.6	122	101	115
Lithium	7439-93-2	E440/VA	2.0	mg/kg		23.4	20.1	20.7	24.8	24.0
Magnesium	7439-95-4	E440/VA	20	mg/kg		32100	28000	26500	27800	28600
Manganese	7439-96-5	E440/VA	1.0	mg/kg		2800	2160	2480	3140	2900
Mercury	7439-97-6	E510/VA	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Molybdenum	7439-98-7	E440/VA	0.10	mg/kg		2.34	1.48	1.73	1.63	1.51

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BG-1	ST-20i	ST-20ii	BG-4	BG-5
					Client sampling date / time	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00	23-Aug-2023 00:00
						VA23C0343-001	VA23C0343-002	VA23C0343-003	VA23C0343-004	VA23C0343-005
						Result	Result	Result	Result	Result
Metals										
Nickel	7440-02-0	E440/VA	0.50	mg/kg		577	483	577	629	622
Phosphorus	7723-14-0	E440/VA	50	mg/kg		663	494	404	404	414
Potassium	7440-09-7	E440/VA	100	mg/kg		11900	10200	9440	11000	10900
Selenium	7782-49-2	E440/VA	0.20	mg/kg		0.40	0.61	0.86	0.50	0.79
Silver	7440-22-4	E440/VA	0.10	mg/kg		0.70	0.56	0.60	0.31	0.27
Sodium	7440-23-5	E440/VA	50	mg/kg		1050	414	463	615	503
Strontium	7440-24-6	E440/VA	0.50	mg/kg		65.9	66.9	64.3	54.6	47.6
Sulfur	7704-34-9	E440/VA	1000	mg/kg		8000	9500	12100	8900	8700
Thallium	7440-28-0	E440/VA	0.050	mg/kg		0.450	0.414	0.415	0.427	0.409
Tin	7440-31-5	E440/VA	2.0	mg/kg		3.2	<2.0	<2.0	<2.0	<2.0
Titanium	7440-32-6	E440/VA	1.0	mg/kg		1480	1110	1130	1340	1260
Tungsten	7440-33-7	E440/VA	0.50	mg/kg		8.09	5.50	7.28	6.25	4.25
Uranium	7440-61-1	E440/VA	0.050	mg/kg		0.885	0.732	0.755	0.719	0.682
Vanadium	7440-62-2	E440/VA	0.20	mg/kg		96.6	76.1	77.4	89.4	86.0
Zinc	7440-66-6	E440/VA	2.0	mg/kg		160	55.9	56.6	58.5	55.4
Zirconium	7440-67-7	E440/VA	1.0	mg/kg		7.4	7.2	6.8	7.1	5.3

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA23C0343**	Page	: 1 of 9
Client	: **Azimuth Consulting Group Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: CREMP Sediment Grabs	Date Samples Received	: 30-Aug-2023 11:00
PO	: ----	Issue Date	: 08-Sep-2023 15:21
C-O-C number	: ----		
Sampler	: Azimuth		
Site	: ----		
Quote number	: Q38011		
No. of samples received	: 6		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	Chromium	7440-47-3	E440	62.9 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	Cobalt	7440-48-4	E440	145 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	Silver	7440-22-4	E440	42.1 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	Tin	7440-31-5	E440	97.0 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid** Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag BG-1	E510	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	07-Sep-2023	28 days	15 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag BG-4	E510	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	07-Sep-2023	28 days	15 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag BG-5	E510	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	07-Sep-2023	28 days	15 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag ST-20i	E510	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	07-Sep-2023	28 days	15 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag ST-20ii	E510	23-Aug-2023	06-Sep-2023	28 days	14 days	✓	07-Sep-2023	28 days	15 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag BG-1	E440	23-Aug-2023	06-Sep-2023	180 days	14 days	✓	07-Sep-2023	180 days	16 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag BG-4	E440	23-Aug-2023	06-Sep-2023	180 days	14 days	✓	07-Sep-2023	180 days	16 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag BG-5	E440	23-Aug-2023	06-Sep-2023	180 days	14 days	✓	07-Sep-2023	180 days	16 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag ST-20i	E440	23-Aug-2023	06-Sep-2023	180 days	14 days	✓	07-Sep-2023	180 days	16 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag ST-20ii	E440	23-Aug-2023	06-Sep-2023	180 days	14 days	✓	07-Sep-2023	180 days	16 days	✓
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BG-1	E144	23-Aug-2023	----	----	----		05-Sep-2023	----	14 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BG-4	E144	23-Aug-2023	----	----	----		05-Sep-2023	----	14 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag BG-5	E144	23-Aug-2023	----	----	----		05-Sep-2023	----	14 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag ST-20i	E144	23-Aug-2023	----	----	----		05-Sep-2023	----	14 days	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag ST-20ii	E144	23-Aug-2023	----	----	----		05-Sep-2023	----	14 days	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag BG-1	E108	23-Aug-2023	06-Sep-2023	30 days	14 days	✓	06-Sep-2023	30 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag BG-4	E108	23-Aug-2023	06-Sep-2023	30 days	14 days	✓	06-Sep-2023	30 days	15 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag BG-5	E108	23-Aug-2023	06-Sep-2023	30 days	14 days	✓	06-Sep-2023	30 days	15 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag ST-20i	E108	23-Aug-2023	06-Sep-2023	30 days	14 days	✓	06-Sep-2023	30 days	15 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag ST-20ii	E108	23-Aug-2023	06-Sep-2023	30 days	14 days	✓	06-Sep-2023	30 days	15 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	1119185	1	17	5.8	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	1119186	1	17	5.8	5.0	✓
Moisture Content by Gravimetry	E144	1119188	1	17	5.8	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	1119187	1	17	5.8	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	1119185	2	17	11.7	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	1119186	2	17	11.7	10.0	✓
Moisture Content by Gravimetry	E144	1119188	1	17	5.8	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	1119187	1	17	5.8	5.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	1119185	1	17	5.8	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	1119186	1	17	5.8	5.0	✓
Moisture Content by Gravimetry	E144	1119188	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 ALS Environmental - Vancouver	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 ALS Environmental - Vancouver	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Metals in Soil/Solid by CRC ICPMS	E440 ALS Environmental - Vancouver	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 ALS Environmental - Vancouver	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Particle Size Analysis (Pipette) - MMER Classification	EC184E ALS Environmental - Saskatoon	Soil/Solid	Metal Mining Technical Guidance for Environmental Effects Monitoring (2012)	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Metal Mining Effluent Regulations (MMER) classification system for Environmental Effects Monitoring.
Total Organic Carbon (Calculated) in soil	EC356 ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Vancouver	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 ALS Environmental - Vancouver	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind in Soil/Solid <60°C	EPP442 ALS Environmental - Saskatoon	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL REPORT

Work Order	: **VA23C0343**	Page	: 1 of 10
Client	: Azimuth Consulting Group Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Marianna DiMauro	Account Manager	: Brent Mack
Address	: # 218 - 2902 West Broadway Vancouver BC Canada V6K 2G8	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: 778-370-3279
Project	: CREMP Sediment Grabs	Date Samples Received	: 30-Aug-2023 11:00
PO	: ----	Date Analysis Commenced	: 02-Sep-2023
C-O-C number	: ----	Issue Date	: 08-Sep-2023 15:21
Sampler	: Azimuth ----		
Site	: ----		
Quote number	: Q38011		
No. of samples received	: 6		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Laboratory Supervisor	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Ophelia Chiu	Department Manager - Organics	Vancouver Organics, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1119187)											
VA23C0291-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	11.9	11.9	0.3%	5%	----
Physical Tests (QC Lot: 1119188)											
VA23C0291-001	Anonymous	Moisture	----	E144	0.25	%	19.8	22.4	12.2%	20%	----
Metals (QC Lot: 1119185)											
VA23C0291-001	Anonymous	Mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	<0.0500	0	Diff <2x LOR	----
Metals (QC Lot: 1119186)											
VA23C0291-001	Anonymous	Aluminum	7429-90-5	E440	50	mg/kg	34000	44500	26.7%	40%	----
		Antimony	7440-36-0	E440	0.10	mg/kg	105	113	7.49%	30%	----
		Arsenic	7440-38-2	E440	0.10	mg/kg	25.7	23.3	9.67%	30%	----
		Barium	7440-39-3	E440	0.50	mg/kg	625	469	28.6%	40%	----
		Beryllium	7440-41-7	E440	0.10	mg/kg	0.34	0.35	0.02	Diff <2x LOR	----
		Bismuth	7440-69-9	E440	0.20	mg/kg	9.21	8.85	3.98%	30%	----
		Boron	7440-42-8	E440	5.0	mg/kg	170	186	9.09%	30%	----
		Cadmium	7440-43-9	E440	0.020	mg/kg	9.99	11.0	9.37%	30%	----
		Calcium	7440-70-2	E440	50	mg/kg	137000	141000	3.03%	30%	----
		Chromium	7440-47-3	E440	0.50	mg/kg	353	184	62.9%	30%	DUP-H
		Cobalt	7440-48-4	E440	0.10	mg/kg	29.3	183	145%	30%	DUP-H
		Copper	7440-50-8	E440	0.50	mg/kg	3720	2760	29.4%	30%	----
		Iron	7439-89-6	E440	50	mg/kg	43100	49100	13.0%	30%	----
		Lead	7439-92-1	E440	0.50	mg/kg	480	484	0.854%	40%	----
		Lithium	7439-93-2	E440	2.0	mg/kg	24.8	30.0	18.7%	30%	----
		Magnesium	7439-95-4	E440	20	mg/kg	12400	12000	3.39%	30%	----
		Manganese	7439-96-5	E440	1.0	mg/kg	754	802	6.08%	30%	----
		Molybdenum	7439-98-7	E440	0.10	mg/kg	22.7	25.8	12.7%	40%	----
		Nickel	7440-02-0	E440	0.50	mg/kg	167	143	15.3%	30%	----
		Phosphorus	7723-14-0	E440	50	mg/kg	10900	9640	12.1%	30%	----
		Potassium	7440-09-7	E440	100	mg/kg	6440	5450	16.6%	40%	----
		Selenium	7782-49-2	E440	0.20	mg/kg	0.30	0.36	0.06	Diff <2x LOR	----
		Silver	7440-22-4	E440	0.10	mg/kg	6.81	4.44	42.1%	40%	DUP-H
		Sodium	7440-23-5	E440	50	mg/kg	18600	16500	11.8%	40%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 1119186) - continued											
VA23C0291-001	Anonymous	Strontium	7440-24-6	E440	0.50	mg/kg	321	314	2.08%	40%	----
		Sulfur	7704-34-9	E440	1000	mg/kg	13300	13600	2.00%	30%	----
		Thallium	7440-28-0	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tin	7440-31-5	E440	2.0	mg/kg	251	87.1	97.0%	40%	DUP-H
		Titanium	7440-32-6	E440	1.0	mg/kg	254	258	1.37%	40%	----
		Tungsten	7440-33-7	E440	0.50	mg/kg	3.98	4.33	8.44%	30%	----
		Uranium	7440-61-1	E440	0.050	mg/kg	3.43	3.41	0.550%	30%	----
		Vanadium	7440-62-2	E440	0.20	mg/kg	46.9	44.4	5.63%	30%	----
		Zinc	7440-66-6	E440	2.0	mg/kg	7110	9230	25.9%	30%	----
		Zirconium	7440-67-7	E440	1.0	mg/kg	1.7	3.4	1.7	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1119188)						
Moisture	----	E144	0.25	%	<0.25	----
Metals (QCLot: 1119185)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 1119186)						
Aluminum	7429-90-5	E440	50	mg/kg	<50	----
Antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
Arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
Barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
Beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
Bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
Boron	7440-42-8	E440	5	mg/kg	<5.0	----
Cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
Calcium	7440-70-2	E440	50	mg/kg	<50	----
Chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
Cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
Copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
Iron	7439-89-6	E440	50	mg/kg	<50	----
Lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
Lithium	7439-93-2	E440	2	mg/kg	<2.0	----
Magnesium	7439-95-4	E440	20	mg/kg	<20	----
Manganese	7439-96-5	E440	1	mg/kg	<1.0	----
Molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
Nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
Phosphorus	7723-14-0	E440	50	mg/kg	<50	----
Potassium	7440-09-7	E440	100	mg/kg	<100	----
Selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
Silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E440	50	mg/kg	<50	----
Strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
Sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
Thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
Tin	7440-31-5	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1119186) - continued						
Titanium	7440-32-6	E440	1	mg/kg	<1.0	----
Tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
Uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
Vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
Zinc	7440-66-6	E440	2	mg/kg	<2.0	----
Zirconium	7440-67-7	E440	1	mg/kg	<1.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1119187)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	100	95.0	105	----
Physical Tests (QCLot: 1119188)									
Moisture	----	E144	0.25	%	50 %	93.2	90.0	110	----
Metals (QCLot: 1119185)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	106	80.0	120	----
Metals (QCLot: 1119186)									
Aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	104	80.0	120	----
Antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	108	80.0	120	----
Arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	107	80.0	120	----
Barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	98.3	80.0	120	----
Beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	91.2	80.0	120	----
Bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	111	80.0	120	----
Boron	7440-42-8	E440	5	mg/kg	100 mg/kg	87.4	80.0	120	----
Cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	102	80.0	120	----
Calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	94.1	80.0	120	----
Chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	101	80.0	120	----
Cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	101	80.0	120	----
Copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	98.8	80.0	120	----
Iron	7439-89-6	E440	50	mg/kg	100 mg/kg	110	80.0	120	----
Lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	103	80.0	120	----
Lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	91.9	80.0	120	----
Magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	108	80.0	120	----
Manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	104	80.0	120	----
Molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	103	80.0	120	----
Nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	100	80.0	120	----
Phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	107	80.0	120	----
Potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	108	80.0	120	----
Selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	102	80.0	120	----
Silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	90.5	80.0	120	----
Sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	108	80.0	120	----
Strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	107	80.0	120	----
Sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	102	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1119186) - continued									
Thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	116	80.0	120	----
Tin	7440-31-5	E440	2	mg/kg	50 mg/kg	99.6	80.0	120	----
Titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	98.2	80.0	120	----
Tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	94.9	80.0	120	----
Uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	100	80.0	120	----
Vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	106	80.0	120	----
Zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	101	80.0	120	----
Zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	100	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 1119185)									
	SCP SS-2	Mercury	7439-97-6	E510	0.059 mg/kg	103	70.0	130	----
Metals (QCLot: 1119186)									
	SCP SS-2	Aluminum	7429-90-5	E440	9817 mg/kg	113	70.0	130	----
	SCP SS-2	Antimony	7440-36-0	E440	3.99 mg/kg	96.7	70.0	130	----
	SCP SS-2	Arsenic	7440-38-2	E440	3.73 mg/kg	101	70.0	130	----
	SCP SS-2	Barium	7440-39-3	E440	105 mg/kg	105	70.0	130	----
	SCP SS-2	Beryllium	7440-41-7	E440	0.349 mg/kg	99.9	70.0	130	----
	SCP SS-2	Boron	7440-42-8	E440	8.5 mg/kg	121	40.0	160	----
	SCP SS-2	Cadmium	7440-43-9	E440	0.91 mg/kg	102	70.0	130	----
	SCP SS-2	Calcium	7440-70-2	E440	31082 mg/kg	102	70.0	130	----
	SCP SS-2	Chromium	7440-47-3	E440	101 mg/kg	118	70.0	130	----
	SCP SS-2	Cobalt	7440-48-4	E440	6.9 mg/kg	105	70.0	130	----
	SCP SS-2	Copper	7440-50-8	E440	123 mg/kg	98.7	70.0	130	----
	SCP SS-2	Iron	7439-89-6	E440	23558 mg/kg	103	70.0	130	----
	SCP SS-2	Lead	7439-92-1	E440	267 mg/kg	108	70.0	130	----
	SCP SS-2	Lithium	7439-93-2	E440	9.5 mg/kg	101	70.0	130	----
	SCP SS-2	Magnesium	7439-95-4	E440	5509 mg/kg	113	70.0	130	----
	SCP SS-2	Manganese	7439-96-5	E440	269 mg/kg	112	70.0	130	----
	SCP SS-2	Molybdenum	7439-98-7	E440	1.03 mg/kg	96.6	70.0	130	----
	SCP SS-2	Nickel	7440-02-0	E440	26.7 mg/kg	104	70.0	130	----
	SCP SS-2	Phosphorus	7723-14-0	E440	752 mg/kg	105	70.0	130	----
	SCP SS-2	Potassium	7440-09-7	E440	1587 mg/kg	114	70.0	130	----
	SCP SS-2	Sodium	7440-23-5	E440	797 mg/kg	110	70.0	130	----
	SCP SS-2	Strontium	7440-24-6	E440	86.1 mg/kg	110	70.0	130	----
	SCP SS-2	Thallium	7440-28-0	E440	0.0786 mg/kg	94.4	40.0	160	----
	SCP SS-2	Tin	7440-31-5	E440	10.6 mg/kg	98.4	70.0	130	----
	SCP SS-2	Titanium	7440-32-6	E440	839 mg/kg	125	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 1119186) - continued									
	SCP SS-2	Uranium	7440-61-1	E440	0.52 mg/kg	106	70.0	130	----
	SCP SS-2	Vanadium	7440-62-2	E440	32.7 mg/kg	112	70.0	130	----
	SCP SS-2	Zinc	7440-66-6	E440	297 mg/kg	99.3	70.0	130	----
	SCP SS-2	Zirconium	7440-67-7	E440	5.73 mg/kg	112	70.0	130	----

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Marianna DiMauro	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	mdimauro@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	imcivor@azimuthgroup.ca; efranz@azimuthgroup	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	meadowbank.environment@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Sediment Grabs	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q38011	
Lab Work Order # (lab use only)	343	**ALS Contact:**	Brent Mack	**Sampler:** Azimuth

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals	TOC, Moisture, pH	Grain size	PAHs, LEPHs, HEPHs, MOG								Number of Containers
	BG-1	23-Aug-23	-	Sediment	X	X	X									2
	ST-20i	23-Aug-23	-	Sediment	X	X	X									2
	ST-20ii	23-Aug-23	-	Sediment	X	X	X									2
	BG-4	23-Aug-23	-	Sediment	X	X	X									2
	BG-5	23-Aug-23	-	Sediment	X	X	X									2
	BG-2	23-Aug-23	-	Sediment												2

Environmental Division
Vancouver
Work Order Reference
VA23C0343

Telephone : +1 604 253 4188

Special Instructions / Regulation requirements (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Archive BG-2 for metals analysis.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Marianna DiMauro	25-Aug-23	7:30				20 °C	SP	30/8/23	11 AM	

Ice Packs

Appendix B-3
Fathead Minnow Toxicity Test Results (May 2023)

Toxicity Testing on Sample ST-20-ii

Sample collected May 08, 2023

Final Report

July 31, 2023

Submitted to: **Azimuth Consulting Group Inc.**
Vancouver, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

TABLE OF CONTENTS

List of Tables

List of Appendices

SIGNATURE PAGE

Report By:
Josh Baker, M.Sc., P.Chem.
Environmental Chemist

Reviewed By:
Karen Lee, R.P.Bio.
Project Biologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Type

Sample ID	ST-20-ii
Sample collection date	May 08, 2023
Sample receipt date	May 17, 2023
Sample receipt temperature	20.9°C
Test types	7-d fathead minnow (*Pimephales promelas*) survival and growth 96-h fathead minnow (*Pimephales promelas*) survival 96-h fathead minnow (*Pimephales promelas*) survival (with pH adjustment and stabilization)

Summary of Results

Endpoint	% v/v (95% CL)	% (Average ± SD)
Pimephales promelas (7-d)		
Survival LC50	69.1 (66.0 – 72.3)	--
Biomass IC50	67.4 (60.2 – 73.5)	--
Pimephales promelas (96-h)		
Survival	--	5.0 ± 10.0
Pimephales promelas (96-h) with pH adjustment and stabilization		
Survival	--	95.0 ± 5.8

LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, SD = Standard Deviation

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted a sub-lethal toxicity test for Azimuth Consulting Group Inc. with a sample identified as ST-20-ii. Sample ST-20-ii was collected on May 8, 2023 and delivered to the Nautilus Environmental laboratory in Burnaby, BC on May 17, 2023. The sample was transported in a 20-L plastic bucket, containing 18 L of sample, and was received at a temperature of 20.9°C. The sample already exceeded the recommended holding time for the test methods at the time of receipt at the laboratory. The sample was stored in the dark at 4 ± 2°C prior to testing.

The sample was tested with a 7-d fathead minnow (*Pimephales promelas*) survival and growth sub-lethal toxicity test. An acute 96-h survival test with fathead minnow was also conducted. The acute test was conducted on the sample with both standard conditions and with an adjusted pH to better understand the role of pH-sensitive toxicants (i.e., ammonia) in the response of the fathead minnow.

The results of these toxicity tests are provided in this report. Copies of raw laboratory data sheets and statistical analyses for each test species are provided in Appendices A to B. The chain-of-custody form is provided in Appendix C.

2.0 METHODS

Methods for the toxicity tests are summarized in Tables 1 to 3. The sub-lethal test with fathead minnow (*P. promelas*) was conducted according to procedures described by Environment Canada (2011). Survival and dry weight at termination were used to estimate the median lethal concentration (7-d LC50) and concentrations which inhibited growth (7-d IC25 and IC50). Acute testing with fathead minnow was conducted according to procedures described by US EPA (2002), with survival at 96 h as the test endpoint. A pH-adjusted acute test was conducted concurrently with the standard acute test. Carbon dioxide (CO_2) was used to adjust the pH of the sample to 7.1 ± 0.3 and maintained for the duration of the test; CO_2 is used in other acute test methods to maintain pH and reduce unionized ammonia toxicity which can occur at high pH (Environment Canada, 2008). Mixed air containing 1.0 – 1.5 % CO_2 was pumped continuously into the headspace of a semi-enclosed chamber. The sample was placed in the chamber for 60 minutes, to bring the sample into the desired pH range, prior to the addition of the organisms at test initiation. Likewise, fresh solution was placed in the chamber for 60 minutes to bring the pH within the desired range prior to being used for the solution renewal at 48-h. A laboratory control, using moderately hard

water, was also tested under the same CO_2-headspace conditions to ensure the pH-adjustment and stabilization method did not cause adverse effects to the organisms. Statistical analyses for all the tests were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 7-d fathead minnow (*Pimephales promelas*) survival and growth test.

Test species	*Pimephales promelas*
Organism source	Aquatic BioSystems, Fort Collins, CO
Organism age	<24 hours post-hatch
Test type	Static-renewal
Test duration	7 days
Test vessel	375-mL glass container
Test volume	250 mL
Test solution depth	6.5 cm
Test concentrations	Seven concentrations, plus laboratory control
Test replicates	3 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day with approximately 1500-2250 newly hatched brine shrimp nauplii (*Artemia sp.*) in each test container
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None, unless dissolved oxygen falls to <40% saturation
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (2011), EPS 1/RM/22
Statistical software	CETIS Version 2.1.4
Test endpoints	Survival and biomass
Test acceptability criteria for controls	≥80% survival; ≥250 µg mean dry weight
Reference toxicant	Sodium chloride (NaCl)

Table 2. Summary of test conditions: 96-h fathead minnow (*Pimephales promelas*) single concentration test.

Test species	*Pimephales promelas*
Organism source	Aquatic BioSystems, CO
Organism age	24-48 hours post-hatch
Test type	Static-renewal
Test duration	96 hours
Test vessel	375-mL glass jars
Test volume	250 mL
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard water
Test solution renewal	Once at 48 hrs
Test temperature	25 ± 1°C
Feeding	Fed upon arrival and once on day 2 with approximately 1500-2250 newly hatched brine shrimp (*Artemia nauplii*) per 10 fish
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	pH, conductivity, dissolved oxygen and temperature measured daily; survival checked daily
Test protocol	USEPA (2002), EPA-821-R-02-012
Statistical software	CETIS Version 2.1.4
Test endpoints	Survival (96-hour %)
Test acceptability criteria for controls	≥90% survival
Reference toxicant	Copper (added as $CuCl_2$)

Table 3. Summary of test conditions: 96-h fathead minnow (*Pimephales promelas*) pH-stabilized single concentration test.

Test species	*Pimephales promelas*
Organism source	Aquatic BioSystems, CO
Organism age	24-48 hours post-hatch
Test type	Static-renewal
Test duration	96 hours
Test vessel	375-mL glass jars
Test volume	250 mL
Test concentrations	100% (undiluted) sample with CO2-supplementation to headspace, plus laboratory control
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard water
Test solution renewal	Once at 48 hrs
Test temperature	25 ± 1°C
Feeding	Fed upon arrival and once on day 2 with approximately 1500-2250 newly hatched brine shrimp (*Artemia nauplii*) per 10 fish
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	pH, conductivity, dissolved oxygen and temperature measured daily; survival checked daily
Test protocol	USEPA (2002), EPA-821-R-02-012
Statistical software	CETIS Version 2.1.4
Test endpoints	Survival (96-hour LC50)
Test acceptability criteria for controls	≥90% survival
Reference toxicant	Copper (added as $CuCl_2$)

3.0 RESULTS

Results of the sub-lethal toxicity test are summarized in Table 4. Adverse effects on survival and biomass of the fathead minnow resulted in LC50 and IC50 estimates of 69.1 and 67.4% (v/v), respectively. A large majority of the mortalities were observed to occur in the first 96 hours of the 7-d test.

Results of the acute toxicity tests are summarized in Table 5. The unadjusted sample, with an average pH of 7.6 during the exposure, resulted in 5.0% survival at 96 h. In contrast, pH adjustment and stabilization resulted in an average pH of 7.0 during the exposure and increased the survival to 95.0% at 96 h.

Table 4. Results: fathead minnow (*Pimephales promelas*) survival and growth test.

Concentration (%v/v)	Mean ± SD	
	7-d Survival (%)	7-d Biomass (mg)
Laboratory Control	100 ± 0.0	0.70 ± 0.05
1.56	100 ± 0.0	0.74 ± 0.01
3.12	100 ± 0.0	0.89 ± 0.01
6.25	100 ± 0.0	0.76 ± 0.02
12.5	100 ± 0.0	0.75 ± 0.03
25	96.7 ± 6.0	0.75 ± 0.06
50	100 ± 0.0	0.68 ± 0.11
100	0.0 ± 0.0	0.0 ± 0.00
Test endpoint (% v/v)		
LC50 (95% CL)	69.1 (66.0 – 72.3)	--
IC25 (95% CL)	--	55.2 (46.5 – 62.9)
IC50 (95% CL)	--	67.4 (60.2 – 73.5)

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits

Table 5. Results: fathead minnow (*Pimephales promelas*) survival test without and with pH adjustment.

Concentration (% v/v)	96-h Survival (%) Mean ± SD
Laboratory Control	100 ± 0.0
100	5.0 ± 10.0
Laboratory Control with pH adjustment	97.5 ± 5.0
100 with pH adjustment	95.0 ± 5.8

SD = Standard Deviation

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the Environment Canada and USEPA protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the tests. Uncertainty associated with the tests are best described by the standard deviation around the mean and/or the confidence intervals around the point estimates. The samples were received and tested outside of the recommended holding times for the tests.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 6. Results for these tests fell within the range for organism performance of the mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate. The reference toxicant tests were performed under the same conditions as those used for the sample.

Table 6. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
P. promelas	Survival (7-d LC50): 4.8 g/L NaCl	4.8 (3.6 – 6.5)	15	May 19, 2023
	Biomass (7-d IC25): 4.3 g/L NaCl	4.1 (3.2 – 5.3)	13	
P. promelas	Survival (96-h LC50): 84.5 µg/L Cu	154.0 (64.1 – 370)	46	June 15, 2023

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration

5.0 REFERENCES

Environment Canada. 2008. Procedure for pH stabilization during the testing of acute lethality of wastewater effluent to rainbow trout. Environmental Protection Series. Report EPS 1/RM/50. Environment Canada, Science and Technology Branch, Environmental Science and Technology Centre, Ottawa, ON.

Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. Environmental Protection Series, Report EPS 1/RM/22, February 2011. Environment Canada, Environmental Protection, Conservation and Protection, Ottawa, ON. 73 pp.

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition. EPA-821-R-02-012.

Tidepool Scientific Software. 2021. CETIS comprehensive environmental toxicity information system, version 2.1.4 Tidepool Scientific Software, McKinleyville, CA. 303 pp.

APPENDIX A – *Pimephales promelas* Sub-lethal Toxicity Test Data

Fathead Minnow Test Summary Sheet

(7-d *Pimephales promelas* Survival and Growth Test)

Client: Azimuth Consulting Group Ltd.
Work Order No.: 230877

Start Date/Time: May 19, 2023 / 13:00
Test Species: P. promelas

Test Validity Criteria:
The test is invalid if :

1) for the control solutions, the combined and cumulative incidence of any mortalities, or fish showing loss of equilibrium or other signs of atypical swimming behavior, is >20%

2) the average dry weight of the surviving control fish does not attain 250 ug when the fish are dried and weighed.

WQ Ranges:
T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4; pH = 6.5 to 8.5

Sample Information:

Sample ID: ST-20-ii
Sample Date: May 8, 2023
Date Received: May 17, 2023
Sample Volume: 1x18L

Dilution Water (initial water quality):

Type: Moderately Hard Water
Temperature (°C) 24.0
pH 7.9
Dissolved Oxygen (mg/L) 8.2
Hardness (mg/L $CaCO_3$) 98
Alkalinity (mg/L $CaCO_3$) 68

Test Organism Information:

Batch No.: 051923
Source: Aquatic Biosystems, CO
Age: <24h
Receipt temperature: 23.0
Acclimation rate: ≤3°C/day

Mortality prior to test initiation: 0.5%
Swim bladder inflated at test initiation? (Y/N): Y
Breeding stock mortality during the week prior to test initiation (%): ~~<2%~~ <1%
Breeding stock mortality on weekly basis: <2%
Incidence of disease: None

NaCl Reference Toxicant Results:

Reference Toxicant ID: PP215
NaCl Lot #: 22A1156214
Date Initiated: May 19, 2023
7-d EC50 (95% CL): 4.8 (4.1 - 5.6) g/L NaCl
7-d IC50 (95% CL): 4.3 (3.9 - 4.8) g/L NaCl

Survival:
Reference Toxicant Mean and Historical Range: 4.8 (3.6 - 6.5) NaCl (g/L) 15 CV (%)

Biomass:
Reference Toxicant Mean and Historical Range: 4.1 (3.2 - 5.3) NaCl (g/L) 13 CV (%)

Test Results:

	Survival	Biomass
LC25 % (v/v) (95% CL)	—	
LC50 % (v/v) (95% CL)	69.1 (66.0-72.3)	
IC25 % (v/v) (95% CL)		~~55.2 (35.4 - 60.9)~~ EV (46.5-62.9)
IC50 % (v/v) (95% CL)		67.4 (60.2 - 73.5)

Reviewed by: Emm
Date reviewed: June 16/23

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Azimuth Consulting Group Ltd
Sample ID: ST-20-ii
Work Order #: 230877

Start Date & Time: May 19, 2023 / 13:00
Stop Date & Time: May 26, 2023 / 12:00
CER #: 11
Test Species: *Pimephales promelas*

% (v/v) Concentration: Ctrl	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	24.5	24.5	24.5	25.0	24.5	25.0	24.5	25.0	25.0	25.0	25.0
DO (mg/L)	8.2	7.3	7.9	6.6	8.0	5.5	7.9	4.5	7.9	5.4	7.9	4.6	7.9	4.6
pH	7.9	7.8	8.0	7.8	8.1	7.5	8.0	7.4	8.0	7.4	8.0	7.3	8.0	7.3
Cond. (µS/cm)	346	346		358		347		347		347		348		388
Initials	PYM	GSM		BAM		PYM		PYM		PYM		PYM		PYM

Concentration: 1.56	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.5	25.0	24.5	24.5	24.5	24.5	25.0	24.5	25.0	25.0	25.0	25.0
DO (mg/L)	8.2	6.3 ①	7.6	6.4	7.8	5.4	8.0	5.1	7.9	5.9	8.0	4.8	7.8	4.9
pH	7.9	7.6	7.8	7.7	8.0	7.5	8.0	7.5	8.1	7.5	8.1	7.3	7.9	7.4
Cond. (µS/cm)	248	388		402		388		388		390		389		419
Initials	PYM	GSM		BAM		PYM		PYM		PYM		PYM		PYM

Concentration: 12.5	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.5	25.0	25.5	25.0	25.0	24.5	24.5	24.5	25.0	24.5	25.0	25.0	25.0	25.0
DO (mg/L)	8.1	7.3	7.6	6.5	7.6	5.4	7.9	5.0	7.9	6.0	8.0	5.2	7.8	5.2
pH	7.9	7.9	7.9	7.8	8.1	7.5	8.1	7.5	8.0		8.0	7.5	8.0	7.5
Cond. (µS/cm)	631	628		639		638		634		641		644		669
Initials	PYM	GSM		BAM		PYM		PYM		PYM		PYM		PYM

Concentration: 100	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.5	25.0	25.5	25.0	25.0									
DO (mg/L)	7.9	7.3	7.9	7.1	7.1									
pH	7.6	8.0	7.8	8.0	8.0									
Cond. (µS/cm)	2420	2400		2425										
Initials	PYM	GSM		BAM										

~~28.1~~ BAM

Thermometer: CER#11 DO meter/probe: 4 / 4 pH meter/probe: 4 / 4 Conductivity meter/probe: 4 / 4

	Control	ST-20-ii 100%		
Hardness*	98	580		
Alkalinity*	68	110		

* mg/L as CaCO3

Analysts: PYM, GSM, BAM

Reviewed by: EMM

Date reviewed: June 16/23

Sample Description: Clear, pale green, odourless liquid w/ few green particulates

Comments: ① confirmed after recalibrating the instrument

7-d Fathead Minnow Toxicity Test
Daily Survival

Client: Azimuth Consulting Group Ltd.
Sample ID: ST-20-11
Work Order #: 230877

Start Date & Time: May 19, 2023 / 13:00
Stop Date & Time: May 26, 2023 / ~~1536~~ ~~1400~~ 12:40
Test Species: *Pimephales promelas*

Concentration % (v/v)	Rep	Day of Test - Percent Survival							Comments
		1	2	3	4	5	6	7	
Ctrl	A	100	100	100	100	100	100	100	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
1.56	A	↓	↓	↓	↓	↓	↓	↓	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
3.12	A	↓	↓	↓	↓	↓	↓	↓	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
6.25	A	↓	↓	↓	↓	↓	↓	↓	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
12.5	A	↓	↓	↓	↓	↓	↓	↓	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
25	A	↓	↓	↓	↓	↓	↓	↓	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	90	
50	A	↓	↓	↓	↓	↓	↓	100	
	B	↓	↓	↓	↓	↓	↓	↓	
	C	↓	↓	↓	↓	↓	↓	↓	
100	A	80	0						
	B	70	↓						
	C	90	↓						
Tech Initials		GBM	BAM	A	pym	PYM	PYM	GBM	

Legend:
1- Fish dying
2- Fish showing loss of equilibrium
3- Fish showing atypical swimming

Test solution depth: ~6.5cm
Comments: Remaining fish appear normal at test termination

Reviewed by: EMM
Date reviewed: June 16/23

Fathead Minnow Toxicity Test Data Sheet

Dry Weight Data

Client: Azimuth Consulting Group

Sample ID: ST-20-11

Work Order No.: 230877

Start Date & Time: May 19, 2023 / 13:00

Termination Date & Time: May 26, 2023 / ~~1100h~~ 12:00 hr

Balance ID: Bal - 6

Oven ID : 2

Acel

Concentration % (v/v)	Rep	Pan No.	No. alive	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	A	1	10	GM	1028.22	1035.26	10	KV / ADD
	B	2			1020.50	1027.97		
	C	3			1018.62	1025.09		
1.56	A	4			1028.54	1036.08		
	B	5			1028.98	1036.30		
	C	6			1023.40	1030.83		
3.12	A	7			1021.40	1030.30		
	B	8			994.29	1003.33		
	C	9			998.36	1007.11		
6.25	A	10			1005.74	1013.18		
	B	11			998.83	1006.65		
	C	12			998.80	1006.40		
12.5	A	13			1001.70	1009.52		
	B	14			1003.13	1010.58		
	C	15			998.12	1005.29		
25	A	16			999.72	1006.91		
	B	17	↓		~~1036.636~~ ①	1040.15	↓	
	C	18	9 GM		② ~~1035.54~~ KV	1042.03	9	
50	A	19	10 GM		1018.59	1026.43	10	
	B	20	↓		1038.59	1045.50	↓	
	C	21	↓		1000.56	1006.21	↓	
100	A	22	0		1009.12	—	0	
	B	23	↓		991.26	—	↓	
	C	24	↓	↓	1015.00	—	↓	↓

① 1032.00 ② 1034.85

Date/time pan placed in oven: May 18/23 @ 14:00

Date/time pan + organisms placed in oven: May 26/23 @ 1245h

Date/time pan removed from oven: May 20/23 @ 1100

Date/time pan + organisms removed from oven: May 27/23 @ 1245h

Comments: 10% Re-weigh: Pan #5: 1036.15 Pan #17: 1039.88 mg

Reviewed by: EMM

Date Reviewed: June 6/23

CETIS Summary Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Batch ID:	05-7918-5835	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Pierre Koelich		
Start Date:	19 May-23 13:00	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water		
Ending Date:	26 May-23 12:00	**Species:**	Pimephales promelas	**Brine:**			
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	<24
Sample ID:	10-9072-2507	**Code:**	41031ACB	**Project:**			
Sample Date:	08 May-23 17:30	**Material:**	Water Sample	**Source:**	Azimuth		
Receipt Date:	17 May-23 09:00	**CAS (PC):**		**Station:**	ST-20-ii		
Sample Age:	10d 20h (20.9 °C)	**Client:**	Azimuth				

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓	Level	%	95% LCL	95% UCL	TU	S
19-0013-1678	7d Survival Rate	Spearman-Kärber		EC50	69.1	66	72.34	1.4	1
17-2874-1467	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)		IC15	51	19.38	59.06	2	1
				IC20	53.07	35.44	60.94	1.9	
				IC25	55.22	46.46	62.88	1.8	
				IC40	62.21	54.27	69.06	1.6	
				IC50	67.35	60.15	73.49	1.5	
11-6527-3877	Mean Dry Weight-mg	Linear Interpolation (ICPIN)	✓	IC15	>50	---	---	<2	1
			✓	IC20	>50	---	---	<2	
			✓	IC25	>50	---	---	<2	
			✓	IC40	>50	---	---	<2	
			✓	IC50	>50	---	---	<2	

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
1.56		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
3.12		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
6.25		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12.5		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
25		3	0.9667	0.8232	1.1100	0.9000	1.0000	0.0333	0.0577	5.97%	3.33%
50		3	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	---	100.00%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	3	0.6993	0.5747	0.8239	0.647	0.747	0.02896	0.05016	7.17%	0.00%
1.56		3	0.743	0.7157	0.7703	0.732	0.754	0.006346	0.01099	1.48%	-6.24%
3.12		3	0.8897	0.8536	0.9257	0.875	0.904	0.008374	0.0145	1.63%	-27.22%
6.25		3	0.762	0.7146	0.8094	0.744	0.782	0.01102	0.01908	2.50%	-8.96%
12.5		3	0.748	0.667	0.829	0.717	0.782	0.01882	0.0326	4.36%	-6.96%
25		3	0.7507	0.6123	0.8891	0.718	0.815	0.03217	0.05572	7.42%	-7.34%
50		3	0.68	0.407	0.953	0.565	0.784	0.06346	0.1099	16.16%	2.76%
100		3	0	0	0	0	0	0	0	---	100.00%

Mean Dry Weight-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	3	0.6993	0.5747	0.8239	0.647	0.747	0.02896	0.05016	7.17%	0.00%
1.56		3	0.743	0.7157	0.7703	0.732	0.754	0.006346	0.01099	1.48%	-6.24%
3.12		3	0.8897	0.8536	0.9257	0.875	0.904	0.008374	0.0145	1.63%	-27.22%
6.25		3	0.762	0.7146	0.8094	0.744	0.782	0.01102	0.01908	2.50%	-8.96%
12.5		3	0.748	0.667	0.829	0.717	0.782	0.01882	0.0326	4.36%	-6.96%
25		3	0.7773	0.6501	0.9044	0.719	0.815	0.02955	0.05119	6.59%	-11.14%
50		3	0.68	0.407	0.953	0.565	0.784	0.06346	0.1099	16.16%	2.76%

7d Survival Rate Detail

MD5: 2816D144C761696743E17278FF80F6DB

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000
3.12		1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000
25		1.0000	1.0000	0.9000
50		1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000

Mean Dry Biomass-mg Detail

MD5: B3AF40D6E855AF24FD6E982FA6E66684

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	0.704	0.747	0.647
1.56		0.754	0.732	0.743
3.12		0.89	0.904	0.875
6.25		0.744	0.782	0.76
12.5		0.782	0.745	0.717
25		0.719	0.815	0.718
50		0.784	0.691	0.565
100		0	0	0

Mean Dry Weight-mg Detail

MD5: 6D40E1B1284036FF4432EECFAE14D012

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	0.704	0.747	0.647
1.56		0.754	0.732	0.743
3.12		0.89	0.904	0.875
6.25		0.744	0.782	0.76
12.5		0.782	0.745	0.717
25		0.719	0.815	0.7978
50		0.784	0.691	0.565
100		---	---	---

7d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	10/10	10/10	10/10
1.56		10/10	10/10	10/10
3.12		10/10	10/10	10/10
6.25		10/10	10/10	10/10
12.5		10/10	10/10	10/10
25		10/10	10/10	9/10
50		10/10	10/10	10/10
100		0/10	0/10	0/10

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

Analysis ID:	19-0013-1678	Endpoint:	7d Survival Rate	CETIS Version:	CETISv2.1.4
Analyzed:	08 Jun-23 10:15	Analysis:	Untrimmed Spearman-Kärber	Status Level:	1
Edit Date:	08 Jun-23 10:13	MD5 Hash:	2816D144C761696743E17278FF80F6DB	Editor ID:	004-311-246-8
Batch ID:	05-7918-5835	Test Type:	Growth-Survival (7d)	Analyst:	Pierre Koelich
Start Date:	19 May-23 13:00	Protocol:	EC/EPS 1/RM/22	Diluent:	Mod-Hard Synthetic Water
Ending Date:	26 May-23 12:00	Species:	Pimephales promelas	Brine:	
Test Length:	6d 23h	Taxon:	Actinopterygii	Source:	Aquatic Biosystems, CO Age: <24
Sample ID:	10-9072-2507	Code:	41031ACB	Project:	
Sample Date:	08 May-23 17:30	Material:	Water Sample	Source:	Azimuth
Receipt Date:	17 May-23 09:00	CAS (PC):		Station:	ST-20-ii
Sample Age:	10d 20h (20.9 °C)	Client:	Azimuth		

Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL	Tox Units	95% LCL	95% UCL
Control Threshold	0	0.00%	1.839	0.00995	69.1	66	72.34	1.4	1.4	1.5

7d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	ΣA/ΣB	Mean	%Effect
0	LC	3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
1.56		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
3.12		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
6.25		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
12.5		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
25		3	0.9667	1.0000	0.9000	1.0000	5.97%	3.33%	29/30	0.9833	1.67%
50		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	0.9833	1.67%
100		3	0.0000	0.0000	0.0000	0.0000	---	100.00%	0/30	0.0000	100.00%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	1.0000	1.0000	1.0000
1.56		1.0000	1.0000	1.0000
3.12		1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000
25		1.0000	1.0000	0.9000
50		1.0000	1.0000	1.0000
100		0.0000	0.0000	0.0000

7d Survival Rate Binomials

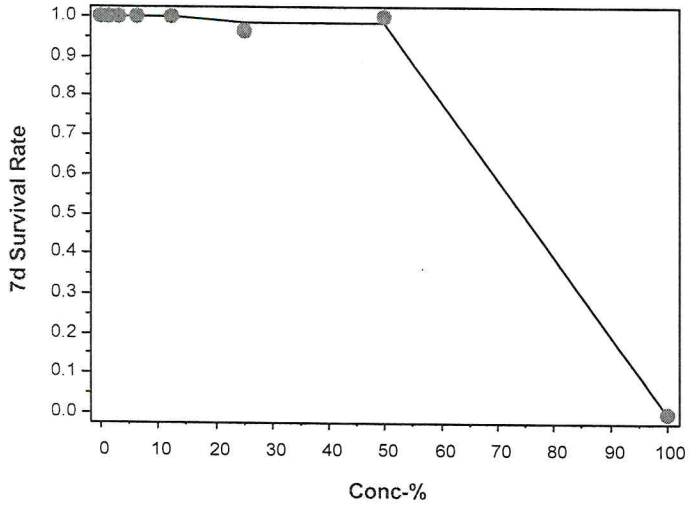
Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	10/10	10/10	10/10
1.56		10/10	10/10	10/10
3.12		10/10	10/10	10/10
6.25		10/10	10/10	10/10
12.5		10/10	10/10	10/10
25		10/10	10/10	9/10
50		10/10	10/10	10/10
100		0/10	0/10	0/10

Fathead Minnow 7-d Larval Survival and Growth Test

Nautilus Environmental

Analysis ID:	19-0013-1678	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv2.1.4
Analyzed:	08 Jun-23 10:15	**Analysis:**	Untrimmed Spearman-Kärber	**Status Level:**	1
Edit Date:	08 Jun-23 10:13	**MD5 Hash:**	2816D144C761696743E17278FF80F6DB	**Editor ID:**	004-311-246-8

Graphics



CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-2874-1467	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv2.1.4
Analyzed:	08 Jun-23 10:16	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Edit Date:	08 Jun-23 10:13	**MD5 Hash:**	B3AF40D6E855AF24FD6E982FA6E66684	**Editor ID:**	004-311-246-8
Batch ID:	05-7918-5835	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Pierre Koelich
Start Date:	19 May-23 13:00	**Protocol:**	EC/EPS 1/RM/22	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	26 May-23 12:00	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	6d 23h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** <24
Sample ID:	10-9072-2507	**Code:**	41031ACB	**Project:**	
Sample Date:	08 May-23 17:30	**Material:**	Water Sample	**Source:**	Azimuth
Receipt Date:	17 May-23 09:00	**CAS (PC):**		**Station:**	ST-20-ii
Sample Age:	10d 20h (20.9 °C)	**Client:**	Azimuth		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1167357	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	Tox Units	95% LCL	95% UCL
IC15	51	19.38	59.06	2	1.7	5.2
IC20	53.07	35.44	60.94	1.9	1.6	2.8
IC25	55.22	46.46	62.88	1.8	1.6	2.2
IC40	62.21	54.27	69.06	1.6	1.4	1.8
IC50	67.35	60.15	73.49	1.5	1.4	1.7

Mean Dry Biomass-mg Summary

			Calculated Variate						Isotonic Variate	
Conc-%	Code	Count	Mean	Median	Min	Max	CV%	%Effect	Mean	%Effect
0	LC	3	0.6993	0.704	0.647	0.747	7.17%	0.00%	0.7773	0.00%
1.56		3	0.743	0.743	0.732	0.754	1.48%	-6.24%	0.7773	0.00%
3.12		3	0.8897	0.89	0.875	0.904	1.63%	-27.22%	0.7773	0.00%
6.25		3	0.762	0.76	0.744	0.782	2.50%	-8.96%	0.762	1.97%
12.5		3	0.748	0.745	0.717	0.782	4.36%	-6.96%	0.7493	3.60%
25		3	0.7507	0.719	0.718	0.815	7.42%	-7.34%	0.7493	3.60%
50		3	0.68	0.691	0.565	0.784	16.16%	2.76%	0.68	12.52%
100		3	0	0	0	0	---	100.00%	0	100.00%

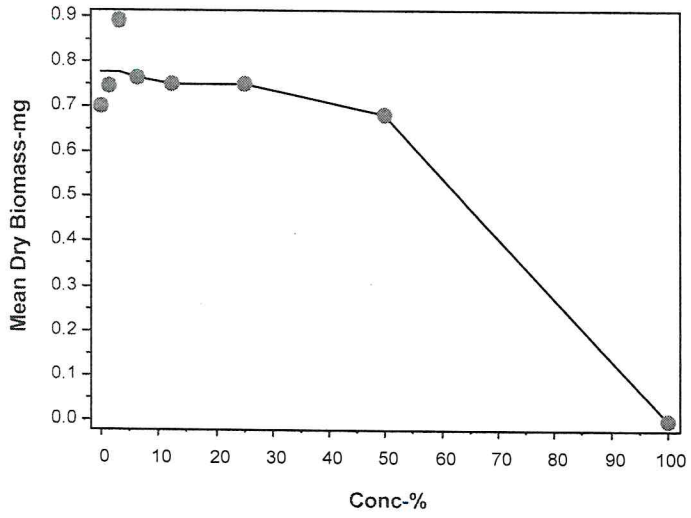
Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3
0	LC	0.704	0.747	0.647
1.56		0.754	0.732	0.743
3.12		0.89	0.904	0.875
6.25		0.744	0.782	0.76
12.5		0.782	0.745	0.717
25		0.719	0.815	0.718
50		0.784	0.691	0.565
100		0	0	0

Fathead Minnow 7-d Larval Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-2874-1467	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv2.1.4
Analyzed:	08 Jun-23 10:16	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Edit Date:	08 Jun-23 10:13	**MD5 Hash:**	B3AF40D6E855AF24FD6E982FA6E66684	**Editor ID:**	004-311-246-8

Graphics



APPENDIX B – *Pimephales promelas* Acute Toxicity Test Data

Acute Fathead Minnow Test Summary Sheet

Client: Azimuth Consulting Group Ltd. Start Date/Time: June 15, 2023 / 12:30

Work Order No.: 231137, 231138 Test Species: *Pimephales promelas*

Sample Information:

Sample ID: ST-20-1
Sample Date: May 8, 2023
Date Received: May 17, 2023
Sample Volume: ~~1 x 20L~~ 1x18L

Dilution Water:

Type: made with DI water MHW ~~DI~~
Hardness (mg/L $CaCO_3$): 92
Alkalinity (mg/L $CaCO_3$): 56

Test Organism Information:

Batch No.: 061423
Source: Aquatic Biosystems, CO
Age: 2 days

Cu Reference Toxicant Results:

Reference Toxicant ID: PP-25-30
Stock Solution ID: 23Cu02
Date Initiated: June 15, 2023
96-hr EC50 (95% CL): 84.5 (69.4 - 100.1) mg/L Cu

Survival:

Reference Toxicant Mean (2SD Range): Cu (µ/L): 154.0 (64.1 - 370.0) CV (%): 46

Test Results:

	Survival (%)
① ~~LC25 % (v/v) (95% CL)~~	5.0 ± 10.0
② ~~LC50 % (v/v) (95% CL)~~	95.0 ± 5.3
~~NOEC % (v/v)~~	
~~LOEC % (v/v)~~	

lesn survival in 100% (v/v) undiluted sample ± 2 SD(%)

mean survival in 100% (v/v) undiluted sample ±2SD w/ pH stabilization (%)

SD: standard deviation

Reviewed by: KJL Date reviewed: Aug 1/23

96 Hour Acute Toxicity Test Data Sheet
Water Quality and Survival Data

Client: Azimuth Consulting Group Ltd.
Sample ID: ST-20-ii
Work Order No.: 231137, -231138

Start Date & Time: Jun 15, 2023 / 12:30
End Date & Time: Jun 19, 2023 / 1230
Test Organism: P. promelas

Conc.	Rep	Survival				Temperature (°C)						Dissolved oxygen (mg/L)						pH						Conductivity (µS)		
		24	48	72	96	0	24	48 old	48 new	72	96	0	24	48 old	48 new	72	96	0	24	48 old	48 new	72	96	0	48 new	96
						~~25.0~~																				
Control	A	10	10	10	10	25.0	25.5	25.5	25.5	25.5	25.5	7.8	7.1	7.0	7.9	6.9	7.0	7.6	7.5	7.4	7.6	7.2	7.3	318	321	329
	B	↓	↓	↓	↓																					
	C																									
	D																									
100	A	8	4	2	2	25.0	25.5	25.5	25.5	25.5	25.5	8.2	7.1	7.0	7.9	6.1	3.9	7.8	7.8	7.7	7.6	7.5	7.4	2420	2430	2490
	B	4	0	0	0																					
	C	2	0	↓	↓																					
	D	6	0																							
Control ① (pH stab.)	A	10	10	9	9	26.0	25.5	25.5	25.5	25.5	25.5	7.7	7.2	6.9	7.8	6.7	6.9	7.1	7.2	~~7.2~~ 6.8	7.4	6.9	6.8	318	321	322
	B	↓	↓	10	10																					
	C			↓	↓																					
	D																									
100 ① (pH stab)	A			↓	↓	25.5	25.5	25.5	25.5	25.5	26.0	8.1	6.6	6.5	7.8	6.2	6.2	7.4 ②	6.8	6.8	7.4 ②	6.9	6.8	2430	2340	2420
	B	↓	↓	9	9																					
	C			10	10																					
	D			9	9																					
	A																									
	B																									
	C																									
	D																									
	A																									
	B																									
	C																									
	D																									
Technician Initials		PYN	IMC	KJL	PY	PYN	PYN	IMC		KJL	PY	PYN	PYN	IMC		KJL	PY	PYN	PYN	IMC		KJL	PY	PYN	IMC	PY

Sample Description: Clear, pale green, odorless liquid w/ few green particulates
Comments: ① Contained in a semi-enclosed environment with 1.0 - 1.5% CO_2 + mixed air continuously added to headspace
② Sample placed in CO_2 chamber for 60 minutes prior to use in test

Reviewed by: KJL
Date Reviewed: July 27/23

CETIS Summary Report

Test Code/ID: 231137-231138 / 17-4349-3754

Fathead Minnow 96-h Acute Survival Test — **Nautilus Environmental**

Batch ID:	15-8484-4100	**Test Type:**	Survival (96h)	**Analyst:**	Pierre Koelich		
Start Date:	15 Jun-23 12:30	**Protocol:**	EPA/821/R-02-012 (2002)	**Diluent:**	Mod-Hard Synthetic Water		
Ending Date:	19 Jun-23 12:30	**Species:**	Pimephales promelas	**Brine:**			
Test Length:	96h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO	**Age:**	2d
Sample ID:	10-9072-2507	**Code:**	41031ACB	**Project:**			
Sample Date:	08 May-23 17:30	**Material:**	Water Sample	**Source:**	Azimuth		
Receipt Date:	17 May-23 09:00	**CAS (PC):**		**Station:**	ST-20-ii		
Sample Age:	37d 19h (20.9 °C)	**Client:**	Azimuth				

SIngle Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result	S
04-9430-5785	96h Survival Rate	Wilcoxon Rank Sum Two-Sample Test	0.0143	99% failed 96h survival rate	1
11-8788-5413	96h Survival Rate	Equal Variance t Two-Sample Test	0.2685	100% passed 96h survival rate	1

Test Acceptability

				TAC Limits			
Analysis ID	Endpoint	Attribute	Test Stat	Lower	Upper	Overlap	Decision
04-9430-5785	96h Survival Rate	Control Resp	1	0.9	<<	Yes	Passes Criteria
11-8788-5413	96h Survival Rate	Control Resp	0.975	0.9	<<	Yes	Passes Criteria

96h Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	LC	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	MC	4	0.9750	0.8954	1.0550	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
99		4	0.0500	-0.1091	0.2091	0.0000	0.2000	0.0500	0.1000	200.00%	95.00%
100		4	0.9500	0.8581	1.0420	0.9000	1.0000	0.0289	0.0577	6.08%	5.00%

96h Survival Rate Detail

MD5: AF2F628339A691006F05584B8742BAEA

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	1.0000	1.0000	1.0000	1.0000
0	MC	0.9000	1.0000	1.0000	1.0000
99		0.2000	0.0000	0.0000	0.0000
100		1.0000	0.9000	1.0000	0.9000

96h Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	10/10	10/10	10/10	10/10
0	MC	9/10	10/10	10/10	10/10
99		2/10	0/10	0/10	0/10
100		10/10	9/10	10/10	9/10

LC = Lab Control

MC = Lab control (pH stabilized)

99 = ST-20-ii 100%(v/v) concentration

100 = ST-20-ii 100%(v/v) concentration (pH stabilized)

CETIS Analytical Report

Fathead Minnow 96-h Acute Survival Test — **Nautilus Environmental**

Analysis ID:	04-9430-5785	**Endpoint:**	96h Survival Rate	**CETIS Version:**	CETISv2.1.4
Analyzed:	02 Aug-23 8:42	**Analysis:**	Nonparametric-Two Sample	**Status Level:**	1
Edit Date:	11 Jul-23 8:54	**MD5 Hash:**	26298967719D237A24636368FAA3739E	**Editor ID:**	004-311-246-8
Batch ID:	15-8484-4100	**Test Type:**	Survival (96h)	**Analyst:**	Pierre Koelich
Start Date:	15 Jun-23 12:30	**Protocol:**	EPA/821/R-02-012 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	19 Jun-23 12:30	**Species:**	Pimephales promelas	**Brine:**	
Test Length:	96h	**Taxon:**	Actinopterygii	**Source:**	Aquatic Biosystems, CO **Age:** 2d
Sample ID:	10-9072-2507	**Code:**	41031ACB	**Project:**	
Sample Date:	08 May-23 17:30	**Material:**	Water Sample	**Source:**	Azimuth
Receipt Date:	17 May-23 09:00	**CAS (PC):**		**Station:**	ST-20-ii
Sample Age:	37d 19h (20.9 °C)	**Client:**	Azimuth		

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	99% failed 96h survival rate endpoint	9.13%

Wilcoxon Rank Sum Two-Sample Test ✓

Control	vs	Conc-%	df	Test Stat	Critical	Ties	P-Type	P-Value	Decision(α:5%)
Lab Control		99*	6	10	---	0	Exact	0.0143	Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	1	0.9	<<	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.77075	2.77075	1	238.5	<1.0E-05	Significant Effect
Error	0.0697081	0.011618	6			
Total	2.84046		7			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Variance Ratio F Test				Indeterminate
Distribution	Shapiro-Wilk W Normality Test	0.7065	0.6451	0.0027	Non-Normal Distribution

96h Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	LC	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
99		4	0.0500	0.0000	0.2091	0.0000	0.0000	0.2000	0.0500	200.00%	95.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	LC	4	1.4120	1.4120	1.4120	1.4120	1.4120	1.4120	0.0000	0.00%	0.00%
99		4	0.2350	-0.0076	0.4776	0.1588	0.1588	0.4636	0.0762	64.87%	83.36%

96h Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	1.0000	1.0000	1.0000	1.0000
99		0.2000	0.0000	0.0000	0.0000

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	1.4120	1.4120	1.4120	1.4120
99		0.4636	0.1588	0.1588	0.1588

LC= Laboratory Control
99= ST-20-ii 100 % (v/v) concentration

Fathead Minnow 96-h Acute Survival Test

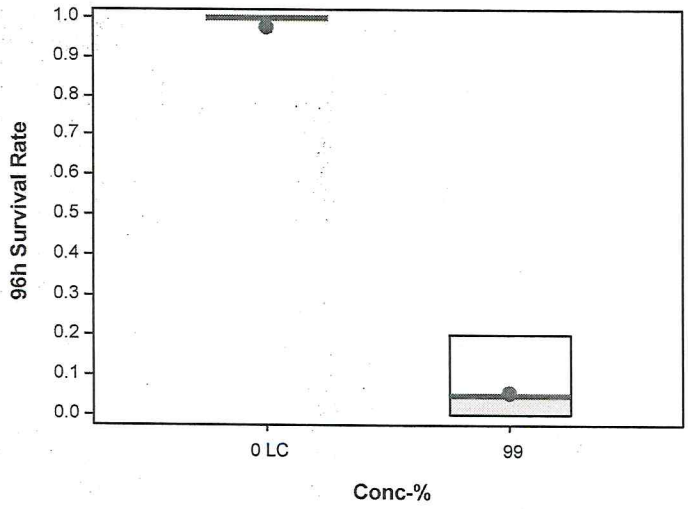
Nautilus Environmental

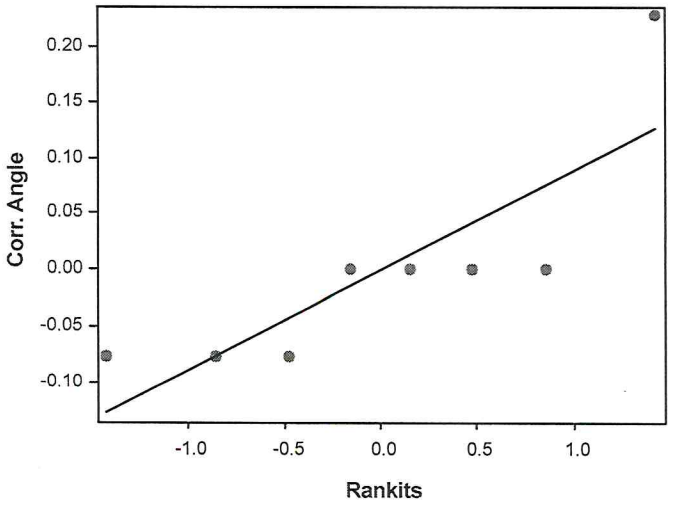
Analysis ID:	04-9430-5785	**Endpoint:**	96h Survival Rate	**CETIS Version:**	CETISv2.1.4
Analyzed:	02 Aug-23 8:42	**Analysis:**	Nonparametric-Two Sample	**Status Level:**	1
Edit Date:	11 Jul-23 8:54	**MD5 Hash:**	26298967719D237A24636368FAA3739E	**Editor ID:**	004-311-246-8

96h Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	LC	10/10	10/10	10/10	10/10
99		2/10	0/10	0/10	0/10

Graphics





Fathead Minnow 96-h Acute Survival Test

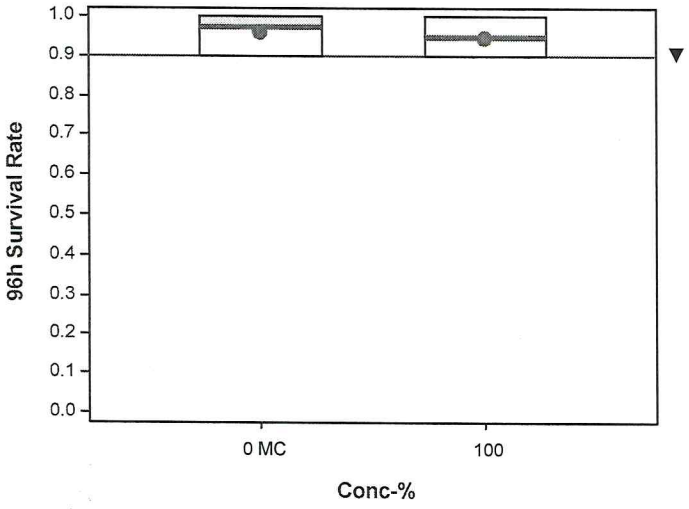
Nautilus Environmental

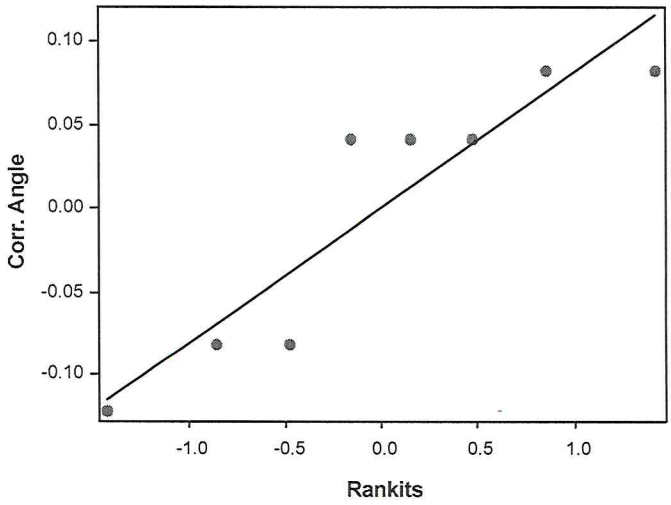
Analysis ID:	11-8788-5413	**Endpoint:**	96h Survival Rate	**CETIS Version:**	CETISv2.1.4
Analyzed:	02 Aug-23 8:43	**Analysis:**	Parametric-Two Sample	**Status Level:**	1
Edit Date:	11 Jul-23 8:54	**MD5 Hash:**	21B60ED8E121B36E6B885A82C874F4CF	**Editor ID:**	004-311-246-8

96h Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	MC	9/10	10/10	10/10	10/10
100		10/10	9/10	10/10	9/10

Graphics





APPENDIX C – Chain-of-Custody Form

NAUTILUS ENVIRONMENTAL

TESTING LOCATION (Please Circle)

Burnaby
8664 Commerce Court
Burnaby, British Columbia, Canada
V5A 4N7
Phone 604.420.8773

Calgary
#4, 6125 12 Street SE
Calgary, Alberta, Canada
T2H 2K1
Phone 403.253.7121

JAB.

Chain of Custody

Date_____Page__of__

Report to:		Invoice To:	
Company	Azimuth Consulting Group	Company	Same as report
Address	218-2902 West Broadway	Address	
City/Prov/PC	Vancouver, BC	City/Prov/PC	
Contact	Eric Franz	Contact	
Phone	778-872-5091	Phone	
Email	efranz@azimuthgroup.ca	Email	
		PO No.	1171422

Sample Collection By: **Sample Type:** Grab ○ OR Composite ○

	SAMPLE ID	DATE (DD/MM/YY)	TIME	MATRIX	# OF CONTAINERS AND VOLUME (e.g. 1 x 20 L)	COMMENTS	ANALYSES REQUIRED: 7-day Fathead Minnow LC50	96-h FHM P/F	96-h FHM P/Fw/CO2	Receipt Temperature (°C)
1	ST-20-ii	2023-05-08	17:30		1x18L		✓	✓	✓	20.9
2										
3										
4										
5							7	1	37	
6							7	1	38	
7							8	1	1	
8							8	1	1	
9							3	1	1	
10							2	2	3	

SPECIAL INSTRUCTIONS/COMMENTS (CLIENT)

Reclaim water from Goose Pit

SAMPLE RECEIPT DETAILS (LABORATORY)

1. Total No. of Containers	1	4. Ice Present in Cooler?	Y / N
2. Courier	Purolator	5. Seal Present?	Y / N
3. Good Condition?	Y / N	6. Initials Present on Seal?	Y / N

SAMPLE DESCRIPTION AND COMMENTS (LABORATORY)

RELINQUISHED BY (CLIENT)

(Printed Name) Kathleen Newberry (Signature)

(Company) Agnico Eagle 2023-05-09 - 7:00AM (Date DD/MM/YY and Time)

RECEIVED BY (LABORATORY)

(Printed Name) Tyrone (Signature) TH

(Company) Nautilus (Date DD/MM/YY and Time) May 17/23 @ 9:00

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

END OF REPORT

Appendix B-4
Rainbow Trout Toxicity Test Results (September 2024)

NAUTILUS ENVIRONMENTAL
B-11 Nicholas Beaver Road
Puslinch, ON N0B 2J0
Tel. (519) 763-4412
Fax. (519) 763-4419

TOXICITY TEST REPORT

Rainbow Trout
EPS 1/RM/13

Work Order : 255586
Sample Number : 83581

SAMPLE IDENTIFICATION

Company :	Azimuth Consulting Group Inc.	Sampling Date :	2024-08-11
Location :	Vancouver BC	Sampling Time :	Not provided
Substance :	ST-20I	Date Received :	2024-08-14
Sampling Method :	Not provided	Time Received :	13:30
Sampled By :	Not provided	Temperature at Receipt :	26 °C
Sample Description :	Clear, colourless	Date Tested :	2024-09-09

Test Method(s) : Reference Method for Determining Acute Lethality of Liquid Effluents to Rainbow Trout. Environment Canada, EPS 1/RM/13 (2nd Edition, December 2000, with May 2007, February 2016, and December 2023 amendments).

96-HOUR TEST RESULTS

Substance	Effect	Value
Control	Mean Impairment	0.0 %
	Mean Mortality	0.0 %
100%	Mean Impairment	0.0 %
	Mean Mortality	0.0 %

The results reported relate only to the sample tested and as received.

TEST ORGANISM

Test Organism :	*Oncorhynchus mykiss*	Mean Fork Length :	42.7 mm
Organism Batch :	T24-17	Range of Fork Lengths :	39 - 50 mm
Control Sample Size :	10	Mean Wet Weight :	0.7 g
Cumulative stock mortality rate :	0% (previous 7 days)	Organism Loading Rate :	0.3 g/L
Control organisms showing stress :	0 (at test completion)		

TEST CONDITIONS

Test Type :	Single concentration	Number of Replicates :	1
Sample pH Adjustment :	None	Organisms Per Replicate :	10
Sample Pre-aeration/Aeration Rate :	6.5 ± 1 mL/min/L	Organisms Per Test Level :	10
Duration of Sample Pre-Aeration :	30 minutes	Volume of Sample :	20 L
Control Pre-aeration/Aeration Rate :	6.5 ± 1 mL/min/L	Volume of Control :	20 L
Duration of Control Pre-aeration:	30 minutes	Test Method Deviation(s) :	Yes (see 'COMMENTS')

REFERENCE TOXICANT DATA

Toxicant :	Potassium Chloride		
Organism Batch :	T24-17	LC50 :	3045 mg/L
Date Tested :	2024-09-01	95% Confidence Limits :	2633 - 3394 mg/L
Analyst(s) :	JGR, JCS, AJS, PG	Historical Mean LC50 :	3937 mg/L
Statistical Method :	Linear Regression (MLE)	Warning Limits (± 2SD) :	2868 - 5405 mg/L

COMMENTS

Noted Deviation: The maximum sample holding time of 5 days allowed by the test method was exceeded. The sample was tested with the client's consent. There were no other unusual conditions, and the test result is considered to be valid.

•All test validity criteria as specified in the test method were satisfied.

Approved By : _____

Project Manager

NAUTILUS ENVIRONMENTAL

TOXICITY TEST REPORT

Rainbow Trout
EPS 1/RM/13

Work Order : 255586
Sample Number : 83581

TEST DATA

	pH	Dissolved O_2 (mg/L)	Conductivity (µmhos/cm)	Temperature (°C)	O_2 Saturation (%)[3]
Initial Water Chemistry (100%) :	7.1	8.2	2409	14	85
After 30 min pre-aeration :	7.2	8.4	2406	14	87

0 HOURS

Date & Time 2024-09-09 14:10
Analyst(s) : AJS

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature	O_2 Saturation[3]
100%	0	0	7.2	8.4	2406	14	87
Control	0	0	8.0	9.7	741	14	100

Notes:

24 HOURS

Date & Time 2024-09-10 13:20
Analyst(s) : AJS

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature
100%	0	0	8.0	–	–	15
Control	0	0	8.2	–	–	15

Notes:

48 HOURS

Date & Time 2024-09-11 12:20
Analyst(s) : FM (NM)

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature
100%	0	0	7.8	–	–	15
Control	0	0	8.1	–	–	15

Notes:

72 HOURS

Date & Time 2024-09-12 15:30
Analyst(s) : GR (NM)

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature
100%	0	0	7.9	–	–	15
Control	0	0	8.1	–	–	15

Notes:

96 HOURS

Date & Time 2024-09-13 13:15
Analyst(s) : JGR

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature
100%	0	0	7.8	9.3	2415	15
Control	0	0	8.0	9.6	710	15

Notes:

"–" = not measured/not required

Number impaired does not include number dead.

[3] adjusted for temperature and barometric pressure

Test Data Reviewed By : JJ

Date : 2024-09-16

NAUTILUS ENVIRONMENTAL
B-11 Nicholas Beaver Road
Puslinch, ON N0B 2J0
Tel. (519) 763-4412
Fax. (519) 763-4419

TOXICITY TEST REPORT
Rainbow Trout
EPS 1/RM/13
EPS 1/RM/50

Work Order : 255586
Sample Number : 83581

SAMPLE IDENTIFICATION

Company :	Azimuth Consulting Group Inc.	Sampling Date :	2024-08-11
Location :	Vancouver BC	Sampling Time :	Not provided
Substance :	ST-20I	Date Received :	2024-08-14
Sampling Method :	Not provided	Time Received :	13:30
Sampled By :	Not provided	Temperature at Receipt :	26 °C
Sample Description :	Clear, colourless	Date Tested :	2024-09-09

Test Method(s) : Reference Method for Determining Acute Lethality of Liquid Effluents to Rainbow Trout. Environment Canada, EPS 1/RM/13 (2nd Edition, December 2000, with May 2007, February 2016, and December 2023 amendments).

Procedure for pH Stabilization During the Testing of Acute Lethality of Wastewater Effluent to Rainbow Trout. Environment Canada, EPS 1/RM/50 (March 2008), with deviation(s) as noted.

96-HOUR TEST RESULTS

Substance	Effect	Value
Control	Mean Impairment	0.0 %
	Mean Mortality	0.0 %
100%	Mean Impairment	0.0 %
	Mean Mortality	0.0 %

The results reported relate only to the sample tested and as received.

TEST ORGANISM

Test Organism :	*Oncorhynchus mykiss*	Mean Fork Length :	42.3 mm
Organism Batch :	T24-17	Range of Fork Lengths :	41 - 43 mm
Control Sample Size :	10	Mean Wet Weight :	0.7 g
Cumulative stock tank mortality rate :	0% (previous 7 days)	Organism Loading Rate :	0.3 g/L
Control organisms showing stress :	0 (at test completion)		

TEST CONDITIONS

Sample Treatment :	pH Stabilization	Number of Replicates :	1
pH Adjustment :	Yes (as per EPS 1/RM/50)	Organisms Per Replicate :	10
pH Stabilization Technique :	pH Controller	Organisms Per Test Level :	10
Gas Mixture Used :	100% CO_2	Pre-aeration/Aeration Rate :	6.5 ± 1 mL/min/L
Test Aeration :	Yes	Total Pre-Aeration Time :	30 minutes
Volume Tested (L) :	20	Test Method Deviation(s) :	Yes (see 'COMMENTS')

REFERENCE TOXICANT DATA

Toxicant :	Potassium Chloride		
Organism Batch :	T24-17	LC50 :	3045 mg/L
Date Tested :	2024-09-01	95% Confidence Limits :	2633 - 3394 mg/L
Analyst(s) :	JGR, JCS, AJS, PG	Historical Mean LC50 :	3937 mg/L
Statistical Method :	Linear Regression (MLE)	Warning Limits (± 2SD) :	2868 - 5405 mg/L

COMMENTS

• All test validity criteria as specified in the test method were satisfied.

Noted Deviations:

• pH controllers are calibrated at the start of the test, and not daily as described in the test method. Extensive internal method validation of this approach has confirmed the accuracy and stability of the pH controllers over the course of the 96-h test.

• The maximum sample holding time of 5 days allowed by the test method was exceeded. The sample was tested with the client's consent. There were no other unusual conditions, and the test result is considered to be valid.

Approved By : _____

Project Manager

NAUTILUS ENVIRONMENTAL

TOXICITY TEST REPORT

Rainbow Trout
EPS 1/RM/13
EPS 1/RM/50

Work Order : 255586
Sample Number : 83581

TEST DATA

	pH	Dissolved O_2 (mg/L)	Conductivity (µmhos/cm)	Temperature (°C)	O_2 Saturation (%)[3]	TAN (mg/L)[1]	NH3 (mg/L)[2]
Initial Water Chemistry (100%) :	7.1	8.2	2409	14	85	35.9	0.124
After 30 min pre-aeration :	7.2	8.4	2400	14	87	–	–

0 HOURS

Date & Time 2024-09-09 14:10
Analyst(s) : AJS

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature	O_2 Saturation[3]	Hardness (mg/L as $CaCO_3$)	Total Chlorine (mg/L)
100%	0	0	7.2	8.4	2400	14	87	640	–
Control	0	0	8.0	9.7	741	14	100	–	–

Notes:

24 HOURS

Date & Time 2024-09-10 13:20
Analyst(s) : AJS

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature	TAN (mg/L)[1]	NH3 (mg/L)[2]
100%	0	0	7.2	–	–	15	–	–
Control	0	0	8.1	–	–	15	–	–

Notes:

48 HOURS

Date & Time 2024-09-11 12:20
Analyst(s) : FM (NM)

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature	TAN (mg/L)[1]	NH3 (mg/L)[2]
100%	0	0	7.3	–	–	15	–	–
Control	0	0	8.1	–	–	15	–	–

Notes:

72 HOURS

Date & Time 2024-09-12 15:30
Analyst(s) : GR (NM)

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature	TAN (mg/L)[1]	NH3 (mg/L)[2]
100%	0	0	7.1	–	–	15	–	–
Control	0	0	8.0	–	–	15	–	–

Notes:

96 HOURS

Date & Time 2024-09-13 13:15
Analyst(s) : JGR

Concentration	Dead	Impaired	pH	Dissolved O_2	Conductivity	Temperature	TAN (mg/L)[1]	NH3 (mg/L)[2]	Average pH (0 - 96 h)
100%	0	0	7.3	9.1	2418	15	–	–	7.2
Control	0	0	8.0	9.6	719	15	–	–	8.0

Notes:

[1] TAN = Total ammonia (as N); analysis conducted by Bureau Veritas S.A., Mississauga ON; MDL = 0.05 mg/L.

[2] NH3 = Un-ionized ammonia (calculated from TAN, pH, and temperature according to the test method).

[3] adjusted for temperature and barometric pressure

"–" = not measured/not required

Number impaired does not include number dead.

Test Data Reviewed By : JL

Date : 2024-09-21

CHAIN OF CUSTODY RECORD

NAUTILUS ENVIRONMENTAL

Nautilus Work Order No: 255586

Shipping Address: Nautilus Environmental Guelph.
B-11 Nicholas Beaver Road
Puslinch, Ontario Canada N0B 2J0

Voice: (519) 763-4412 **Fax:** (519) 763-4419

P.O. Number:	
Field Sampler Name (print):	
Signature:	
Affiliation:	
Sample Storage (prior to shipping):	
Custody Relinquished by:	
Date/Time Shipped:	

Client:	Azimuth Group
Phone:	(604) 730-1220
Fax:	
Contact:	Marianna DiMauro

Sample Identification					Analyses Requested										Sample Method and Volume		
Date Collected (yyyy-mm-dd)	Time Collected (e.g. 14:30, 24 hr clock)	Sample Name	Nautilus Sample Number	Temp. on arrival	Rainbow Trout Single Concentration	Rainbow Trout LC50	*Daphnia magna* Single Concentration	*Daphnia magna* LC50	Fathead Minnow Survival & Growth	*Ceriodaphnia dubia* Survival & Reproduction	*Lemna minor* Growth	*Pseudokirchneriella subcapitata* Growth	Other (please specify below)	Grab	Composite	# of Containers and Volume (eg. 2 x 1L, 3 x 10L, etc.)
2024-08-11		ST-20I	83581	26°C		✔										4X10L
2024-08-11		ST-20II	83582	26°C		✔										4X10L ☆

For Lab Use Only

Received By:	JGR/XD
Date:	2024-08-14
Time:	13:30
Storage Location:	
Storage Temp.(°C)	

Please list any special requests or instructions:

pH Stabilization

Azimuth) will confirm the method before the tests are initiated the week of August 19

☆ 3 x10L arrived 2024-08-14

APPENDIX C
ATKINSRÉALIS. 1D TAILINGS CONSOLIDATION MODELLING OF GOOSE PIT. TECHNICAL NOTE. APRIL 30, 2024

Title of document: **1D Tailings Consolidation Modelling of Goose Pit**

Client: **Agnico Eagle Mines (AEM)**

Project: **Pit Lake Stratification and Tailing Consolidation Study**

Prepared by: (under ICS[1])	Mansoureh Mouchan, Eng., M.A.Sc.	
Prepared by:	Faustin Saleh Mbemba, P.Eng., M.A.Sc., Ph.D. #OIQ: 5087472	
Reviewed by:	Miguel Medina, P.Eng., M. Eng. #OIQ: 5018504	
Approved by:	Anh-Long Nguyen, Eng., M. Sc. #OIQ: 122858	

[1] ICS: Immediate control and supervision.
In terms of supervising the engineering activities and supervision of people who are not engineers or junior engineers, the Ordre des ingénieurs du Québec uses a term often used in its regulation: Immediate control and supervision (ICS). In other words, an engineer must be involved in a continuous and active manner throughout the reserved tasks entrusted to him, and not just before or after.

LIST OF REVISIONS

Revision					Pages Revised	Observations
#	Prep.	Rev.	App.	Date		
PA	MM	FSM		2023-11-16	All	Issued for Internal Review
PB	MM	MM/ FSM	ALN	2023-12-08	All	Issued for Client's Comments
00	MM/FSM	MM	ALN	2024-04-30	All	Issued for Client's Comments

NOTICE TO READER

This document contains the expression of the professional opinion of AtkinsRéalis ("AtkinsRéalis") as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the agreement dated 19 May 2023 (the "Agreement") between AtkinsRéalis and Agnico Eagle Mines (the "Client") and the methodology, procedures and techniques used, AtkinsRéalis' assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

AtkinsRéalis has, in preparing estimates, as the case may be followed, accepted methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that current values will be consistent with the estimate/s. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which AtkinsRéalis' opinion as set out herein are based have not been verified by AtkinsRéalis; AtkinsRéalis makes no representation as to its accuracy and disclaims all liability with respect thereto.

To the extent permitted by law, AtkinsRéalis disclaims any liability to the Client and to third parties in respect of the publication, reference, quoting, or distribution of this report or any of its contents to and reliance thereon by any third party.

TABLE OF CONTENTS

List of Tables

List of Figures

1.0 Introduction

Agnico Eagle Mines (AEM) is currently conducting multiple studies regarding the water management in closure for Goose Pit at its Meadowbank operations in Nunavut, Canada.

The Meadowbank Mine site is located approximately 100 km north of the town of Baker Lake in Nunavut. Goose Pit is located at the southern extremity of the Meadowbank Mine site. Goose Pit has a maximum depth of about 67.0 m at the centre of the pit, a total volume of about 25 million m^3, an area of over 1 km^2 (100 ha) and it is characterized by steep slopes. The pit was exploited since 2015 and it was naturally flooded with water. The tailings deposition began in 2019 and extended through 2020 when the deposition was terminated. No additional tailings have been deposited since 2020.

In 2018, an initial estimate of the tailing's consolidation was carried out based on the tailings geotechnical properties assessed from laboratory tests (SLI, 2018b).

The objective of the present study is to update the tailings consolidation model based on bathymetric surveys taken in Goose Pit since the previous study. A one-dimensional (1D) modelling was carried out to assess the tailings consolidation after one (1) year of deposition (from 2019 to 2020) followed by a 9-year period (until 2029), in order to estimate future settlements, representing a total period of 10 years of modelling. The assessment will also be used to estimate the amount of pore fluid that could be released from the tailings to predict their impact in the water quality during deposition, closure, and post-closure.

This report presents the results of the 1D consolidation, which evaluates the tailings settlement and the estimated consolidation flow rate during and after tailings deposition in Goose Pit. The results were calibrated with existing bathymetric surveys which were then used to predict future settlements.

2.0 Methodology

The first step in the methodology is to estimate the settlement using the numerical model and geotechnical parameters which were retrieved from laboratory test results on the Whale Tail tailings (Golder 2017).

In 2018, FSConsol software was used to estimate future settlements (SLI, 2018b). For this update, the same software was initially used for comparison purposes.

Once the settlement is computed at each time step, the volume of expelled water is computed as the product of the settlement and the plan area, according to the following equation:

Volume of expelled water, V (m^3) = settlement (m) x plan area (m^2)

And the flow rate of water expelled to the surface is computed at each time step as follows:

Flow of expelled water, Q (m^3/s) = volume of water (m^3)/Δt (s)

With Δt = the time step (s).

The plan area was determined by using the storage capacity curve from Muk3D which was based on the Goose Pit bathymetric surveys for years 2020 and 2021 and the original ground profile from 2019 which represent the pit shell at the end of mining operation. **Figure** 2-1 presents the plan view from 2019. Due to negligible difference between settlements that happened for one year, an average value for the plan area was considered for calculating the flow rate in this study.

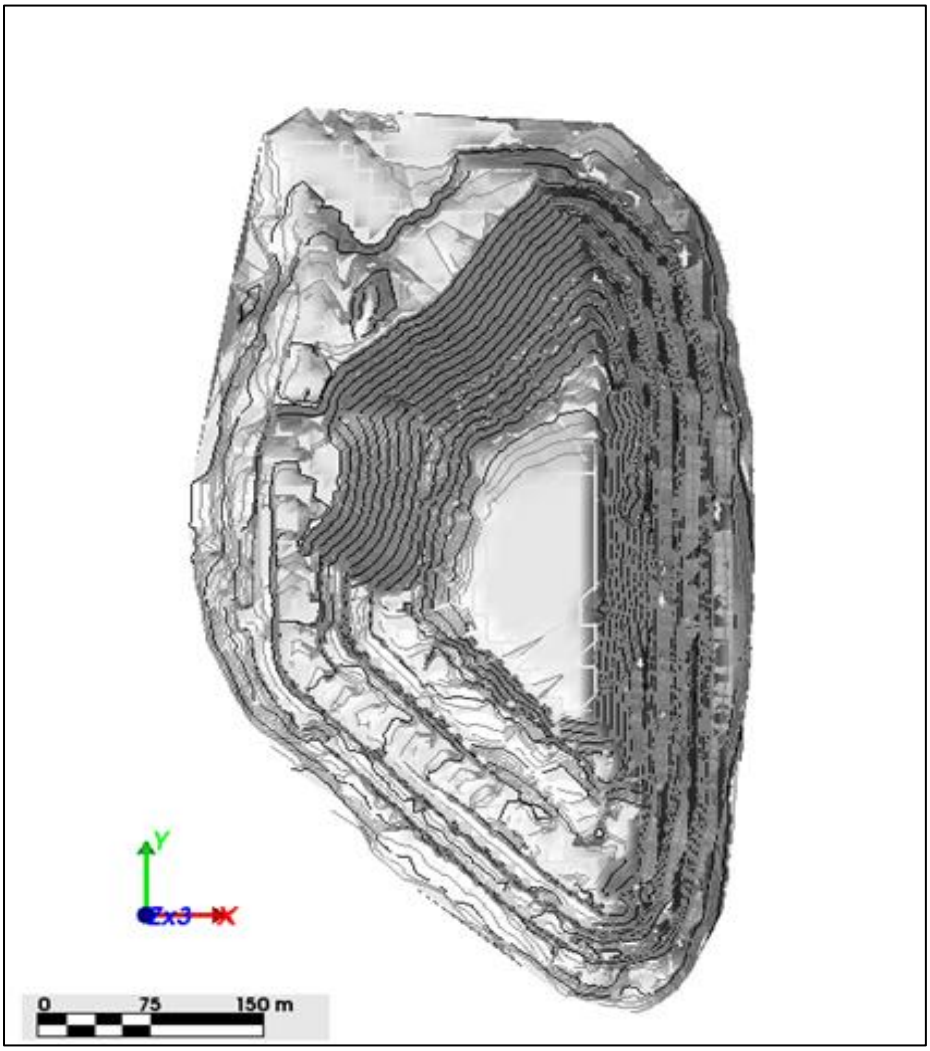


Figure 2-1: Plan View of Goose Pit (Year 2019- Muk3D)

3.0 Parameters

3.1 Geotechnical Parameters

The tailings geotechnical properties from the 2018 modelling of Goose Pit and the Portage Pit A and Pit E (SLI, 2018b) were used for this study. These geotechnical parameters were obtained from Golder's laboratory test results on Whale Tail Pit tailings (Golder 2017). **Table** 3-1 presents the summary of the geotechnical parameters while **Figure** 3-1 and **Figure** 3-2 present the compressibility and permeability data from Golder (2017). The geotechnical parameters from **Table** 3-1, **Figure** 3-1 and **Figure** 3-2 constitute the base case or the base scenario for modelling.

Table 3-1: Geotechnical Parameters from Golder (2017)

Parameters	Value
Tailings solid specific gravity	2.96
Tailings solid concentration from the mill	54% w/w
Initial dry unit weight (calculated by laboratory)	0.84 tons/m^3
Initial void ratio (calculated by laboratory)	2.56
Initial total unit weight (calculated by laboratory)	1.56 tons/m^3

3.1.1 Tailings Density

In January 2024 (during the revision of the PB version of this technical note), Agnico Eagle mentioned that the tailings density measured on site was variable, ranging from 1.45 t/m^3 in 2019, 1.8 t/m^3 in 2020 and 1.5 t/m^3 in 2021. However, as the consolidation numerical model cannot consider variable values of density, the value obtained from Golder laboratory tests (1.56 t/m^3, see **Table** 3-1) was selected as it represents the average of these values (from 2019 to 2021).

3.1.1 Void Ratio

The void ratio of 0.86, which is the initial void ratio on compressibility curve (**Figure** 3-1), is a measurement obtained on a sample in laboratory by Golder (2017). These measurements were probably made on a sample which is not representative of the field conditions, as **Table** 3-1 of Golder (2017) also indicates an initial void ratio of 2.56.

However, the fact of having carried out the compressibility test with an initial void ratio of 0.86 instead of 2.56 will induce an error in the results. FSConsol model calculates the settlements as a function of the material compressibility and initial void ratio. The only geotechnical data available to date are those from Golder (2017). There has not been additional geotechnical testing, as is usually the case before any geotechnical study, to obtain geotechnical parameters that are suitable for the current conditions of the materials at the site. The results obtained in this study with FSConsol will be discussed regarding this aspect.

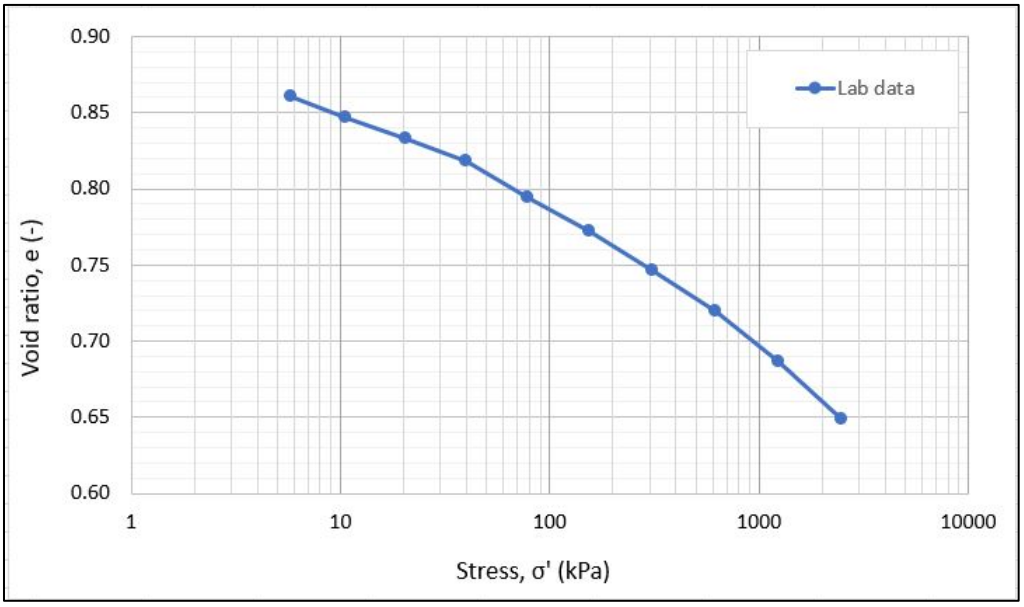


Figure 3-1: Void Ratio vs. Effective Stress or Compressibility Curve (from Golder, 2017)

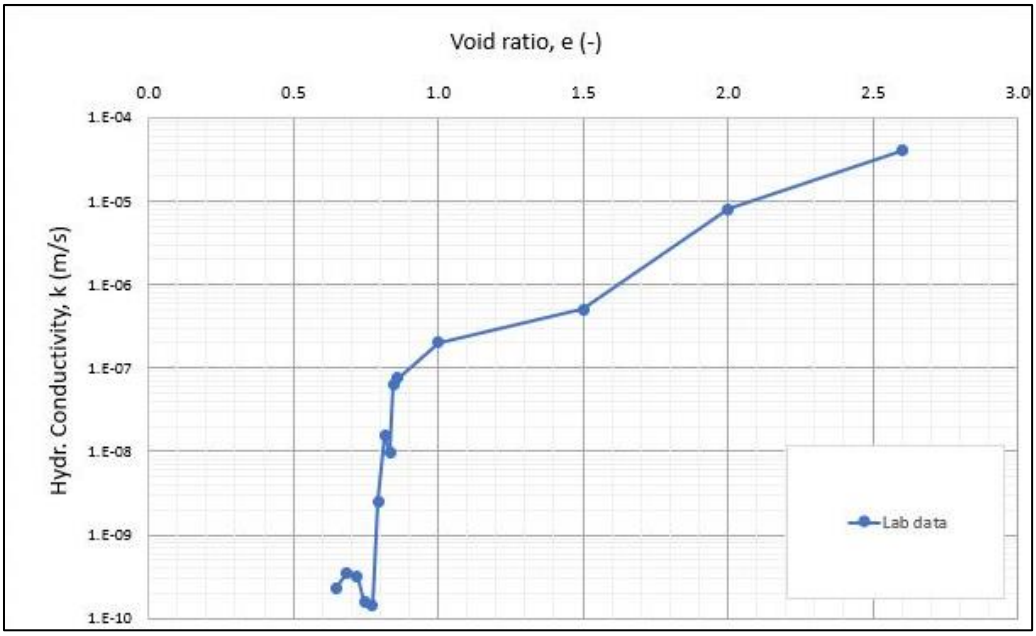


Figure 3-2: Hydraulic Conductivity vs. Void Ratio Curve (from Golder, 2017)

Due to the lack of recent data, several scenarios were considered using different compressibility curves. The base case (curve), called "Lab data" in **Figure** 3-3, is the one from Golder (2017), which is also shown in **Figure** 3-1. Then, different curves, following different paths (but having all the same initial and final void ratios) were considered. These are the curves labelled "Scenario 1", "Scenario 2", "Scenario 3" and "Scenario 4" in **Figure** 3-3.

This served as a sensitivity study to understand the behaviour (settlement) of tailings. As said above, the initial and final void ratios of these curves remained the same as those provided by Golder (2017).

The same approach was also used for the hydraulic conductivity curves shown in **Figure** 3-4 where the base case (base curve) from Golder (2017) is called "Lab Data" (also shown in **Figure** 3-2) and the three other curves used for sensitivity are called "Scenario a", "Scenario b" and "Scenario c".

The aim of this parametric (sensitivity) study was to derive the optimal compressibility and permeability curves for calibrating the data through different scenarios along with initial properties, which were measured in the laboratory (represented by the blue line). Scenario 1, selected for compressibility curves, and Scenario a, selected for hydraulic conductivity curves, were applied in modelling given that they yield the maximum values, as it will be highlighted later.

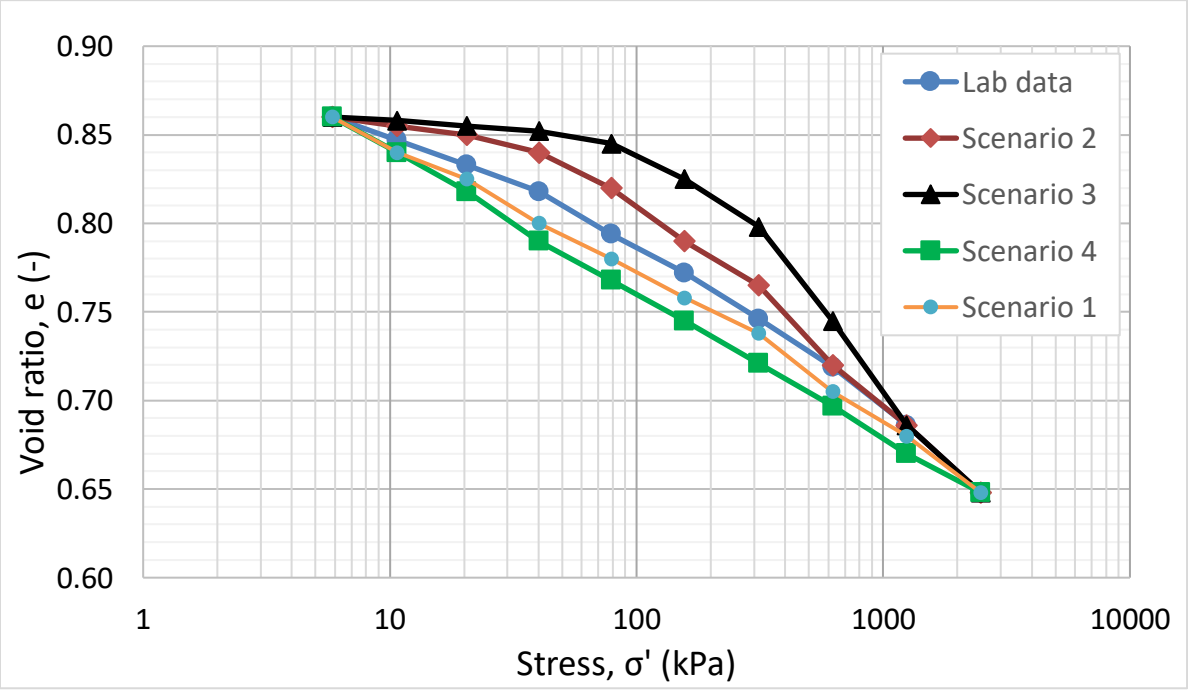


Figure 3-3: Different Scenarios for Compressibility Data

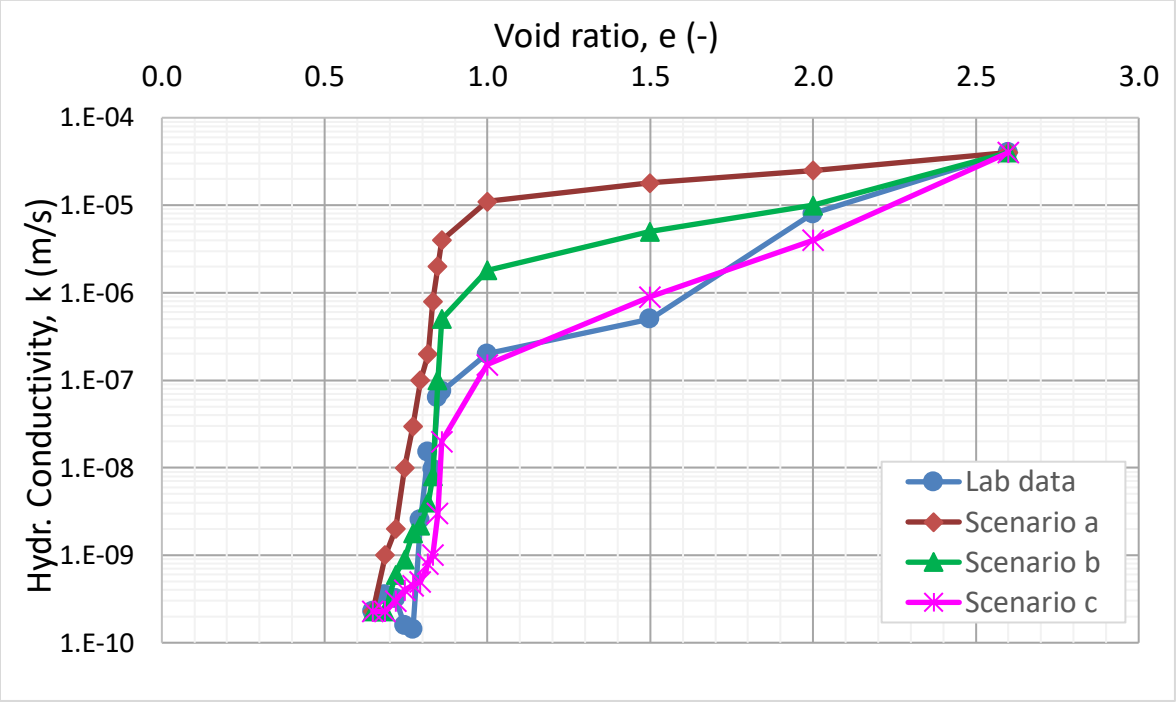


Figure 3-4: Different Scenarios for Permeability Data

In **Figure** 3-5, the initial state of the open pit is shown. The initial condition is an empty pit (no water, no tailings), with t = 0 at the time of the first bathymetry, which corresponds to the 2019 survey.

The initial deposition started in 2019, marked by the black line at t = 0, and modelling began from an initial depth of 0 m. The tailing process extended until 2020 (blue line), followed by a settlement until 2021 (pink line). Settlement measurements were modelled during the period between 2020 and 2021.

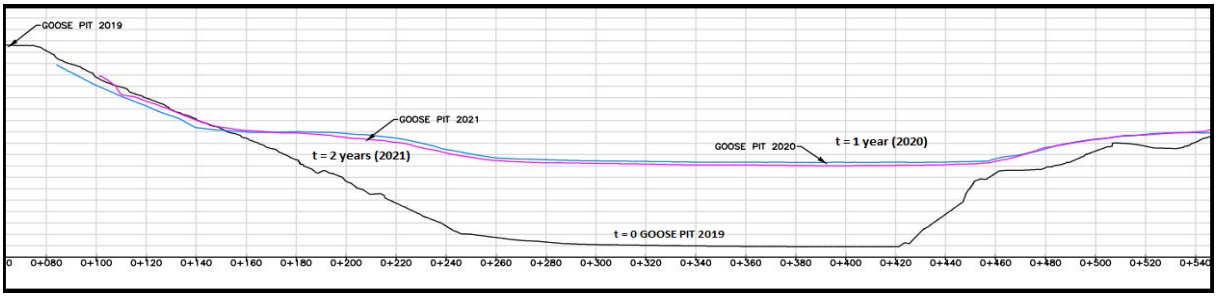


Figure 3-5: Initial Conditions for Depth and Time

3.2 Bathymetry

The bathymetry of Goose Pit was constructed from a digital elevation map (DEM) that was used as the basis for the two-dimensional discretization. The model's way of calculating the storage volume is almost identical (less than 1% difference) to the method using a 0.1 m step size for each point in the DEM. Therefore, the model is a good representation of the lake volume. **Figure** 3-6 presents a view of Goose Pit geometry from year 2022.

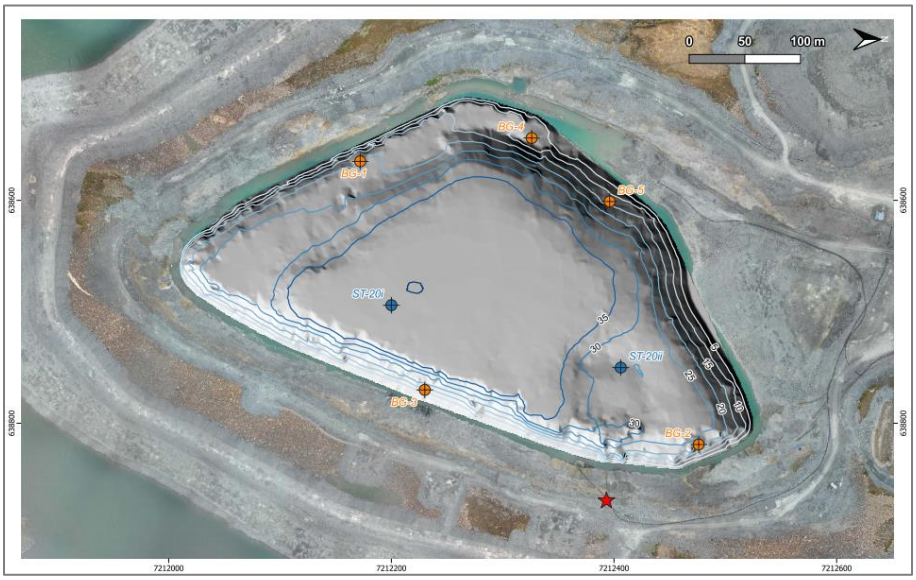


Figure 3-6: Goose Pit Geometry (Azimuth, 2022)

Figure 3-7 shows the plan view of the Goose Pit topography (from bathymetry), with various sections used in the analysis to highlight the evolution of filling and settlement of the tailings in the pit.

Bathymetries are used to calibrate the model, offering a basis for comparison with settlement data, which constitutes the model's output. It is essential to clarify that the bathymetric data does not qualify as geotechnical data for modelling. A single bathymetric dataset, such as the one from 2021, is adequate for this comparison. Additional bathymetries will not provide more information if the bathymetry is consistent. Hence the need for a good methodology for measuring it. It should, however, be noted that settlements on a site are measured by specific field devices such as settlement plates. Bathymetries are extremely coarse data and cannot give the precision required in geotechnics which can be, in some cases, of the order of mm or cm.

Figure 3-8 shows the profile of six sections from bathymetric data (from A to F). As it can be seen, the bathymetric surveys are not consistent. There are many uncertainties in the received bathymetric data. The same bathymetry can indicate a settlement of 0.5 m, 1 m, 1.5 m, 2 m or even more depending on location. In some instances, it may even indicate swelling or negative settlement when the tailings level in 2021 (after stopping filling) is above that of 2020. A few cross-sections located at the centre of the pit, which appeared to be more consistent, were chosen for the study.

According to **Figure** 3-8 (section B), which seems more coherent, the initial depth of 0 is at an approximative elevation of 5,035.0 m, as measured at the centre of the pit. The tailings deposition extended until 2020 (the blue line, at an approximative elevation of 5,072.5 m), followed by a settlement until 2021 (the red line, at an approximative elevation of 5,070.5 to 5,071.0 m). Therefore, the initial thickness of the deposited tailings layer is evaluated at H_0 = 37.5 m, and the settlement between the 2020 and 2021 surveys is around 1.5 to 2 m, as measured at the centre of the pit (elsewhere than in the centre, we can have values of less than 1 m or more than 2 m). Even in the centre of the pit, the settlement reading margin (from 1.5 m to 2.0 m) is too large and affects the precision. However, this value will be used later to validate or calibrate the numerical model, if necessary. Profile E in **Figure** 3-8 seems to give approximately the same information as profile B. The other profiles cannot be used. In the same way, all 2022 bathymetric profiles can be used. This raises serious questions regarding the methodology used to measure bathymetry, as will be highlighted below.

Figure 3-9 and **Figure** 3-10 show the storage capacity curve and plan area obtained from the bathymetric surveys using Muk3D, from the bottom of the pit. The area at the tailings surface and the stored volume can be read from these figures at any elevation (for any year).

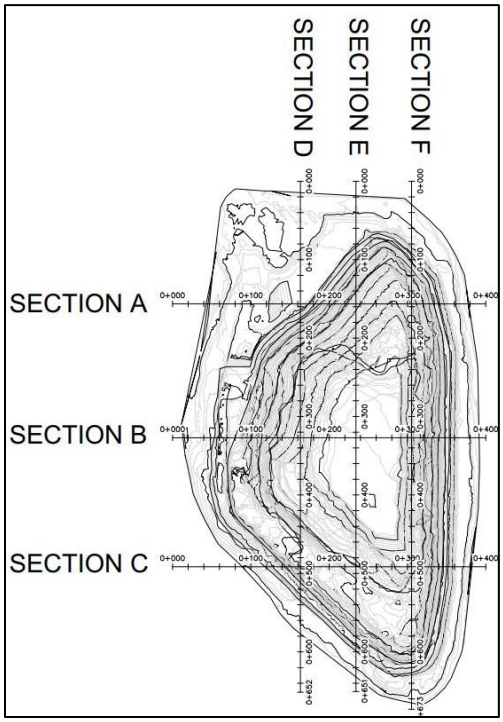
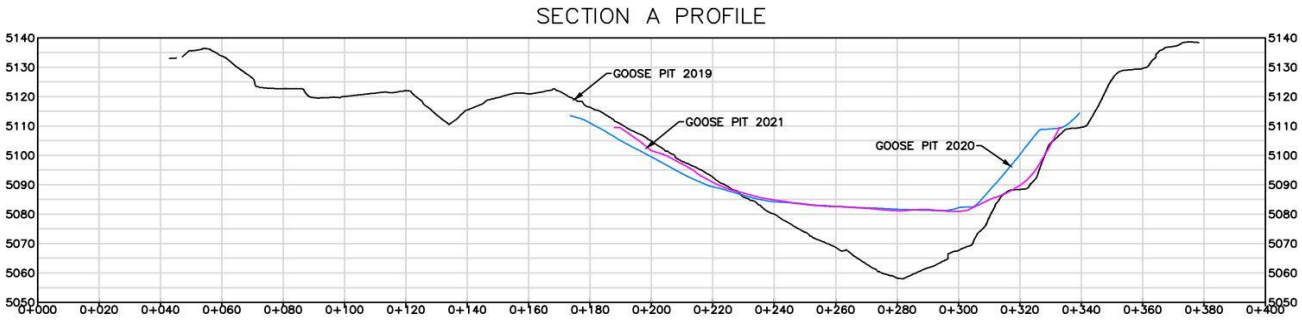
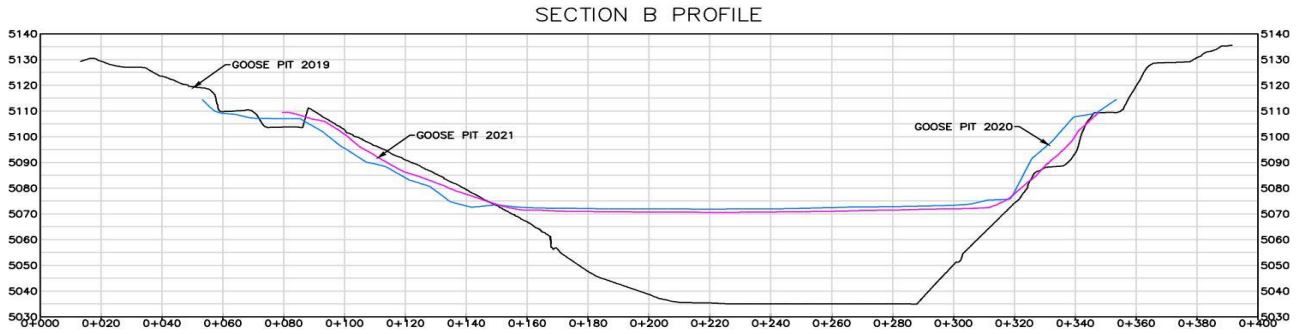


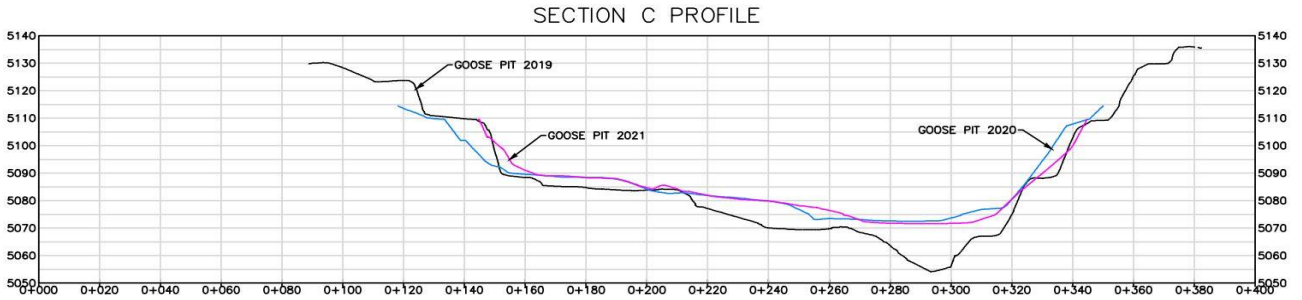
Figure 3-7: Plan View of Goose Pit Topography


SECTION A PROFILE
GOOSE PIT 2019
GOOSE PIT 2021
GOOSE PIT 2020

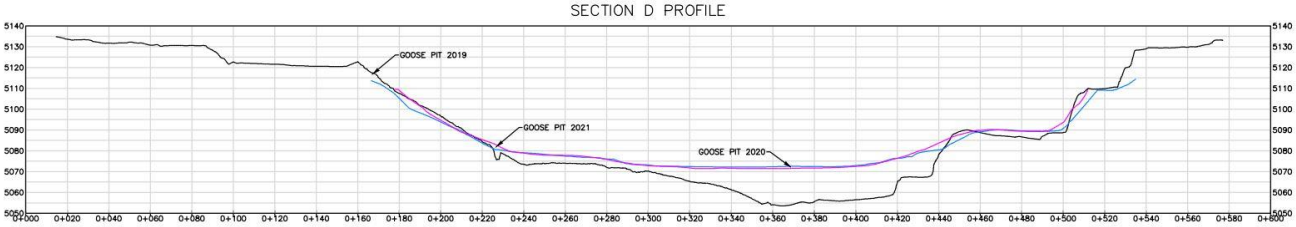
(A)


SECTION B PROFILE
GOOSE PIT 2019
GOOSE PIT 2021
GOOSE PIT 2020

(B)


SECTION C PROFILE
GOOSE PIT 2019
GOOSE PIT 2021
GOOSE PIT 2020

(C)


SECTION D PROFILE
GOOSE PIT 2019
GOOSE PIT 2021
GOOSE PIT 2020

(D)

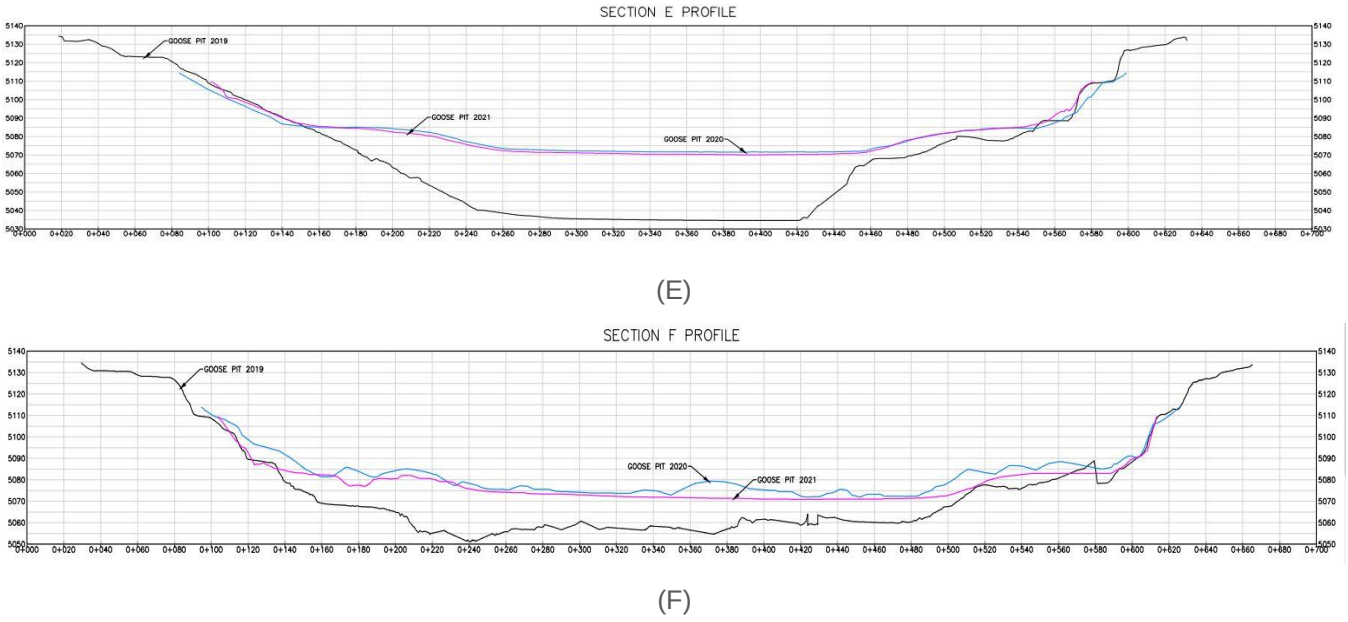


Figure 3-8: Profiles of Sections A to F in Goose Pit

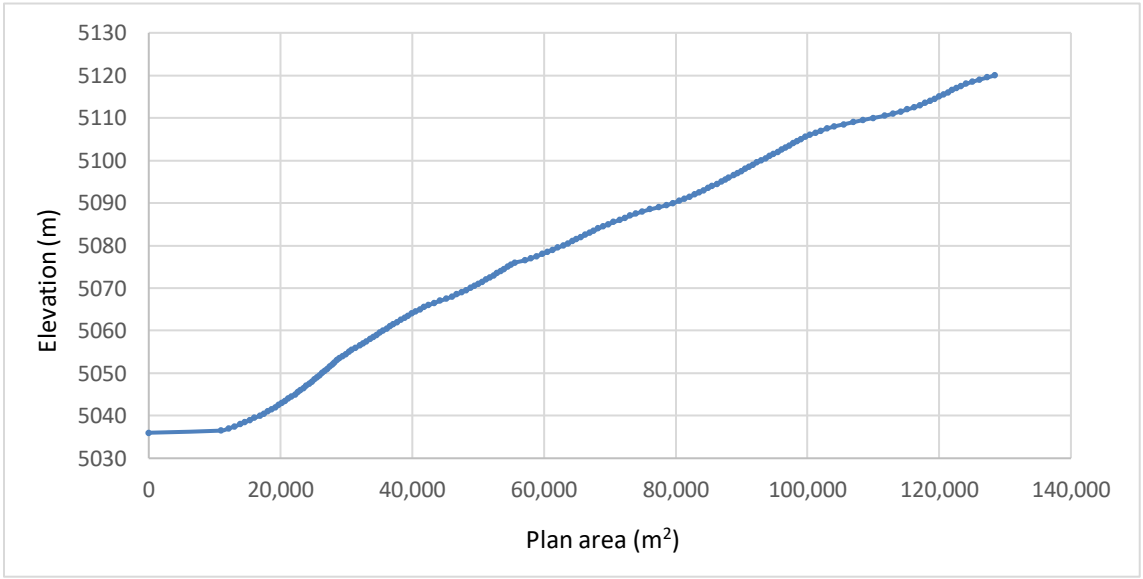


Figure 3-9: Goose Pit Plan Area vs. Elevation

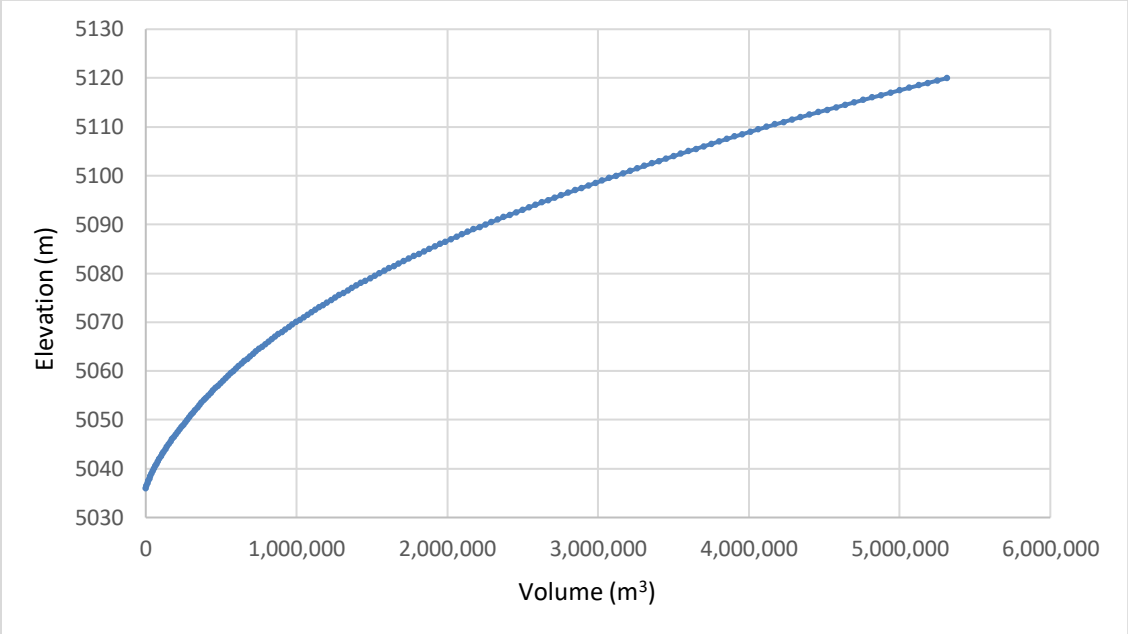


Figure 3-10: Storage Capacity Curve of Goose Pit

4.0 Modelling the Goose Pit Consolidation with FSConsol

The computer program FSConsol (GWP Software Inc) version 3.49 was used to carry out the 1D modelling of the in-pit tailings consolidation. The program is based on the finite strain consolidation theory (Gibson et all, 1967). It accounts for self-weight consolidation and the consolidation of the deposit during the filling operation. FSConsol can simulate various consolidation scenarios with changing filling rates, pond areas and soil properties in tailings, and it is a numerical model designed for handling significant deformations. This software was previously used to simulate tailings consolidation at Goose Pit (SLI, 2018b). The choice of this software first is justified by its previous use for consolidation modelling at Goose Pit in 2018 and for comparison purposes.

4.1 Assumptions

The following assumptions were made in the modelling of the tailings' consolidation in Goose Pit. These assumptions have already been used for modelling consolidation at Goose Pit in 2018.

- The bedrock underneath each pit is competent and there is no significant drainage through the pit bottom as well as through the pit walls (SLI, 2017).
- The daily mill throughput is 9,000 tons of dry tailings. It is assumed that the dry tailings waste produced is also 9,000 tons per day (SLI, 2018a), also corresponding to the average deposition done over 2019-2020.
- Tailings are being deposited as a 54%w/w slurry (SLI, 2018a).
- For simplification, the model assumes a flat tailings surface and can reach the maximum height.
- The 1D analysis represents a soil column taken from the middle of the pit.
- Tailings are continuously deposited in Goose Pit and deposition will stop when the maximum tailings elevation allowed is reached (maximum elevation is calculated based on bathymetric data which was 37.5 metres).
- The tailing is deposited sub-aqueously into the pit and the formation of ice lenses during deposition is negligible. The consolidation model does not consider the potential effect of seasonal variation of the ambient and water temperature on the tailing deposition. It was assumed that with the sub-aqueous tailings' deposition method, tailings in the pit are not frozen during the winter months.

4.2 Modelling Results

The results of settlements at Goose Pit for a period of 10 years after the end of tailings deposition in 2020 are presented in **Figure** 4-1. As discussed in **Section 3.1**, Scenario 1, chosen for compressibility, and Scenario a, selected for permeabilities, were applied in modelling since they are yielding the maximum values.

As it can be seen in **Figure** 4-1, the model results indicate a settlement of 0.46 m only after 1 year and a total settlement of 0.66 m after 10 years. Compared to the settlement of 1.5 m to 2 m observed from the +/- consistent bathymetric profile (profile B in **Figure** 3-8), this settlement is very small. The relative settlement S_t/H_0 = 0.66 m / 37.5 m = 1.8%.

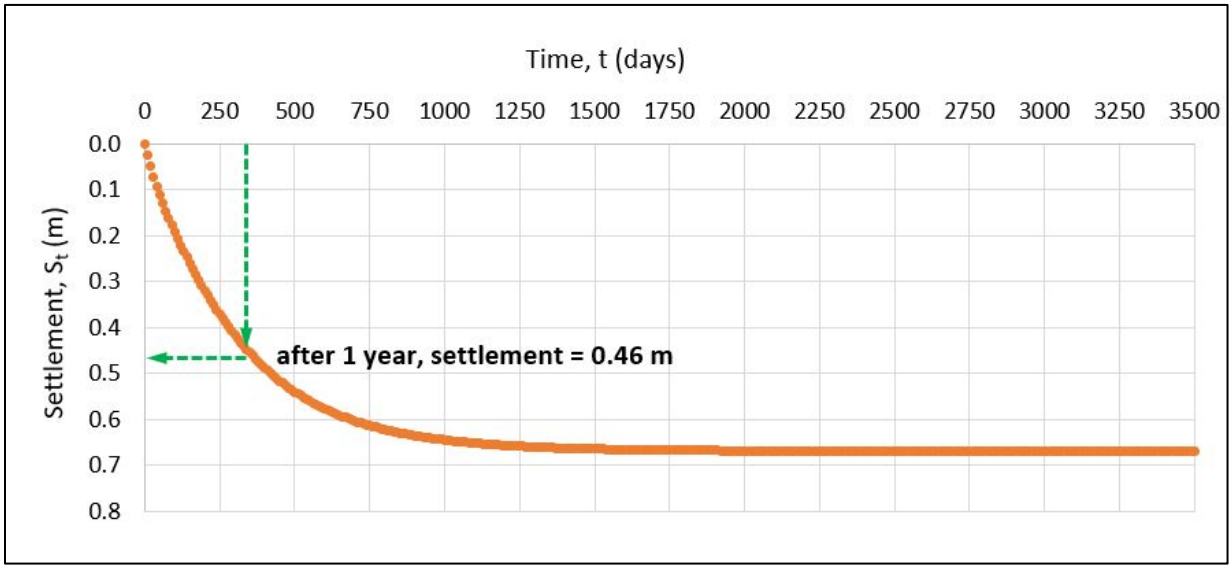


Figure 4-1: Settlement Obtained From FSConsol

The settlement obtained from FSConsol after 1 year (0.46 m) is much smaller than that observed on site (1.5 to 2 m obtained from the bathymetric surveys). It should be noted that the initial void ratio of the compressibility curve (Golder 2017, **Figure** 3-1) is inferior to the *in situ* estimated initial void ratio (Golder 2017, **Table** 3-1). It is therefore considered that the tailings compressibility curve must be re-evaluated in the laboratory, starting from a larger void ratio value, representative of the site conditions, in order to reach comparable settlement values.

5.0 Modelling the Goose Pit Consolidation With Sigma/W

To adjust the FSConsol model, another numerical model was used. Sigma/W is a well-known small deformation numerical code used to compute settlement. To adapt to large deformations (i.e., to compute large settlements), Sigma/W makes the accumulation (summation) of the results of several small deformations.

Sigma/W (GeoSlope Ltd. 2016) is a finite element code which can be used for numerical simulations of tailings consolidation. This code can solve constitutive equations for coupled stress – strain – pore water pressure analysis. The modified cam-clay (MCC) model can be applied to simulate the behaviour of deformable tailings. The advantage of Sigma/W in this case is that it calculates settlements by using other parameters than the compressibility curve.

The main parameters required for modelling with Sigma/W are presented in **Table** 5-1. The Lambda parameter λ is computed from the compression index C_C, which is obtained from the compressibility curve. Instead of using the initial void ratio of 2.56 from Golder (2017), the initial void ratio e was calculated from the provided solid content at the mine (54%, see **Table** 3-1) following the procedure presented just below. The reason is simple: we do not know how this initial void ratio of 2.56 was measured, especially since it was measured in the laboratory and not *in situ*. The hydraulic conductivity corresponding to the initial void ratio was deduced from the hydraulic conductivity function presented in **Figure** 3-2.

Table 5-1: Goose Pit Tailings Parameters Used for Sigma/W Model

Parameters	Value	Source (Obtained from)
Lambda λ= ($Cc/2.303$)	1.1	Compressibility curve
Void ratio I	2.13	Solid content
Hydraulic conductivity k(m/s)	1.1 x 10^{-05}	Function of void ratio (**Figure** 3-2)

The consolidation parameter lambda (λ) represents the gradients of the normal consolidation line (λ), and it can be derived from the compression index (Cc) obtained through conventional 1D consolidation tests or on the compressibility curve:

$$\lambda = C\_c / 2.303$$

The void ratio for the Sigma/W was computed from the provided solid content P at the mine (P = 54% or 0.54, **Table** 3-1). The water content (w) can be estimated based on the solid content according to the following equation:

$$w = P\%(100-P\%)$$

This gives a corresponding water content of 0.82.

The void ratio can be calculated using the well-known following geotechnical relationship:

$$e \times Sr = w \times Gs$$

Where e is the void ratio, S_r the degree of saturation (S_r = 1 or 100% for saturated materials), and G_S the specific gravity (G_S = 2.6, **Table** 3-1). The resulting (calculated) void ratio is e = 2.13.

Figure 5-1 shows the results of settlements from Sigma/W at Goose Pit for a period of 5 years after the end of filling. These results indicate a settlement S_t of 2.1 m after 1 year and a total settlement of 3.0 m after 5 years. The relative settlement S_t/H_0 = 3.0 m / 37.5 m = 8%, which is more coherent for tailings categorized as "thickened tailings" with a solid content (P) falling within the range of 45% to 70%.

As mentioned above, Sigma/W results show a 2.1 metres settlement after 1 year, which is near the observed values on site (1.5 m to 2 m, from bathymetry in the centre of the pit). According to Sigma/W, the final settlement is expected to be no more than 3 metres; this settlement is reached approximately 2 years after the end of filling.

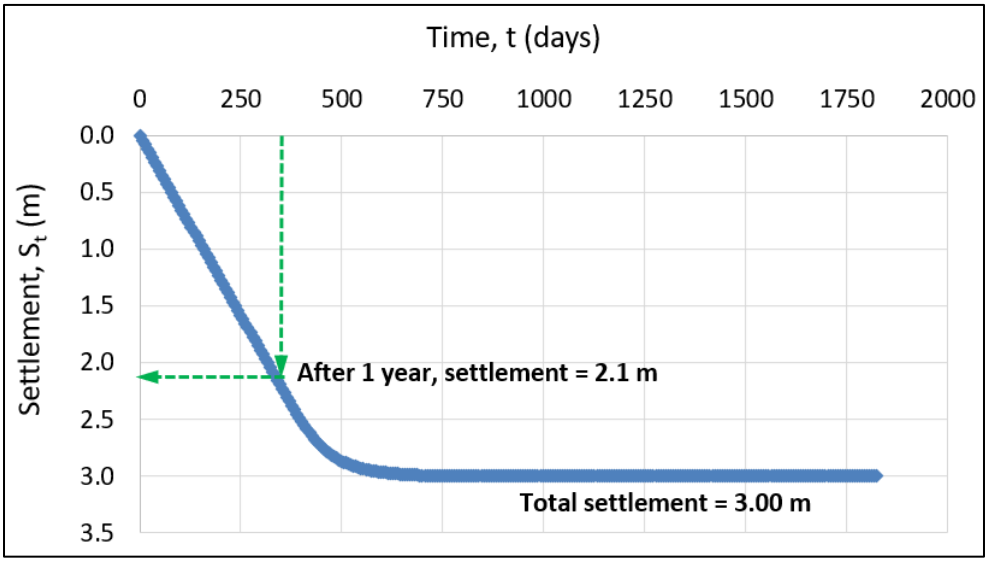


Figure 5-1: Tailings Settlement Obtained from Sigma/W

6.0 Adjustment of FSConsol Tailings Settlement Curve

As described in **Section 4.0**, the tailings settlement results from FSConsol are much smaller than what was observed on site (i.e., 1.5 to 2 metres) due to the input used in the model (i.e., compressibility with an initial void ratio of 0.86 instead of an initial void ratio higher than 2). To compensate for this deficiency, the tailings consolidation curve from FSConsol was adjusted to that obtained from Sigma/W. This adjustment aims to reach the same final settlement (more coherent) value of 3.0 m for both models (Sigma/W and FSConsol) and thus deduce from FSConsol the duration necessary to complete the settlements, for the purposes of comparison with the results from Sigma/W.

Figure 6-1 shows the FSConsol settlement curve adjusted to that from Sigma/W, which serves as calibration. The adjustment is made to have the same final settlement (3 m), but it is observed that the adjustment is also valid for the settlement obtained 1 year or 365 days after the end of filling, as the figure shows that for both models (Sigma/W and FSConsol) the settlement after 1 year is 2.1 m. This figure also indicates that the end of settlement occurs after 1.8 years based on the Sigma/W model and after 3 years based on the FSConsol model. From a conservative point of view, a duration of 3 years needed to reach the end of settlements will be considered.

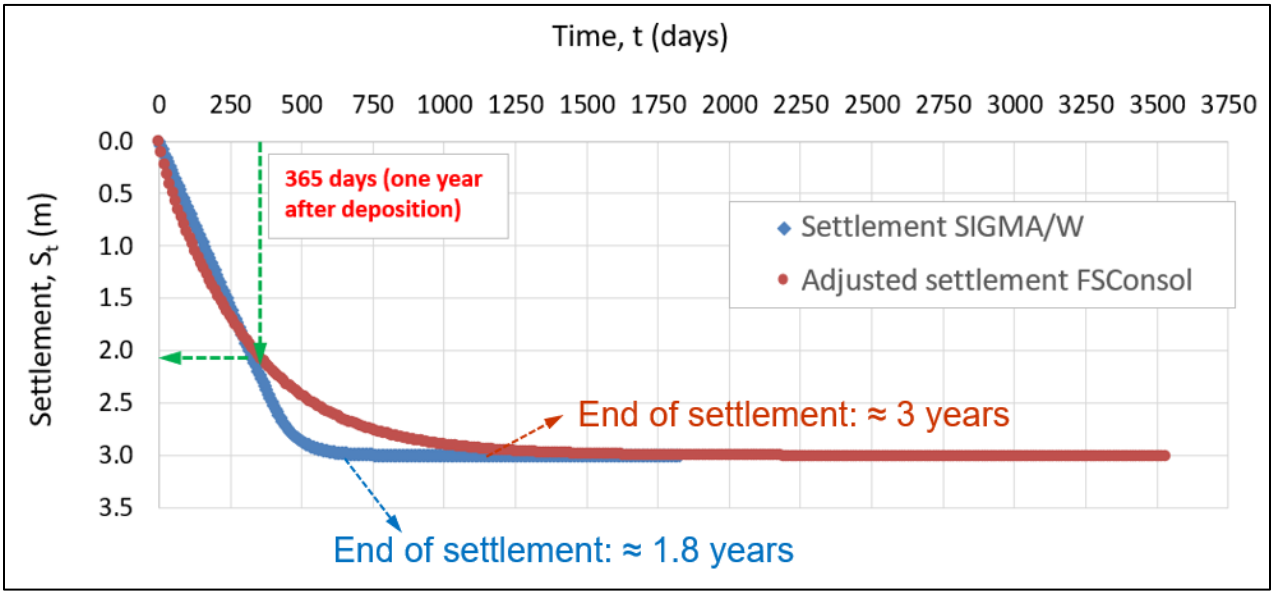


Figure 6-1: Adjustment of Settlement Curve from FSConsol to that from Sigma/W

In 2018, a 1D consolidation modelling was carried out with FSConsol to obtain the achievable dry tailings density after consolidation and estimate the cumulative volume (quantity) of water released into the supernatant. The actual modelling in the present study is focused on the water flow (flux) which should be used as input in another numerical model which is performing the hydrodynamic and geochemical modelling of Goose Pit; this flow is deduced from the settlement because settlement only takes place due to the expulsion of water from the pores.

However, even if it did not attract much attention, the settlement of the 2018 study, calculated with geotechnical data from Golder (2017), indicated a relative settlement of St/H0 = 3.8 m / 125.6 m = 3.02%, which is also low for "thickened tailings", especially since the tailings layer considered in the 2018 study was thicker (i.e., H0 = 125.6 m, placed for 4 years and 9 months). It is also important to highlight that in 2018, the modelling was carried out without validation/calibration, primarily because there was no bathymetric data available at that time. The 2023 study must reproduce field settlement observations (bathymetries), even if they are extremely imprecise and do not replace field measurements.

Evaluation of the flow rate of water expelled from tailings

For both models, the flow rate (flux) of water expelled from tailings is computed at each time step as follows:

Flow of expelled water, Q (m^3/s) = settlement (m) x plan area (m^2)

The average plan area at the top surface of tailings has been obtained from Muk3D analyses.

Figure 6-2 and **Figure** 6-3 show the flow rate of water expelled from the tailings for the entire duration of consolidation, respectively for Sigma/W and FSConsol models. The results from the Sigma/W model indicate that the maximum flow rate Q_{max} = 0.004 m^3/s and that the flux remains stable for the first 375 days after deposition. Subsequently, it gradually decreases and eventually reaches nearly zero after 700 days (approximately 2 years).

The results from the FSConsol model indicate that the maximum flow rate Q_{max} = 0.007 m^3/s; from the outset, the flow begins to decrease, and it reaches zero after 1,000 days (approximately 3 years). From a conservative point of view, a max flow rate of Q_{max} = 0.007 m^3/s will be considered.

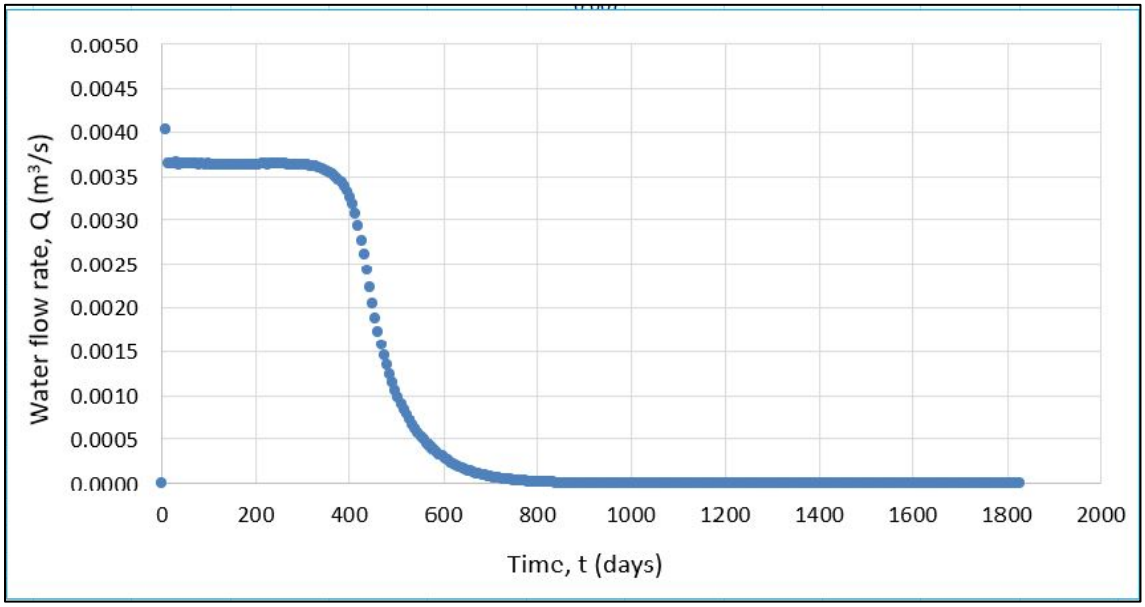


Figure 6-2: Evolution of Flow Rate of Water Expelled at Tailings' Surface with Sigma/W Model

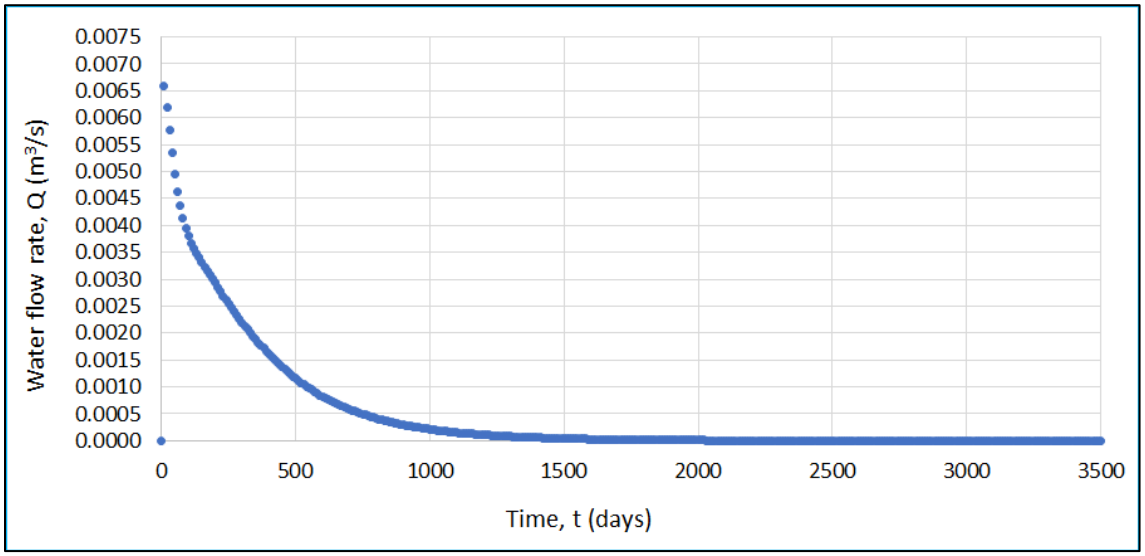


Figure 6-3: Evolution of Flow Rate of Water Expelled at Tailings' Surface with FSConsol Model

7.0 Discussion and Conclusion

The modelling of Goose Pit tailings consolidation has been achieved using two numerical models: FSConsol and Sigma/W.

Tailings settlement initial results from FSConsol were not in-line with field observations (i.e., 0.46 m after 1 year of deposition against an observed settlement of 1.5 to 2.0 m) because of an inappropriate input in the model, specifically the compressibility curve of the tailings. After a few iterations with FSConsol software, it was observed that the data available from the laboratory testing conducted in 2017 (Golder, 2017) were not representative of the *in situ* conditions.

Geoslope's Sigma/W was then used to estimate the tailings settlement. Settlement results from Sigma/W were close to the field observation. The results were then used to adjust the FSConsol model results. A total settlement of approximately 3 m was obtained from both the Sigma/W model and the adjusted FSConsol model, which is more in alignment with the observed field data.

The flow rate expelled from the tailings was evaluated for both models as the product of settlement and plan area for each time step. Sigma/W indicated a maximum flow rate of 0.004 m^3/s, reaching a flux nil (zero) after approximately 2 years while FSConsol indicated a maximum flow rate of 0.007 m^3/s, reaching a flux nil (zero) after approximately 3 years.

From a conservative standpoint, it is imperative to give due consideration to the maximum expelled flow rate from the tailings, which is calculated by using the FSConsol model at 0.007 m^3/s. This conservative approach ensures that not only this is the best case (worst case) scenario considered, but it also allows to prepare for potential outliers and extreme conditions.

Figure 7-1 shows the bathymetric profiles (topographies) of sections B and E in 2019, 2020, 2021 and 2023. The 2019, 2020 and 2021 bathymetric profiles have already been shown in **Figure** 3-8, only the 2023 bathymetric profile is added here. It is observed that the bathymetric profile of 2023 is closer to that of 2021. This indicates that the settlement which occurred from 2021 to 2023 is a residual settlement, the greatest settlement occurred between 2020 (when filling stopped) and 2021. In 2021, the settlement in the centre of the pit was estimated at 1.5 to 2 m. According to **Figure** 7-1, the settlement in 2023 at the same location is estimated at 2.1 to 2.3 m. This settlement is less than that predicted by the Sigma/W model (i.e., 3 m as total settlement). We can assume that residual settlements at Goose Pit could continue to occur for a period of time (for less than a year according to FSConsol which predicts a period of 3 years to complete the settlements), but based on the current analyzed data, these residual settlements will hardly reach the total settlement of 3 m predicted by the Sigma/W model.

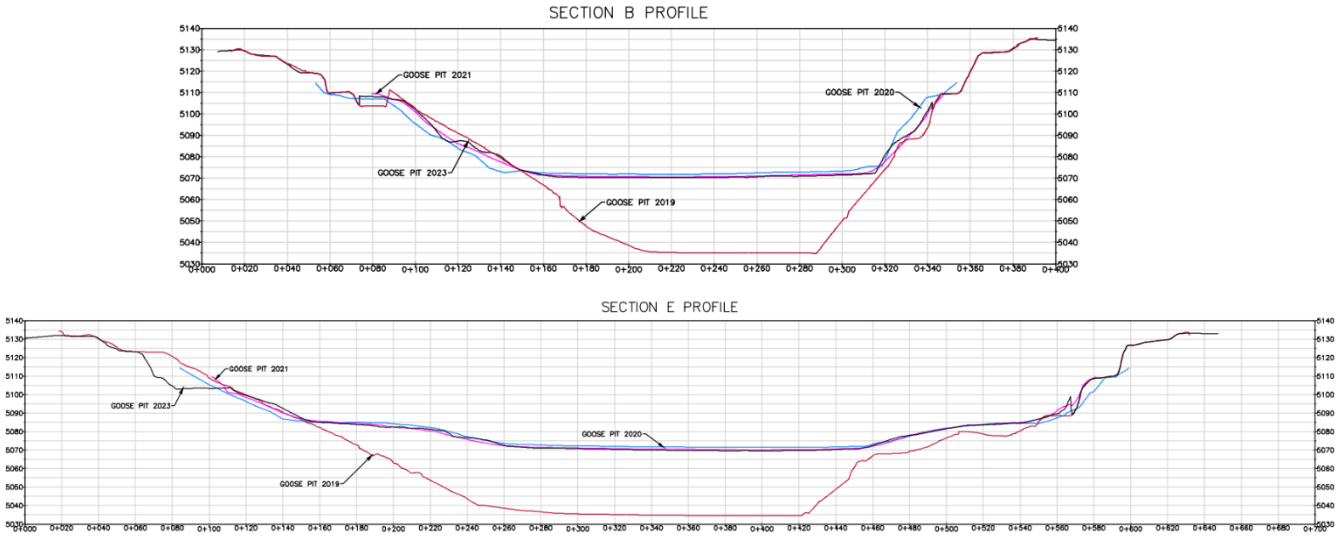


Figure 7-1: Profiles of Sections B and E of Goose Pit – 2019, 2020, 2021 and 2023

The differences between numerical predictions and field observations are often linked to the accuracy of the geotechnical parameters introduced into the model. It is important to mention that bathymetric data provided are not entirely consistent. Also, bathymetries are extremely coarse data and cannot give the precision required in geotechnics which can be, in some cases, of the order of mm or cm. This greatly affects the water flow deduced from settlements.

8.0 Recommendations

To improve the modelling results, the following items are recommended:

- Obtaining new and recent geotechnical investigations, including laboratory tests and characterization of materials (tailings), that reflect field conditions.
- Obtaining a detailed description of the site filling conditions (deposition rates and sequencing), including specific dates, granulometry, solid content and relevant historical data; and
- Exploring new interpretation and methodology for bathymetric studies.

Frequent measurements of the solid content before deposition and of the particle size (which could change with time and depth) are important elements that can help validate the inputs in the numerical models.

The situation of Goose Pit tailings deposition is more complex compared to most mining tailings deposition sites (example of slurred or filtered residues stored in an impoundment). At least a few field measurements, beside laboratory tests, will provide a significant improvement to the predictions made by the numerical models. The geotechnical work should be preceded by a geotechnical investigation, or at least an assessment of real geotechnical needs through discussions between AtkinsRéalis and Agnico Eagle geotechnical teams.

9.0 References

Azimuth (2022). Technical Memo, in-pit tailing assessment, aerial imagery, photo, and bathymetry data from Agnico Eagle (page 14).

Golders (2017). Whale Tail Pit Project, Laboratory Testing on Process Plant Tailings AEM Document: 6112-E-105-001-REP-002. Technical Memorandum. December 14, 2017.

SNC-Lavalin (2017). Hydrogeological Modelling for In-Pit Deposition of Tailings. Document no. 643541-3000-4WER-0001, revision A00. November 30, 2017.

SNC-Lavalin (2018). Tailings Deposition Design Criteria. Document no. 651196-2000-40EC-0001, revision E00. February 23, 2018.

SNC-Lavalin (2018). 1D Tailing consolidation assessment – in-pit Tailing Deposition Detailed Engineering. 651196-2000-4GCA-0001, Rev 01, May 03, 2018.

APPENDIX D

ATKINSRÉALIS. PRELIMINARY GOOSE PIT HYDRODYNAMIC WATER QUALITY FORECAST – WATER QUALITY PROFILE FOR SIMULATION 3B-2 AT THE END OF CLOSURE (NOVEMBER 2043)

Water Quality Profile - Simulation 3B-2

Simulation Date: 2043-11-30

Water Depth	m	1	2	3	4	5	6	7	8
Elevation (m)	m	133.8	132.5	131.5	130.5	129.5	128.5	127.5	126.5
Temperature	deg C	0.021	2.17	3.46	3.76	3.62	3.60	3.60	3.60
Density	kg/m3	1000.1	1000.2	1000.3	1000.3	1000.3	1000.3	1000.3	1000.3
DO	mg/L	7.31	5.99	4.78	4.08	3.75	3.74	3.74	3.74
pH	mg/L	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95
TDS	mg/L	320.3	337.5	354.0	364.5	369.8	370.0	370.0	370.0
Total Inorg. Carbon	mg C/L	0.918	2.64	4.10	4.83	5.10	5.11	5.11	5.11
Total Ammonia	mg/L	0.320	0.372	0.427	0.466	0.489	0.490	0.490	0.490
NO3	mg/L	2.73	2.73	2.74	2.75	2.75	2.75	2.75	2.75
SO4	mg/L	179.2	185.0	191.0	195.1	197.4	197.5	197.5	197.5
Al	mg/L	0.000255	0.000275	0.000296	0.000310	0.000319	0.000319	0.000319	0.000319
As	mg/L	0.0228	0.0242	0.0256	0.0266	0.0272	0.0272	0.0272	0.0272
Be	mg/L	0	0	0	0	0	0	0	0
Ca	mg/L	56.90	58.65	60.45	61.69	62.39	62.41	62.41	62.41
Cd	mg/L	0	0	0	0	0	0	0	0
Cl	mg/L	22.6	23.7	24.9	25.7	26.1	26.1	26.1	26.1
Cu	mg/L	0.00505	0.00533	0.00562	0.00582	0.00593	0.00594	0.00594	0.00594
Fe2+	mg/L	0.0144	0.0154	0.0165	0.0172	0.0176	0.0176	0.0176	0.0176
Fe3+	mg/L	0.000232	0.000242	0.000253	0.000259	0.000234	0.000232	0.000232	0.000232
Mg	mg/L	9.32	9.35	9.38	9.40	9.40	9.40	9.40	9.40
Mo	mg/L	0.00486	0.00501	0.00515	0.00526	0.00531	0.00532	0.00532	0.00532
Na	mg/L	27.4	28.7	30.0	30.9	31.4	31.4	31.4	31.4
PO4	mg/L	0.046	0.046	0.047	0.047	0.047	0.047	0.047	0.047
SCN-	mg/L	3.08	3.17	3.35	3.48	3.55	3.56	3.56	3.56
Se	mg/L	0.00164	0.00172	0.00180	0.00186	0.00189	0.00189	0.00189	0.00189