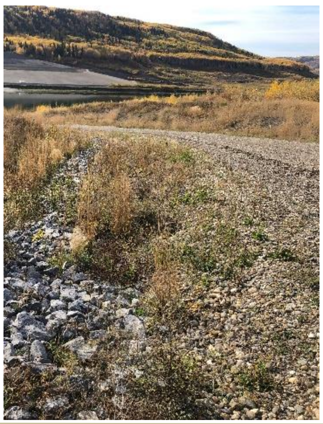
Appendix C

Site C Clean Energy Project
Water Quality Monitoring for River Road, South Bank Initial Access Road, BC Hydro Left Bank Debris Boom and L2 Powerhouse 2023 Annual Report




PRESENTED TO
BC Hydro

MARCH 27, 2024
ISSUED FOR USE
FILE: 704-ENG.VMIN03021-06

Tetra Tech Canada Inc.
150, 1715 Dickson Avenue
Kelowna, BC V1Y 9G6 CANADA
Tel 250.862.4832 Fax 250.862.2941

This page intentionally left blank.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by BC Hydro (the client) to develop and implement a surface water quality monitoring program at midstream and discharge locations along River Road ditch near Blind Corner and below Howe Pit, in proximity to the South Bank Initial Access Road (SBIAR), and along the L3 Creek catchment. The River Road and SBIAR locations have been sampled monthly, except when frozen or dry conditions exist, since initiation of the program in 2017. Additional monitoring locations were added in October 2020 at the L2 Powerhouse Area and BC Hydro Left Bank Debris Boom (LBDB), to help evaluate the effectiveness of mitigation measures which have shown, by monitoring results, to have effectively mitigated for non-PAG slopes. Sampling at L3 Creek was terminated in April 2021 after a sufficient dataset of trends over time had been collected. Details of the 2023 sampling locations, objectives, and requirements for testing at each location are presented in Section 5 of this report.

This water quality sampling program is conducted in accordance with BC Hydro Site C Clean Energy Project Construction Environmental Management Plan (CEMP), Rev. 12, Appendix E (Rev. 6.1) Acid Rock Drainage and Metal Leachate Management Plan - Section 5.2.1.7 (BC Hydro, 2023), which specifies requirements for road cut monitoring. This water quality program is one component of numerous water quality monitoring programs, including regular monitoring in the Peace River receiving environment, reported under separate cover (Ecofish, 2024a).

The monitoring program includes locations at the discharge points and at midstream locations as well as locations upstream from the discharge to characterize variation to water chemistry within the catchment due to mixing and inflow of water from multiple sources. Throughout the report the "RB" and "LB" nomenclature refers to right and left riverbanks (when facing downstream), respectively.

In accordance with the CEMP, results for the monitoring program locations are evaluated against the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (BCAWQG).

Water quality measurements collected at discharge locations along River Road and downstream locations at SBIAR that exceed the BCAWQG-FST values are reported to BC Hydro within 24-hours of receiving the results, and subsequently to the provincial Emergency Management BC hotline, the Independent Environmental Monitor, and the office of the Comptroller of Water Rights. The complete results of sampling at all locations are presented in a monthly routine memo to BC Hydro.

The results of monthly monitoring are compiled and tracked for changes over time with special interest in metals associated with ARD/ML drainage, e.g., iron, aluminum, arsenic, cadmium, cobalt, copper, manganese, silver, and zinc. The trend charts are updated approximately on a quarterly basis, depending on sampling frequency, that are included with the routine memo for that month's sampling event. The results of time series trend analysis are evaluated against the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (BCAWQG) freshwater long-term (FLT) chronic values for sulphate since no short-term (FST) exceedance value is applicable.

River Road

Access road construction in 2016-2017, on the north/left bank, between Howe Pit and the Peace River along River Road cut through bedrock. Current mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined "Chimney ditches" which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone rip-rap to provide neutralization potential and mitigate against acidic drainage. The limestone in the ditch was replaced in July 2021 to provide fresh surfaces for acid buffering.

A total of ten (10) monitoring locations were monitored in the River Road catchment near Blind Corner to monitor the effectiveness of the limestone rip-rap in the ditch line and on the rock slope, and to observe longer term influences from the Potentially Acid Generating (PAG) outcrop at Blind Corner and potential run-off/seepage from Howe Pit (non-Site C impacted area) on the water collected in the River Road ditch. In 2023, water quality sampling was attempted on a routine monthly basis from six of the River Road catchment locations, 1) the upper chimney drain (LBRR-UC), 2) lower chimney drain (LBRR-LC), 3) at the discharge of culvert RR-11 (LBRR-DD), 4) end of ditch diversion pipe (LBRR-EDP), 5) RR-9 culvert (LBRR-RR9), and 6) RR-8 culvert (LBRR-RR8). The LBRR-12+500 location was no longer sampled in 2023. In situ testing, without lab sampling, is conducted at four additional locations within the River Road ditch at LBRR-12+600, LBRR-12+700, LBRR-12+810 and LBRR-12+920. Occasionally, discharge from the outlet of culverts LBRR-DD, LBRR-RR9 and/or LBRR-RR8 is observed, which potentially reaches the Peace River and is documented in field notes and each of the routine monthly memos.

In the months of January, February, October, November and December 2023, frozen and/or dry conditions prevailed at RR. Lab samples were collected from River Road during three (3) sampling events in 2023 (March, April, September) resulting in a sum of seven (7) total samples. One (1) sample was collected from LBRR-DD (March), three (3) samples from LBRR-EDP (March, April, September), one (1) sample from LBRR-LC (March), and two (2) samples from LBRR-RR9 (March, September). No in situ or lab samples were collected from LBRR-UC or RR8 in 2023 due to dry or frozen conditions.

Of the total three (3) water quality sample events outside frozen and/or dry conditions at River Road locations in 2023, exceedances to the BCAWQG-FST were measured for total iron (6), total arsenic (3), total zinc (1), dissolved aluminum (2) and chloride (2). Of the three discharge locations, at LBRR-DD one exceedance was measured for total iron, at RR9 two exceedances were measured for total iron and one exceedance for chloride during the months of March and September 2023. The RR8 culvert was not sampled in 2023, or previously in 2021 or 2022, due to water not reaching this point in the ditch.

Water quality measurements along River Road have indicated that run-off water quality is influenced by active acid rock drainage and metal leaching (ARD/ML) processes within the River Road ditch catchment, however neutral drainage conditions prevail, and the elevated metals concentrations are generally attributed to sediment loading from the roadway or from sediment in the ditchline. Elevated metal levels at River Road have also been correlated in the past with periods of naturally elevated metals concentrations in the Peace River during freshet and after high precipitation events. As per CEMP Appendix E Section 5.2.1.7, it is recommended that water quality monitoring is continued on a monthly basis at the established locations within the River Road catchment.

SBIAR

The South Bank Initial Access Road (SBIAR) shale slope was initially exposed in 2015 as part of road construction works on the south bank between Relocated Surplus Excavation Material (RSEM) R6 and Area A. The total area of the shale slope is approximately 14,000 m^2, between both the East and West slopes. Management and mitigation measures include reduction of surface contact water through capture of up-gradient flow and diversion through a pipe to limit flow along the exposed shale slope, and collection of any remaining PAG contact water in ditches. It is noted that the water flowing in the ditches does not have a direct downstream receptor; the water from the east ditch passes under the road via culvert to the downstream location in the west ditch where all water flows into a limestone armored spillway into a ditch which conveys to the PRHP RSEM R6 pond (permitted for PAG contact water and subject to monitoring before discharge). The effectiveness of the mitigation is evaluated through monthly monitoring of water quality stations along the road.

In 2023, four (4) monitoring locations were sampled at SBIAR, which included two stations in each of the east and west ditches at the toe of the PAG slope exposure. The west upstream and downstream SBIAR ditches (RBSBIAR-DS, RBSBIAR-US) and east upstream and downstream SBIAR ditches (RBSBIAR-EDS and RBSBIAR-EUS). The sample stations are to monitor for potential long-term influence on water quality from construction of the SBIAR facility. Sampling at the SBIAR monitoring locations was conducted monthly in 2017, 2019, 2020, 2021, 2022 and 2023, and quarterly in 2018.

During 2023, outside of dry or frozen conditions, lab samples were collected from SBIAR during six (6) sampling events (March, April, June, July to September) resulting in a sum of twelve (10) samples. One (1) sample was collected from RBSBIAR-US (September), six (6) samples from RBSBIAR-DS (March, April, June to September), two (2) samples from RBSBIAR-EUS (June, July) and one (1) sample from RBSBIAR-EDS (March).

In situ testing was attempted on a monthly basis with sufficient water available at some, but not all, SBIAR locations for eight (8) months between March to October 2023. Frozen conditions in January, February, November and December 2023 prevented any situ measurements, and no lab samples were collected in January, February and October to December 2023 due to frozen conditions.

During 2023, BCAWQG-FST exceedances were measured in the west ditch at RBSBIAR-US for total iron (1), and at RBSBIAR-DS for total (2) and dissolved (1) iron, dissolved aluminum (2), total arsenic (2), total zinc (1), total cobalt (1) and dissolved cadmium (1). In the east ditch, BCAWQG-FST exceedances were measured at RBSBIAR-EUS for dissolved aluminum (1), and at RBSBIAR-EDS for total iron (1), total arsenic (1) and total zinc (1).

L2 Powerhouse Area

Two sample locations were established at the L2 Powerhouse area adjacent to the powerhouse on the Right Bank in October 2020. The L2 area was identified for sampling due to the exposure of a shale slope during excavation for the Powerhouse and continues to evaluate the water quality for potential impact from shale exposures in the area.

The lower L2 Area PAG slope is mitigated by covering of the slope that effectively makes it a non-PAG contact surface. The water quality monitoring program has been put in place to verify that the mitigation applied is working and that non-PAG contact water is observed in this area. The L2 Powerhouse is an area of active construction which may influence the sampling stations. The water management at this area is difficult to follow as there is active construction throughout the area and multiple sources of water input and discharges. Water is tested and pumped to treatment as needed.

In 2023, the L2-US location was sampled three (3) times from January to March, resulting in one BCAWQG-FST exceedance measured for total iron (1).

The L2-DS location was not sampled in 2023.

BC Hydro Left Bank Debris Boom

Shale was exposed during construction of the BC Hydro Left Bank Debris Boom (LBDB) anchor area in approximately March 2020. The LBDB PAG slope exposures will eventually be completely inundated with the reservoir formation. Water quality sampling at LBDB provides data to apply to understanding of water discharge and flooding in subsequent phases of increased elevation of the Peace River and during water diversion through the Diversion Tunnels. Sample locations were established and first sampled on October 8, 2020, to characterize water quality in the LBDB area for ARD/ML monitoring.

The Left Bank Pond (LB Pond or occasionally referred to as LBP Pond) is the only location within the area that has been consistently available for sampling. In 2023, no samples were collected from LBDB ditches due to dry and/or frozen conditions. Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LB Pond location, is immediately following a significant rainfall event.

During 2023, the LB Pond was sampled five (5) times including April and June to September.

At LB Pond, four BCAWQG-FST exceedances were measured above the guidelines in September 2023 for total and dissolved iron, dissolved aluminum and total manganese. Water is not commonly observed to discharge from the LB Pond, but if it does it passes through a limestone lined water management ditch system to the downstream monitoring station.

TABLE OF CONTENTS

APPENDIX SECTIONS

TABLES

FIGURES

PHOTOGRAPHS

APPENDICES

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
ARD	Acid Rock Drainage
ARD/ML	Acid Rock Drainage and Metal Leaching
BC MoE	BC Ministry of Environment and Climate Change Strategy Water Protection & Sustainability Branch
BCAWQG	British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture
°C	Degrees Celsius
CEMP	Construction Environmental Management Plan
DOC	Dissolved Organic Carbon
FB	Field Blank
FST	Freshwater Short-Term Maximum
FLT	Long-term Maximum
L/s	Litres per second
LBDB	Left Bank Debris Boom
LBRR	Left Bank River Road (referring to Sample ID)
Lorax	Lorax Environmental Services Ltd.
mg/L	milligrams per litre
ML	Metal Leaching
PAG	Potentially Acid Generating
PRHP	Peace River Hydro Partners
ppm	parts per million
RBSIBAR	Right bank South Bank Initial Access Road (referring to Sample ID)
RPD	Relative Percent Difference
RSEM	Relocated Surplus Excavation Material
SBIAR	South Bank Initial Access Road
TB	Travel Blank
µg/L	micrograms per litre
WQG	Water Quality Guideline

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of BC Hydro and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than BC Hydro, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by BC Hydro (the client) to develop and implement a surface water quality monitoring program at locations around the Site C project site where bedrock shale exposures, classified as potentially acid generating (PAG), may have the potential to contribute to water quality changes due to acid rock drainage and metal leaching (ARD/ML) potential of the shale bedrock.

We acknowledge this work is being conducted on the traditional territory of Treaty 8 First Nations of Dunne Zaa, Cree and Tse'khene cultural descent.

Monitoring locations were established by Tetra Tech in conjunction with BC Hydro personnel. Where possible (and applicable), they are coincident with the locations and station names used in 2016 by Lorax Environmental Services Ltd. (Lorax) for water quality monitoring on behalf of Peace River Hydro Partners (PRHP) prior to BC Hydro taking over sampling of these stations. Water sampling locations with UTM coordinates are shown in the attached maps in Figures 1 through 3. Photos of the water sampling locations during 2023 are included in the Photographs (Photos 1 to 28) section of the Appendix.

Locations along River Road ditch near Blind Corner and below Howe Pit, and in proximity to the South Bank Initial Access Road (SBIAR) have been sampled monthly, except when frozen or dry conditions exist, since initiation of the program in 2017. Additional monitoring locations were added in October 2020 at the L2 Powerhouse Area and the BC Hydro Left Bank Debris Boom (LBDB). These locations are also sampled monthly, outside of frozen or dry conditions. The monitoring program includes locations at the discharge points and at midstream locations as well as locations upstream from the discharge to characterize variation to water chemistry within the catchment due to mixing and inflow of water from multiple sources.

This report documents the sampling events conducted monthly between January and December of 2023 and the results of water quality monitoring. Results are discussed in the context of ARD/ML management and mitigation.

The water conveyance facilities at River Road ditch near Blind Corner and SBIAR are identified as having potential for direct ARD/ML impacts due to exposure of shale bedrock during construction related activities. River Road and SBIAR are downstream of the dam.

The LBDB area has an exposed PAG slope in the central part of the area. Water quality sampling at LBDB provides information on the water quality at locations upstream and downstream of the PAG slope exposure. Ultimately, this area will be flooded by reservoir filling.

The L2 Powerhouse area is sampled to establish upstream and downstream water quality characterization and for ARD/ML PAG slope monitoring in the L2 Powerhouse area and adjacent to the powerhouse on the Right Bank.

2.0 MONITORING PROGRAM SET-UP AND PURPOSE

Water quality sampling has been scheduled during approximately the third week of each month from 2017 to 2023 to support a continuous monitoring record for reportable water quality compliance. The monitoring locations are visited monthly, and samples are collected except under frozen or dry conditions. The 2023 monitoring period commenced with the first sample event on January 30, 2023 and the twelfth and final sample event of the year on December 21, 2023. Each sampling event was completed by BC Hydro personnel and was documented by field notes and photographs, including during dry and frozen conditions.

2.1 Monitoring Program Requirements and Comparison Criteria

Requirements for the development and implementation of the water quality monitoring programs are mandated under the Environmental Assessment Certificate – Condition 3, and the Federal Decision Statement – Condition 7. Reporting of the program results are required on an annual basis. These requirements were carried forward and presented in the BC Hydro Site C Clean Energy Project Construction Environmental Management Plan (CEMP), Revision 12 (October 23, 2023), Appendix E (Rev 6.1) Acid Rock Drainage and Metal Leachate Management Plan.

In accordance with the CEMP Appendix E Section 5.2.1.7, analytical results for all monitoring locations are evaluated against the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (BCAWQG) freshwater short-term maximum (FST) values[1] (BC MOE, 2021). In August 2023, the BC Ministry of Environment introduced amendments to the BCAWQG that included specific changes for aluminum, arsenic and zinc (BC MOE, 2023), summarized as follows:

> Aluminum: changed from short-term (FST) to long-term (FLT) guideline; from dissolved to total concentration; and, is now hardness, pH and DOC-dependent.
>
> Arsenic: changed from short-term (FST) to long-term (FLT) guideline.
>
> Zinc: changed from total to dissolved concentration; and is now hardness, pH and DOC-dependent.

Water quality measurements recorded at the sampling stations are reported to BC Hydro within 24-hours of receiving lab results, and a routine memo is prepared on a monthly basis to summarize field in situ and analytical lab results. The monthly results are compiled for long-term trend analysis in trend charts. The long-term trends data is evaluated against the BCAWQG freshwater long-term (BCAWQG-FLT) chronic values in Appendix B, Table B1 to B4 and trend charts in Figures 6 to 56.

Water quality measurements collected at discharge locations along River Road and downstream locations at SBIAR that exceed the BCAWQG-FST values are reported to BC Hydro within 24-hours of receiving the results, and subsequently to the provincial Emergency Management BC hotline, the Independent Environmental Monitor, and the office of the Comptroller of Water Rights. The complete results of sampling at all locations are presented in a monthly routine memo to BC Hydro.

Under BCAWQG, the intention of freshwater long-term (FLT; “chronic”) WQG’s are for the protection of the most sensitive species and life stage against sub-lethal and lethal effects for indefinite exposure, and uses an averaging period, whereas the freshwater short-term (FST; “acute”) WQG’s are intended to protect against severe effects, e.g., lethality, to the most sensitive species and life stage over a defined short-term exposure period approach (BC MOE, 2021, 2023).

2.2 Analytical Program Parameters

An off-site laboratory analytical program was designed to measure a suite of parameters suitable for screening the water quality against the BCAWQG-FST for surface water. The sampling and analytical procedures implemented during 2023 were commensurate with Tetra Tech’s monitoring programs from 2017 to 2022, and the program

[1] The British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture document has been updated frequently during the course of the monitoring program, and has undergone revisions in March 2016, January 2017, March 2018, August 2019, 2021, and 2023 Screening of the monthly water quality results are performed against the contemporary guideline values. During the 2023 monitoring program, water quality results were evaluated against the 2021 guidelines. Most recently, the BC MoE introduced new WQG’s in August 2023 with changes to aluminum, arsenic and zinc guideline/calculations, which were also introduced into the BC Hydro master datasheet. This change affects the latter 2023 reporting.

previously implemented in 2016 by Lorax for parameters, analytical methods, and detection limits. Samples were collected in a set of clean bottles provided by the lab and were submitted for analysis.

Analysis was conducted for the following parameters:

- Total Metals, Low Level (including Hg);
- Dissolved Metals, Low Level (including Hg);
- Hardness;
- pH;
- Alkalinity: Total/Species (CO_3^{2-} , HCO_3^-, OH^-);
- Acidity;
- Solids: Total Suspended (TSS) and Total Dissolved (TDS);
- Anions: Nitrogen species (nitrite, nitrate, ammonia), Sulphate, Chloride; and
- Dissolved Organic Carbon (DOC).

2.3 Summary of Parameters of Interest

Some of the key parameters that were monitored during this program are described below. Although some of these parameters do not have BCAWQG-FST guidelines, they can be useful indicators to potential changes in water chemistry related to ARD/ML processes.

Alkalinity and pH are important water quality parameters to indicate the ratio between residual alkalinity and acidity in solution and are key indicators for onset of acidic conditions within neutral to alkaline waters when monitored over time. Neutralization of acidity by carbonate, and to a lesser degree silicate, minerals can temporarily increase alkalinity through release of the bicarbonate ion into solution, thereby buffering pH at a near constant value. Bicarbonate will continue to react with, and deplete, any residual acidity. Once all carbonate and bicarbonate sources are depleted, alkalinity no longer is available to neutralize acidity and pH will drop. An indicator for accelerating acid generating processes is when increasing alkalinity is observed without proportional change to pH. The BCAWQG-FST guideline for pH ranges from 6.5-9.0. There is no BCAWQG-FST guideline for alkalinity or acidity.

Water clarity is measured as turbidity (nephelometric turbidity units, NTU) or as total suspended solids (TSS), which is an indicator of the amount of sediment (generally accepted as silt sized particles and coarser, or >0.45 µm in diameter), contained within the water column. TSS can increase if sediment loading occurs due to erosion, or due to rapid precipitation of secondary minerals from chemical reactions such as neutralization of acidic water. The bulk chemistry of water with high TSS tends to mimic the chemical composition of the source sediment being eroded, or in the case of mineral precipitation tends to be high in iron as iron-oxide minerals are the most common secondary mineral to form. Rapid temporal changes to TSS measurements within a catchment due to formation of secondary minerals can indicate presence of active ARD/ML reactions. The BCAWQG-FST guideline is based on deviations relative to background TSS.

Measurements such as total dissolved solids (TDS), electrical conductivity (EC) and salinity are indicators for the concentration of dissolved components and/or ions in solution. Sudden or gradual increases in these parameters can indicate changes in water chemistry such as an increase in reactive ions or dissolved metals as a result of potential metal leaching processes. Changes to these parameters in association with changes to pH or alkalinity may also indicate active metal leaching processes. BCAWQG-FST guidelines are not defined for these parameters.

Dissolved sulphate can originate from anthropogenic sources, microbial processes and through chemical processes related to degradation of rock forming minerals in environments with potential for acid generation through the oxidation of primary sulphide (e.g., pyrite) or dissolution of sulphate minerals (e.g., gypsum). Elevated sulphate concentrations may indicate oxidation, or weathering, of PAG materials in proximity to sample collection locations, however, it may also indicate influence from regional groundwater sources. Water quality with elevated sulphate and pH > 7.0 may indicate ARD/ML processes with sufficient acid neutralizing materials, whereas sulphate with decreasing pH may indicate a shortage of acid neutralizing materials. Sulphate is commonly reactive with several cations and metal ions under ambient environmental conditions forming both soluble and non-soluble mineral precipitates.

Marine shales such as the local Shaftsbury Formation commonly contain sulphide minerals (mainly pyrite, FeS_2) and may also have primary sulphate minerals such as anhydrite ($CaSO_4$), gypsum ($CaSO_4 \cdot 2H_2O$), or barite ($BaSO_4$), and/or other sulphate minerals. Preliminary characterization determined that the primary sulfur species in the shale was sulphide with some detectable sulphate (Klohn Crippen Berger, 2015). Based on this mineral association and site observations, it is possible that groundwater contacting fractured bedrock could contain naturally elevated sulphate concentrations. Only one well from the Main Civil Works (MCW) Site was reported in the baseline groundwater sampling conducted as part of the project’s Environmental Impact Statement (Hemmera Envirochem Inc. and BGC Engineering Inc., 2012) which did indicate groundwater contained elevated sulphate.

Groundwater monitoring from 2016-2020 up-gradient and down-gradient of RSEM R5a and R5b measured elevated sulphate concentrations below the BCAWQG-FLT guideline, as reported in the Site C Clean Energy Project, 2020 Q4 Groundwater Quality, Monitoring Report for RSEM R5a and R5b (Lorax, 2020). These results indicate the presence of sulphate in the groundwater systems. It is noted that the down-gradient monitoring wells at RSEM R5b were screened in overburden materials above the bedrock contact. The guideline value for sulphate is not stated in the short-term BCAWQG-FST guideline, however, a long-term average guideline value is stated (variable with hardness) and is referenced in this report.

Water hardness is derived from the total concentration of calcium and magnesium ions in solution, and often reported as mg/L of dissolved $CaCO_3$) is known to mitigate the effect of certain metals on aquatic organisms, and the guidelines are presented with equations derived from experimental data for sulphate and numerous metals (cadmium, copper, fluoride, lead, manganese, silver and zinc that tests a range of hardness specific to each metal or sulphate). Water hardness classification on-site is Hard to Very Hard (180 to >250mg/L, and up to 1,000 mg/L, dependent on location) and is often measured above the guideline threshold used to calculate BCAWQG-FST guideline values. Where the ambient hardness values exceed the guideline limit listed for BCAWQG, the exceedance criteria have been calculated using the upper limit “capped” hardness value instead of the measured ambient hardness.

Water quality screening efforts have focused on elements with BCAWQG-FST guidelines, which include pH, ammonia, chloride, nitrite, total concentrations of arsenic, boron, cobalt, iron, lead, manganese, molybdenum, silver, and zinc, and dissolved concentrations of aluminum, cadmium, and iron. Changes in concentrations of some elements or metals, reported as both total and dissolved, can have various implications for water quality under ARD/ML conditions. The solubility of individual elements can vary with pH. Geochemical modelling completed by Klohn Crippen Berger (2015) identified copper, cobalt, cadmium, and zinc as having high probability of leaching into solution of site water during oxidation of the local shale bedrock under oxic acid rock generating and metal leaching conditions.

Formation of iron-oxide precipitate is a widely recognized indicator of active ARD/ML processes. Total iron concentrations are associated with ARD/ML due to liberation of ferric iron from the oxidation of primary iron bearing sulphides. Subsequent formation of iron-oxide or iron hydroxide minerals can precipitate when acidic waters are neutralized and may be present as suspended solids or can form scaling on reactive surfaces such as limestone.

Aluminum is abundant in rock forming minerals and can be released as part of oxidation and degradation of rocks during ARD/ML processes. Aluminum is soluble in acidic water and is typically not soluble in neutral and alkaline waters. Aluminum, as Al^{3+}, can also contribute to the acidity along with H^{+}. When concentrations of aluminum are measured in detectible concentrations in neutral or alkaline water, it is possible that the formation of very fine aluminum hydroxide clays may occur in previously acidic waters that have been neutralized. Aluminum hydroxide mineral species (e.g., polymorphs of gibbsite or hydrargillite) can form on rock surfaces and are indicators of acid generating conditions. Precipitation of aluminum and iron hydroxide produced by weathering may occur on and reduce the exposure of acid generating and acid neutralizing minerals. (Price, 2009).

Concentrations of aluminum, iron and copper are typically low in neutral pH drainage, however, elements such as antimony, arsenic, cadmium, molybdenum, selenium, and zinc can be present in neutral pH drainage (BC MEM, 1998). Neutral pH metal leaching is an important mechanism to be observed on the Site C project as several of these neutral pH soluble elements are prevalent in the shale bedrock. These elements can be concentrated within secondary mineral formation on shale bedrock during prolonged period of low moisture, then released into run-off water in elevated concentration during high precipitation events.

3.0 SAMPLE LOCATIONS

A list of sample locations is provided in the attached Table 1 and the locations are shown on Figures 1 through 3. A summary of the rock cut locations that are subject to monthly monitoring are presented in the following sections, along with a description of the monthly sampling and in situ testing locations.

3.1 Description of River Road Sample Locations

Access road construction in 2016-2017, on the north/left bank, between Howe Pit and the Peace River along River Road cut through bedrock. ARD/ML management and mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone rip-rap to provide neutralization potential and mitigate against acidic drainage. The limestone in the ditch was replaced in July 2021 to provide fresh surfaces for acid buffering.

Sample locations are established along the River Road ditch for in situ testing, primarily as a means of monitoring the effectiveness of the limestone rip-rap and to observe longer term trends related to the PAG outcrop at Blind Corner and run-off/seepage from Howe Pit. A total of ten (10) monitoring locations are established in the River Road catchment near Blind Corner, shown in Figure 1. The River Road ditch was refreshed with new limestone in July of 2021. See Section 5.3 for additional discussion of management and mitigation of ARD/ML in this area.

The six sample stations include 1) upper chimney (LBRR-UC), 2) lower chimney drain (LBRR-LC), 3) discharge of culvert RR-11 (LBRR-DD), 4) LBRR-EDP, and downstream drainage culvert outlets at 5) RR8 and 6) RR9. The four stations with only in situ monitoring include LBRR-12+600, LBRR-12+700, LBRR-12+810 and LBRR-12+920.

The River Road Ditch Diversion pipe installed in March 2018 is to address erosion and sediment control by transport of run-off water into an elongated ditchline to reduce flow velocities and to promote settlement of suspended sediment. Inlets to culverts RR9 and RR8 are slightly elevated from the ditch base which will allow water to pond within the ditch and infiltrate or discharge via the culverts only if water levels reach sufficient height. Both culverts are made of HDPE materials. The monitoring program includes sampling of discharge from these LBRR-RR8 and LBRR-RR9 culverts.

The established River Road monitoring locations are shown in Figure 1 and photos of the locations are included in the Photographs section of the Appendix. Water quality lab data results are provided in Appendix B, Table B1 and discussed in Section 5.3.

3.1.1 Limestone Ditch Status and Maintenance

Current mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone rip-rap to provide neutralization potential and mitigate against acidic drainage.

The placed limestone rip-rap is effective at mitigating the pH of the drainage when there are fresh surfaces of limestone available for chemical reactions. Potentially acidic leachate generated from the rock cut-slopes reacts with the alkaline limestone to help neutralize water as it passes through the rip-rap lined ditch. Mineral precipitates can accumulate on rip-rap over time which reduces the effectiveness of the limestone. Periodic refreshing or replacement of limestone has been completed over the life of the project. No maintenance activities were completed in 2022 as the limestone continued to work effectively with minor precipitate coatings noted as well as road sediment encroachment.

With increased use of River Road, sediment and erosion control measures are needed to be addressed to manage the sediment load coming off of the road and into the ditch. The limestone is monitored for accumulation of precipitates and sediment and refreshed either by cleaning or replacement as needed.

Maintenance 2017-2020

In 2017, the collection ditch on the cut-bank (north) side of River Road between approximately 12+340 and 12+960 (Blind Corner) was lined with limestone rip-rap to assist with mitigating the potential effects of ARD/ML from PAG bedrock that was exposed during the initial road construction in 2015 and early 2016. Limestone was also placed between stations LBRR+920 and LBRR-DD to manage the pH of baseline drainage water at the outflow location. Limestone rip-rap within the ditch between road stations 12+600 and 12+900 continued to be maintained in 2018, including completion of a hydroseeding program and a limestone buttress as the tow of the shale slope at blind corner to support long-term erosion control and slope stability in March 2018. The hydroseed appeared to remain in place on the slope, however, germination was not successful at year’s end. No maintenance activities were completed in 2020.

Maintenance in 2021

In early July 2021, rip-rap was replaced with fresh limestone from the start of Blind Corner ditch up to but not including under the diversion pipe. During replacement of limestone the contractor removed the previously installed bentonite liner. Placement of new bentonite liner and replacement of limestone was subsequently completed in 2021.

Maintenance in 2022 and 2023

No maintenance requirements for limestone in 2022 and 2023.

3.2 Description of South Bank Initial Access Road Locations

The South Bank Initial Access Road (SBIAR) shale slope was initially exposed in 2015 as part of road construction works on the south bank between Relocated Surplus Excavation Material (RSEM) R6 and Area A. The total area of the shale slope is approximately 14,000 m^2, between both the East and West slopes. Management and mitigation measures included reduction of surface contact water through capture of up-gradient flow and diversion through a pipe to limit flow along the exposed shale slope, and collection of any remaining PAG contact water in ditches which is captured and conveyed to PRHP RSEM R6 Settlement Ponds (permitted for PAG contact water). In May 2023 this capture system was removed and surface water from the top of the slope flowed over the western slope and was conveyed to R6 via the ditch.

A total of four (4) monitoring locations are established in the SBIAR catchment to monitor water quality flowing in the SBIAR ditches at the toe of the SBIAR road cut. The four sample locations allow for data collection from the east and west SBIAR ditches. This provides long-term characterization of SBIAR water management from the upstream location in the west ditch (RBSBIAR-US) and the downstream location in the west ditch (RBSBIAR-DS), as well as upstream and downstream sampling locations in the east ditch, (RBSBIAR-EUS and RBSBIAR-EDS, respectively).

It is noted that the water flowing from the downstream locations does not have a direct downstream receptor; the water from the east ditch passes under the road via a culvert to the downstream location in the west ditch where all water flows into a limestone armored spillway into a ditch, which conveys to the PRHP RSEM R6 pond. There is an intensive water quality monitoring program in the pond (continuous in situ measurements of pH, conductivity; daily lab analysis for all parameters) conducted prior to discharge by Lorax (Lorax, 2024), Ecofish Research Ltd. (Ecofish 2024a) and others, as well as Peace River receiving environment monitoring conducted by Ecofish (Ecofish, 2024a) and others.

The established RBSBIAR monitoring locations are shown in Figure 2 and photos of the locations are included in the Photographs section of the Appendix. Water quality lab data results are provided in Appendix B, Table B2 and discussed in Section 5.4.

3.3 Description of L2 Powerhouse Area Sampling Locations

The L2 Powerhouse area is sampled to establish upstream and downstream water quality characterization and for ARD/ML PAG slope monitoring in the L2 Powerhouse area and adjacent to the powerhouse on the Right Bank. The two sample locations were established in October 2020. The L2 area was identified at that time for sampling due to the exposure of a shale slope during excavation for the Powerhouse. The RB Foundation Enhancement work (January 2022) included additional shale excavation. Mitigation and monitoring are addressed as per the site's EPPs. The L2 Powerhouse is an area of active construction which may influence the results of sampling month to month. The water management at this area is complex and there may be multiple sources of water input and discharges. At the L2-US and L2-DS locations, sampling continued until March 2023, then were discontinued since construction of the powerhouse expanded and extended overtop of the sample locations.

The water quality monitoring program was put in place to evaluate if shale excavations are contributing to water quality impacts in the area. Due to the complex construction activities in this area and presence of both AFDE and PRHP construction teams, the water quality monitoring program discussed in this report is only one component of the overall program.

The lower L2 Area PAG slope exposed in 2020 was mitigated by covering of the slope that effectively makes it a non-PAG contact surface. The lower slope was bolted and covered in mesh and shotcrete. The slope treatment was subsequently removed, and the slope was shotcrete to support stability. The L2-DS is established at the base of this slope adjacent to the Powerhouse. Water from the intermediate slope flows in a ditch and down to the L2-DS station area. The water that collects at this location is tested and collected via vac truck for water treatment as needed.

The L2-DS sample location is adjacent to the L2 Powerhouse, specifically collected from the pump tubing on the west side of the culvert and approximately 1-2 m from the south rock ditch wall and 1-2 m from the culvert. Sandbags in the ditching adjacent to the Powerhouse are used to separate AFDE and PRHP water in this area. Water management and quality, and conveyance in the L2-DS area was frequently changing due to construction activities. In 2023, the L2-DS location was not sampled.

The L2-US station is located upstream from the L2 Powerhouse in a ditch line. Water at this station is pumped to the AFDE treatment plant, as required. Samples from L2-US were collected from January to March 2023 then discontinued due to potential influence of construction from multiple sources in the area.

Representative photos of the L2 Powerhouse Area are included in the Photographs section of the Appendix. Water quality lab data results are provided in Appendix B, Table B3 and discussed in Section 5.5. A map showing the locations is in Figure 2.

3.4 Description of BC Hydro Left Bank Debris Boom Sampling Locations

Shale was exposed during construction of the BC Hydro Left Bank Debris Boom (LBDB) anchor area in approximately March 2020. In September 2020, the river at Phase 1 elevation (~410 m) followed by a partial block and diversion of the Peace River to allow construction of the main Site C dam in October 2020, causing the river/reservoir to flood up to stage 2 levels (~417-420 m). The final river/reservoir planned elevation is ~ 460 m.

The ditches above the 420 m elevation are lined with 3 to 10-inch size fraction limestone as a management measure to provide additional buffering capacity to leachate entering the ditches. The area below 420 m elevation was flooded by the head pond after construction in early Fall 2020, and therefore that area did not require rip-rap. The area above 420 m elevation will be exposed prior to flooding to the final river/reservoir elevation of around 460 m elevation planned for 2024. Seeding with ESC mix was completed on exposed soil areas after they were track packed and loosened.

Water quality sampling at LBDB provides data to apply to understanding of water discharge and flooding in subsequent phases of increased elevation of the Peace River and during water diversion through the Diversion Tunnels. Sample locations were established and first sampled on October 8, 2020, to characterize water quality in the LBDB area for ARD/ML monitoring. The purpose of sampling is to monitor PAG contact water from shale exposed during construction in March 2020, and that drains to the Peace River.

The initial sampling locations included the LB Pond location and LB Side Channel. The LB Pond sample location has been sampled regularly since initiation. The LB Side Channel was only sampled in 2020 prior to inundation of the Peace River and this station is now back flooded and no longer considered.

Additional sample locations were added in July 2021 following a review of the area during the Tetra Tech ARD/ML site audits. Water management structures and ditch linings were also amended. The water management structures were improved to manage flow and prevent erosion and ditches were lined with limestone to provide acid buffering capacity. These were proactive measures to manage signs of erosion and initial signs of ARD/ML generation on the exposed shale slopes.

Monitoring locations were added to the west and east armor ditch, which captures water from the shale slopes at upstream and downstream locations. These four stations are named as LBDB-WUS (west ditch upstream), LBDB-WDS, LBDB-EUS, and LBDB-EDS. Three stations were also added along the LB Pond flow path. Station LBDB-LD-US captures water upstream of and draining into the LB Pond. Station LBLD-LD-MS is downstream of LB Pond, and station LDBD-LD-DS is further downstream prior to discharge to the Peace River.

Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LB Pond location, is immediately following a significant rainfall event. Sample staff are instructed to sample these locations outside of regular monitoring events, if possible, when high rainfall is observed.

A representative photo of the LBDB locations is included in Photographs section of the Appendix. Water quality lab data results are provided in Appendix B, Table B4 and discussed in Section 5.6. A map showing the locations is in Figure 3.

4.0 LOCAL CONDITIONS

4.1 Weather Conditions - Temperature and Precipitation

The minimum, maximum, and average daily temperature and the 7-day temperature range preceding each sampling event are summarized in the attached Table 2. The total precipitation measured for the 7-days preceding each sample event and the precipitation on the day prior to and the day of the sample event are also summarized in Table 2. The temperature and precipitation data were sourced from BC Hydro’s Site C Meteorological and Air Quality Station (Figure 4; BC Hydro, 2022), Station 7C Site C North Camp. A summary of mean daily temperature recorded on sampling events, and precipitation recorded prior to and during the sampling event is provided in Table 4-1.

In 2023, the temperature recorded during each sampling event results in five sample events with sub-zero temperatures, including January 30, February 20, October 29, November 29 and December 21. The remaining sample events record a range of temperature from 1.10 °C (March 29th) to 21.2 °C (June 28th).

In 2023, the precipitation recorded during each sampling event shows two events with minimal precipitation (throughout the day on March 29 (1.03 mm) and on September 28 (8.67 mm)) and four events including January 30, February 20, June 28 and August 30, with very minimal precipitation totaling 0.10 to 0.91 mm is <1mm during the sample event. The remaining events on April 28, May 19, July 17, October 29, November 29 and December 21 coincided with dry or frozen conditions and no precipitation. During the prior 7-days to the sampling event, the highest amount of precipitation was recorded before the June 28 sample event.

Table 4-1: Sample Event Temperature and Precipitation

Routine Memo No.	Sample Event No.	Sample Event Date	Mean Daily Temperature (°C)	Precipitation on day of Sample Event (mm)	Precipitation for 7-Days Prior to Sample Event (mm)
-	1	30-Jan-23	-11.3	0.91	1.08
1	2	20-Feb-23	-10.2	0.21	2.36
	3	29-Mar-23	1.10	1.03	0.44
2	4	28-Apr-23	12.0	0.00	3.38
	5	19-May-23	14.1	0.00	0.00
3	6	28-Jun-23	21.1	0.10	9.31
	7	17-Jul-23	16.8	0.00	3.20
4	8	30-Aug-23	18.0	0.28	0.37
	9	28-Sep-23	8.70	8.67	12.3
-	10	29-Oct-23	-3.80	0.00	4.63
-	11	29-Nov-23	-1.70	0.00	0.57
-	12	21-Dec-23	-1.00	0.00	3.55

[1] No sampling or in situ measurements due to frozen or no flow conditions.

4.2 Classification of Seasonal Flows in Ditches

Residence time for water is low in the investigated area ditches due to their small catchment size. The climate data was used to evaluate water availability and potential water source for flows that were observed in the ditches.

The flows in ditches are susceptible to seasonal change and flow rate is highly influenced by local precipitation events, thus the classification of flow in ditches can assist to interpret the source and subsequent chemical fluctuations in water sampled (attached Table 3). For example, flows in ditches can be attributed to shallow or regional groundwater, spring freshet or surface run-off, dependant on the season and amount of precipitation recorded in the previous 24-hours and 7-days to the sampling event.

When significant or moderate precipitation has occurred in the previous 7-days, but minimal precipitation within the prior 24-hour period to the sampling event, the flows in ditches can result from shallow groundwater flow, mainly through unconsolidated overburden. The highest amount of precipitation in the preceding 7-days (12.31 mm) and during the sampling event (8.67 mm) was documented to occur for the September 28, 2023, sampling event. The second highest precipitation occurred for the June 28, 2023, sampling event, with 9.31 mm during the previous 7-days and 0.10 mm on the sample day. Precipitation data shows limited influence from precipitation and a much stronger correlation with freshet (Table 4). These values in the river are heavily influenced by the freshet and snowmelt during April, May, June as discussed below.

During spring freshet and snow melt, sampling events (e.g., March, April, May, and June) can be classified as having a ‘dilution’ effect to the water chemistry, although increased TSS from turbid high flows can counteract this effect. To the contrary, during more arid seasons with little to no precipitation occurring in the previous 7-days and 24-hours, flows in ditches can be attributed to regional groundwater baseline seepage. In this event, when precipitation and sampling occur following dry periods, the surface chemistry of the rocks will be washed into the ditches and be concentrated.

There was moderate rainfall prior to the September 28, 2023, event and June 28, 2023, sample event. The rainfall, along with potential freshet snowmelt in June, increased turbidity and flow in the ditches resulting in short-term effects on measurements such as TDS, TSS and potentially total metal concentrations from flushing of exposed slopes and ditch fill material. The highest turbidity and TSS values measured in the Peace River by Ecofish during the May 19, 2023, sampling event do not coincide with a rainfall event but likely freshet melt conditions.

As outlined in Section 2.3, regional bedrock groundwater in locations sampled are suspected to have elevated concentrations of dissolved sulphates due to groundwater interaction with local pyritic-shale bedrock and local bacteria, In previous sampling years from 2017 to 2022, it was observed that elevated sulphate may, to some degree, be related to dry periods following minimal precipitation during the previous 7-day and 24-hours to the sampling event. In 2023, outside of the moderate rainfall prior to the June and September sampling events, there did not appear to be elevated sulphate related to dry periods in the trend analysis. Sulphate and TDS commonly follow similar trends.

The classification of seasonal flows in ditches, therefore, are important to consider when interpreting fluctuations and exceedances in parameters measured in water quality guidelines over the period of one year.

4.3 Peace River Turbidity and TSS

Turbidity of the Peace River is monitored by BC Hydro through a series of continuous data loggers situated both upstream and downstream of the dam construction area. Time series data is collected from the left and right banks of the Peace River up-gradient of the Moberly River (stations PAM-LB and PAM-RB, respectively) were provided to Tetra Tech by Ecofish to provide a general understanding of influence by precipitation on natural sediment within the Peace River upstream from the construction area surrounding sampling events. TSS estimates are calculated from turbidity. A TSS-Turbidity relationship of 0.71 was applied for the entirety of 2023 based on in situ TSS measurements taken throughout 2023 (Ecofish, 2024).

The turbidity data, measured in NTU, is converted to a value representing TSS, in mg/L, using a conversion factor developed by Ecofish using calibration of field measurements with laboratory data (Ecofish, 2024b). The data considered by Tetra Tech include turbidity measurements for the 7-days prior to the sampling event, the day of, during, and the day following the sampling event (Appendix Table 4). Turbidity and TSS spiked during the height of spring freshet in the month of May, then decrease towards baseline conditions for the remainder of 2023. The turbidity and TSS measurements outside of May report below 35 NTU and 24 mg/L TSS, as summarized in Appendix Table 4. In May 2023, the values are generally higher on the Left bank compared to the Right Bank, similar to turbidity values in previous years, as summarized in Table 4-2.

Table 4-2: Elevated Turbidity and TSS during Water Quality Sample Events in 2023

Sampling Date	Turbidity (NTU)		TSS (mg/L)	
	LB	RB	LB	RB
28-Apr-23	28.9	20.6	33.2	23.6
19-May-23	146.4	103.9	104.0	73.9
28-Jun-23	17.3	12.3	19.2	13.6
17-Jul-23	14.4	10.2	8.1	5.7

NTU: Nephelometric Turbidity Units

The daily mean turbidity and TSS measurements reach the highest values in May 2023 (average NTU 125 and TSS 89 mg/L) during freshet and snowmelt, with a gradual increase towards May and decrease following May, shown in Figure 4-1.

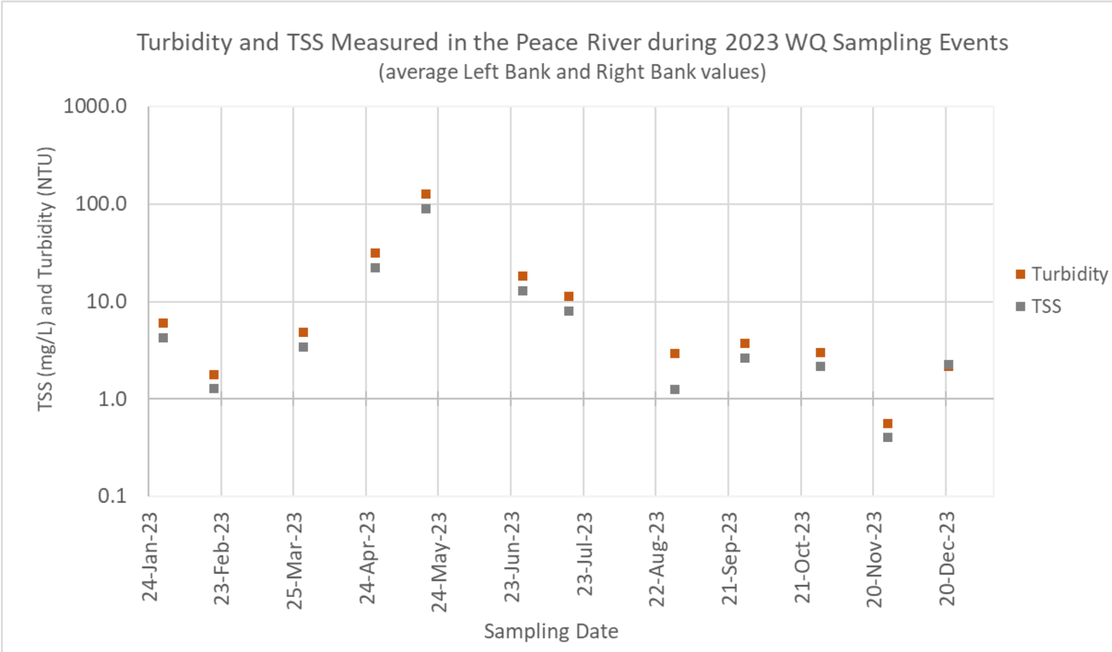


Figure 4-1: Turbidity and TSS during Water Quality Sample Events in 2023

The highest reported 7-day precipitation to occur prior to a sampling event, recorded on September 21-27, 2023 (12.31 mm), coincides with a minor increase in turbidity in TSS and turbidity values. The highest turbidity and TSS values in 2023 were measured leading up to and including the May 19 sampling event, which records no precipitation. Therefore, the relatively high turbidity and TSS on May 19, does not coincide with a precipitation event. Figure 4-1 illustrates the variability and trends in turbidity and TSS during 2023 (Ecofish, 2024b) and can be reviewed in conjunction with the precipitation events listed in Appendix Table 2.

5.0 WATER QUALITY MONITORING PROGRAM RESULTS

5.1 Sample Events in 2023

A summary of each water quality sampling event and corresponding analytical results in four (4) routine memos summarized twelve (12) sampling events at the RR, SBIAR, and LBDB catchments. Three (3) sampling events occurred at the L2 Powerhouse in January, February and March 2023 before the sample location was discontinued. In 2023, monthly results were reported in the first (January, February, March), second (April and May), third (June and July) and fourth (August, September) routine memos to BC Hydro between January to December 2023. No samples were collected in October, November, and December 2023 due to frozen and no flow conditions.

The attached Table 1 presents a summary of the dates of the sampling events and which locations had in situ or lab testing completed.

Field notes document field observations at each monitoring location including estimated flow rate and water clarity, site conditions and construction activities, if applicable to monitoring. In situ tests are completed with record of measurements for water temperature, hardness, alkalinity, pH, and electrical conductivity collected using a hand-held meter. The in situ test data is presented in the Appendix Tables 6, 8, 10 and 12.

Laboratory results for all locations are provided in Appendix B (Tables B1 to B4). A summary of BCAWQG-FST water quality exceedances listed by monitoring location and month are listed in Tables 7, 9, 11 and 13.

Appendix Table 14 presents a summary of minimum, maximum and mean values for measurements at discharge and downstream locations in 2023.

5.2 Quality Control and Quality Assurance Program

5.2.1 Overview of QA/QC Program

The Quality Control and Quality Assurance (QA/QC) program is based first and foremost on experienced field staff familiar with the water quality monitoring program adhering to the British Columbia Field Sampling Manual, Part A and Part E (BC MoE, 2013) for sample collection procedures and QA/QC practises. New sample containers were acquired from the laboratory prior to the sampling event and all handling of the containers, sampling devices and equipment during sample collection was completed wearing new nitrile gloves to minimize potential for contamination of the samples. A new disposable syringe and 0.45 µm filter are used for each sample being submitted for dissolved metals, as per field sampling procedures (BC MoE, 2013). A peristaltic pump and 0.45 µm high capacity inline filter is used when the water is too turbid for the manual syringe filtering, All samples were stored in a cooler filled with ice packs at a temperature between approximately 4°C and 8°C.

The program incorporates the use of a Travel Blank (TB), Field Blank (FB) and replicate sample to test for potential contamination during sample collection, handling, or laboratory preparation, and to evaluate the precision of laboratory analysis. Travel Blanks were prepared by the laboratory and Field Blanks were prepared in the field at sample collection sites by field staff using the same source water as was used for the Travel Blank.

5.2.2 Laboratory QA/QC

Analytical results were received from ALS Laboratories (ALS). The lab implements a detailed QC program into the sample analysis which includes a series of checks and evaluations for consistency in the sample analysis. The QC program includes method blanks, certified reference materials, laboratory control samples and duplicates. The QC Lot reported on Assay Certificates consistently met internal ALS Data Quality Objectives throughout the year.

5.2.3 Tetra Tech QA/QC

The analytical results of the QA samples (TB, FB, and replicate samples) were reviewed by Tetra Tech, and if potential contamination or concerns with analytical results were identified, they were discussed with the laboratory and/or the field sampler representatives, with reanalysis of samples completed for verification if necessary. Appendix Table 5 provides the results of the field and travel blanks (Table 5a) and replicate samples (Table 5b) in the QA program.

5.2.3.1 Blank Samples

Travel Blanks were prepared by the laboratory and Field Blanks were prepared in the field at sample collection sites by field staff using the same sourced water. If the source distilled water was contaminated, similar elemental anomalies would be expected in both the TB and the FB. Blank samples were considered to ‘fail’ where any measured value was in concentrations above the reported detection limits for that parameter. Elemental concentrations measured above detection limit can be attributed to field contamination or calibration of analytical instrumentation. During 2023, TB and FB data showed minimal occurrences of any significant concentrations of values above the detection limit. As a result, no reruns were required by the lab during 2023.

Elemental concentrations measuring above the analytical detection limits in TB and FB samples occurred once (1) during the 2023 monitoring period, as detailed in the attached Table 5a. The above detection limit value occurred for ammonia in the February 20, 2023 sample event.

The pH for the TB and FB samples ranged from 5.15 to 5.42, with an average pH value of 5.23 from the 2023 sampling events. This pH range is typical for distilled water used for the TB and FB samples.

5.2.3.2 Replicate Samples

Replicate samples were evaluated using Relative Percent Difference (RPD). When an RPD value is less than 30% it is considered an acceptable threshold for variation of surface waters.

Field replicate samples with differences of elemental concentrations above the acceptable threshold of RPD > 30% had occurrences for a variable number of parameters measured during all nine sampling events in 2023, including: January 30 (7 occurrences), February 20 (1), March 29 (3), April 28 (2), May 19 (8), June 28 (43), July 17 (1), August 30 (2) and September 28 (2). Discrepancies are attributed to sediment disturbance during the collection of the first sample. The field staff were informed of these issues and were reminded of the importance of QC procedures during replicate sampling.

5.2.3.3 Total vs Dissolved Concentrations

Tetra Tech also reviewed the data for more general anomalies and inconsistencies. The total and dissolved concentrations for the full suite of elements were continued to be compared since there are frequent occurrences of dissolved concentrations exceeding total concentrations. The results were screened for analytical error, then assessed for expected natural variability of surface waters. Most instances were due to measurements at or near the analytical detection limit and could be explained by being within an acceptable range of error up to five times the lower detection limit for the respective element. In this case of reporting within five times of detection limit, the total concentrations are considered equal to the dissolved concentrations.

Dissolved concentrations exceeding total concentrations in samples were calculated within the acceptable threshold of an RPD < 30%, with exception of the following occurrences in the May 19, 2023 (cadmium, cobalt, copper, nickel, zinc) and June 28, 2023 (barium, copper) sample events.

5.3 River Road Water Quality Monitoring

Dry, freezing and/or low or no flow conditions prevented consistent sampling at the River Road monitoring locations in 2023. In situ measurements were not collected from each station consistently every month due to dry or frozen conditions. Field observations were documented each month and results for each monthly sampling event were plotted on time series charts for trend and qualitative correlation analysis.

Sufficient flowing water permitted samples to be collected during 2023 from the following stations, with the sampled months listed in parentheses:

- LBRR-DD (March);
- RR8 (no samples);
- RR9 (March, September);
- LBRR-EDP (March, April, September);

- LBRR-UC (no samples); and
- LBRR-LC (March).

A summary of water quality exceedances at River Road relative to BCAWQG-FST listed by monitoring location and month are listed in Table 7, and the screening results based on the laboratory data are tabulated in Appendix B, Table B1.

5.3.1 In Situ Measurements and Field Observations

Values for pH, conductivity, hardness, alkalinity, water temperature, estimated flow and turbidity measured at the River Road monitoring locations are included in Table 6. At River Road during 2023, the range in water temperatures was -0.20 °C to 17.3 °C. Measurements of pH ranged between 7.76 to 8.34, alkalinity ranged between 40 to 800 ppm, hardness ranged between 240 to 800 ppm and conductivity between 21.3 to 3890 µS/cm.

Flows within the River Road ditch are ephemeral. During 2023, flow at RR was most commonly observed at LBRR-12+920 during the March through September 2023 sampling events, then only at the following downstream locations in March and September. Flow was noted at LBRR-DD, LBRR-LC, LBRR-12+920, RR9 and LBRR-EDP on March 29, 2023 and at LBRR-12+920, RR9 and LBRR-EDP on September 28, 2023. No flow was noted at RR8, LBRR-UC, LBRR-12+600, LBRR-12+700 and LBRR-12+810 throughout the year. Dry or frozen conditions prevailed for the remainder of 2023.

In the River Road catchment, considering all sampling conditions, TSS measurement ranged from a low of 9.1 mg/L (March; LBRR-LC) to a high of 1,680 mg/L (March; LBRR-EDP). For all stations, the combined average TSS was 560 mg/L, and each sample location showed variable TSS that too minimal of sampling events to recognize seasonal trends. The March, April and September TSS values measured from the LBRR-EDP location are elevated relative to the other locations sampled through the year. The source of TSS is primarily attributed to River Road run-off, scouring of sediment deposited within the River Road ditch and washing from the cut-slopes.

5.3.2 Freshwater Short-Term Maximum Exceedances

The summary of exceedances is presented in Table 7 and summarized below. The complete data results from the samples are summarized in Appendix B, Table B1.

Of the total seven (7) samples collected from River Road during 2023, fourteen (14) occurrences of elevated total metal concentrations above the BCAWQG-FST were measured, for total iron (6), total arsenic (3), total zinc (1), dissolved aluminum (2) and chlorite (2). Neutral to alkaline laboratory pH values were measured with pH ranging between 7.88 to 8.19.

At the three RR discharge locations, there was one exceedance measured at LBRR-DD (total iron, March) and three exceedances measured at RR9 (total iron, March, September; chloride, September). No sampling occurred at the RR8 discharge location. Non-discharge locations along River Road measured BCAWQG-FST exceedances at LBRR-EDP in total iron (3), total arsenic (3), total zinc (1), dissolved aluminum (2) and chloride (1) (March, April, September). No exceedance was measured at LBRR-LC in the one sampling event in March 2023. The exceedances are attributed to washing, or flushing, of sediment and secondary mineral precipitate during freshet (or precipitation following a dry period), as water contacted accumulated sediment within the ditch in addition to the exposed shale, colluvium, and overburden cut-banks.

5.3.3 Trend Monitoring and Details of 2023 Sample Results

Data results from 2017 to 2023 at River Road monitoring stations have been compiled and plotted for trend analysis. Please refer to Figures 6 to 17 for time series charts. Time series charts include pH and alkalinity, acidity, TSS and TDS, sulphate, total and dissolved aluminum, total and dissolved iron, total arsenic, dissolved cadmium, total cobalt, dissolved copper, and total zinc.

Monthly water quality monitoring measures instantaneous ambient conditions at the time of sampling and as discussed in Section 3.1 the measurements are highly susceptible to temporal climate conditions due to the small catchment and short residence time of water within the River Road ditch. Event data characterizes the influences of seasonal conditions at the site.

Water quality sampling has been inconsistent at the River Road locations since 2017 due to frequent low flow or frozen conditions. There is minimal data available from mid-2018 to the end of 2019, and variable amounts of data in 2017, 2020 to 2023 from different stations and times. The available data makes it challenging to discern seasonal trends at River Road. Additional data collection and ongoing time series trend analysis is needed to support interpretation of trends.

The measured pH values collected at River Road have remained within an acceptable BCAWQG-FST range (pH 6.5 to 9.0) during 2023 sampling events that show more consistency in 2020-23 relative to more variability in pH during 2017 and 2018 when pH values varied below and above the acceptable BCAWQG-FST. During 2023, alkalinity and pH remain relatively consistent whereas acidity is more variable and shows an overall increase between March and September although no data was collected in-between to determine a seasonal trend. The collection of acidity data is limited to primarily 2020-23 and will continue to be monitored.

During 2023, TDS and TSS values at River Road sample locations generally remain within range of measurements in 2017 through 2022. During 2023, sulphate concentrations measured within range of values collected from 2017 to 2022, which continue to straddle the BCAWQG-FLT guideline value of 429 mg/L (guideline variable based on hardness). Insufficient data was collected in 2023 to show conclusive trends.

During 2023, total and dissolved aluminum shows an overall consistent trend when samples were collected from March to September and remains within range of measurements in 2017 to 2022.

During 2023, total iron varies in concentration that measures below and above the BCAWQG-FST guideline and within range of measurements since 2017. Total iron measured at LBRR-EDP and RR9 are relatively consistent and elevated above the BCAWQG-FST guideline during 2023. The one sample collected from LBRR-DD in March 2023 was elevated above the BCAWQG-FST. During 2023, dissolved iron remains below the BCAWQG-FST guideline.

Metal concentrations for a number of elements, including total aluminum, total iron, total arsenic, total cobalt, total and dissolved copper, and total zinc show a trend from a higher value at freshet, coincident with elevated TSS values) in the spring that gradually decreases through summer and autumn to October. In 2023, metals generally measure within range of concentrations since 2017.

5.4 SBIAR Water Quality Monitoring

The South Bank Initial Access Road (SBIAR) shale slope was initially exposed in 2015 as part of road construction works on the south bank between RSEM R6 and Area A. The total area of the shale slope is approximately 14,000 m^2, between both the East and West slopes.

At SBIAR, sufficient flowing water permitted samples to be collected during 2023 from:

- RBSBIAR-US (September);
- RBSBIAR-DS (March to September);
- RBSBIAR-EUS (May to July); and
- RBSBIAR-EDS (March).

In situ measurements were collected in the same months when sampling was possible, in addition to low flow conditions at RBSBIAR-EUS (March, April, August and September) and RBSBIAR-DS (October) that allowed only situ measurements when sample collection was not possible. Field observations were documented each month and results for each monthly sampling event were plotted on a quarterly basis on time series charts for trend and qualitative correlation analysis.

A summary of BCAWQG-FST water quality exceedances at SBIAR listed by monitoring location and month are listed in Table 9. The complete set of screening results based on the laboratory data are tabulated in Appendix B, Table B2.

5.4.1 In Situ Measurements and Field Observations

Values for water temperature, pH, total alkalinity, and electrical conductivity measured at the SBIAR monitoring locations are included in Table 8. At the SBIAR locations during 2023, the range in water temperatures was -0.1 °C to 21.3 °C. Measurements of pH ranged between 7.00 to 9.31, alkalinity ranged between 40 and 450 ppm, hardness ranged between 180 to 800 ppm and conductivity between 575 to 1,347 µS/cm.

Flows in the SBIAR ditch system can vary between increases from the upstream to downstream locations, with flows of approximately 0.0005 L/s to 2.5 L/s. During the August 2023 sampling event, the ditch upstream from RBSBIAR-EUS was noted to be filled in.

5.4.2 Freshwater Short-Term Maximum Exceedances

Concentrations of total and dissolved iron, dissolved aluminum, total arsenic, total zinc, total cobalt, and dissolved cadmium were measured as exceedances to the BCAWQG-FST at various locations in the SBIAR catchment during 2023 (Appendix Table 9). Concentrations typically increase at downstream locations due to the influence of sediment washing in the ditchline and influence of SBIAR cut-slope.

In 2023, at the upstream SBIAR locations, one (1) exceedance was measured at RBSBIAR-US in one sampling event (September 2023) and one (1) exceedance was measured at RBSBIAR-EUS June 2023.

In 2023, at the downstream SBIAR locations, total iron (2), dissolved iron (1), dissolved aluminum (2), total arsenic (2), total zinc (1), total cobalt (1), dissolved cadmium (1) were measured at RBSBIAR-DS in six sampling events (March, April, June to September 2023), and total iron (1), total arsenic (1), total zinc (1) were measured at RBSBIAR-EDS in one sampling event (March 2023).

It is noted that the water flowing from the downstream locations do not have a direct downstream receptor; the water from the east ditch passes under the road via culvert to the downstream location in the west ditch where all water flows into a limestone armored spillway into a ditch which conveys to the RSEM R6 pond. Details of water flow and the intensive water quality monitoring program in RSEM R6 is referenced in Section 3.2 above.

5.4.3 Trend Monitoring and Details of 2023 Sample Results

Monthly water quality monitoring measures instantaneous ambient conditions at the time of sampling and, as discussed in Section 4, the measurements are highly susceptible to temporal climate conditions due to the small catchment and short residence time of water in the SBIAR ditch. Recurring trends at SBIAR over the monitoring periods sine 2017 may be preliminary indications of long-term trends and are discussed below and summarized in the attached Figures 18 to 31. In 2018 and 2019 a trend was observed for total metals showing a potential progressive increase in concentrations was occurring, although this appears to have been short-term and temporary and has not been observed in the subsequent monitoring years from 2020 to 2023.

Alkalinity and pH values indicate that waters have remained alkaline from 2017 through 2023. Alkalinity is more variable than pH values. In 2020 and 2021, an overall increase in alkalinity is observed to occur between freshet in the spring towards the fall and winter month, which is observed in 2023 at RBSBIAR-DS but lack of significant data does not show this trend at other SBIAR locations. Acidity measured during 2023 remains within range to below range of values collected since 2018.

Typically, the SBIAR ditches measure variable TSS and TDS values attributable to the relatively small catchment and short residence time of waters that are subsequently sensitive to flux in surface water inputs from precipitation. In 2023, TDS values were elevated at RBSBIAR-DS in March, otherwise TDS values have remained relatively constant at the SBIAR locations and within range of previous sampling years since 2017.

During 2023, sulphate measures within range of values collected since 2017 with exception to one spike in sulphate at RBSBIAR-DS in March 2023. Sulphate values show more variability in 2020 than in previous (2017 to 2019) and following (2021 to 2023). The RBSBIAR-DS location shows a decreasing trend from March to September 2023, then consistent with sulphate values at all sample locations. A seasonal trend in the SBIAR ditches is observed whereby sulphate concentration peaks in spring/early summer followed by an overall decrease.

Ammonia (NH_4 as N) is subject to a temperature and pH-dependent BCAWQG-FST and BCAWQG-FLT guideline. Although no exceedances are measured to the BCAWQG-FST, it is observed that ammonia values have commonly measured higher in the downstream SBIAR ditches (RBSBIAR-DS/-EDS) than the upstream ditches from 2017 to 2022. In 2023, ammonia values show more variability, but minimal sample collection does not offer further trend analysis in 2023.

During 2023, total and dissolved aluminum measure within range of values collected since 2017. In 2023, the RBSBIAR-DS location was elevated in total aluminum in March (in addition to RBSBIAR-EDS) and September, relative to lower values during the summer. The BCAWQG-FST guideline relevant prior to August 2023 for dissolved aluminum measures three exceedances above the guideline, two (2) at RBSBIAR-DS and one (1) at RBSBIAR-EUS. For the BCAWQG-FLT guideline relevant after August 2023 for total aluminum, there were not enough samples and data collected to provide a long-term average, although the discrete September 2023 samples collected from RBSBIAR-DS and RBSBIAR-US both measured above the calculated (hardness, pH and DOC-dependent) BCAWQG-FLT guideline.

In 2023, total iron measures within range of values collected since 2017 and shows a similar spike in concentration in March and September at RBSBIAR-DS, RBSBIAR-EDS and RBSBIAR-EUS, relative to lower values during the summer months. In 2023, dissolved iron measures within range of values collected since 2017 with exception to a spike in dissolved iron in March 2023 at RBSBIAR-DS that is a higher value than measured since 2017.

Total iron shows a more variable trend below and above the BCAWQG-FST guideline, whereas dissolved iron commonly remains below detection limit and the BCAWQG-FST guideline. The measured dissolved iron in March 2023 at RBSBIAR-DS is an exception and exceeded the BCAWQG-FST guideline.

During 2023, the concentrations of metals, such as arsenic, cobalt, copper, and zinc measure within range of values in previous years from 2018 to 2022, although follow a similar trend of elevated concentration in March and September 2023, and lower values during the summer months. In 2023, dissolved cadmium shows a decreasing trend from March to September.

The downstream / upstream ratio of total zinc measured in both the RBSIBAR west ditch and RBSBIAR east ditch is shown in Figure 30a and 30b. In the years of 2018, 2019 and 2020, an annual increasing trend was observed but this does not appear to have continued since in the years of 2021, 2022 and 2023. Minimal samples were collected from both upstream and downstream locations in either ditch in 2023 for further trend analysis. In September 2023, one ratio of total zinc values in the west ditch measures below or within range of former years and does not indicate further increasing trend.

Monthly sampling in the SBIAR catchment occurred from 2017 to 2023 and will need to continue to be monitored going forward into 2024 for effective observations of trends.

5.5 L2 Powerhouse

Water quality sampling commenced at two locations within the BC Hydro L2 Powerhouse area at L2-US and L2-DS in October 2020, and continued sampling until March 2023, then were discontinued.

The L2-US location was sampled in each of the months of January, February and March 2023. The L2 Powerhouse L2-DS location was not sampled in 2023 due to frozen or dry conditions prior to the discontinuation of the L2 Powerhouse sample locations in March. In situ measurements were collected in each month where a sample for lab testing was collected.

A summary of in situ measurements are provided in Table 10 and water quality BCAWQG-FST exceedances measured at the L2 Powerhouse location are listed in Table 11. Screened lab data results are tabulated in Appendix B, Table B3.

Water from the L2 Powerhouse area is conveyed to AFDE RSEM R6 pond as needed or to the water treatment facility that discharges to the sediment pond. Water from the AFDE RSEM R6 pond is monitored prior to discharge.

5.5.1 Field Observations and In Situ Measurements

In situ measurements collected from January to March 2023 at L2-US recorded a range of pH 7.74 to 8.55 with mean pH value of 8.24, electrical conductivity 350 to 610 µs/cm, hardness 250 to 450 ppm, alkalinity 80 ppm, water temperature 5.8 and 7.2 °C, and flow 2.0 to 5.0 L/s, with turbidity ranging between clear to slightly turbid.

No in situ measurements were collected from the L2-DS location in 2023.

5.5.2 Freshwater Short-Term Maximum Exceedance

In the three sampling events during 2023 at the L2-US location, there was one BCAWQG-FST exceedance measured for total iron (1).

No water quality samples were collected from the L2-DS location in 2023.

5.5.3 Trend Monitoring and Details of 2023 Sample Results

Trend charts for the L2 Powerhouse sample stations include sampling and further trends in 2023 at the L2-US location, since the L2-DS location was not sampled. From 2020 to 2023, the pH values measured at L2-US are consistently neutral to alkaline. Total alkalinity values are highly variable from 2020 to 2023; at L2-US, alkalinity shows a decreasing trend since August 2022 to March 2023, although is within range of alkalinity values since 2020. Acidity values measured at the L2 Powerhouse have been commonly at or below detection limit; at L2-US, acidity shows a decreasing trend from January to March 2023 at values within range of acidity values since 2020. Trend monitoring is discussed below and summarized in the attached Figures 31 to 44.

Sulphate and TDS values at L2-US and L2-DS show an overall decreasing trend since May 2022 that continues to March 2023 at L2-US. TSS values measured from January to March 2023 at L2-DS indicate a decreasing trend that remains within range of measurements collected since 2020.

Metal concentrations at L2-US from January to March 2023 show a decreasing trend for total aluminum, total iron, total arsenic, dissolved cadmium, and total zinc. The one (1) exceedance measured at the L2-US location in 2023 is for total iron in March prior to a sharp decreasing trend. Dissolved aluminum is measured below the BCAWQG-FST and shows an overall consistent trend from 2020 to 2023. Dissolved iron measures below detection limit in 2023 which is a continued trend from 2020.

Total and dissolved selenium do not have a BCAWQG-FST guideline for reporting requirements, although it is noted that both total and dissolved selenium show a decreasing trend at L2-US from above the FLT guideline in June through November 2022 to below the FLT guideline in December 2022 and continued decrease from January to March 2023.

5.6 BC Hydro Left Bank Debris Boom

Water quality sampling commenced at the BC Hydro LBDB area in October 2020 and continued sampling through the 2023 monitoring period. The most consistently sampled location is LB Pond. Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LB Pond location, is immediately following a significant rainfall event. Sample staff are instructed to sample these locations outside of regular monitoring events, if possible, when high rainfall is observed.

The LB Pond was sampled five times from March through September 2023. No other sample locations were sampled in 2023 due to dry or frozen conditions. The sample locations are shown on Figure 3.

A summary of water quality exceedances at LBDB relative to BCAWQG-FST listed by monitoring location and month are listed in Table 13, and the screening results based on the laboratory data are tabulated in Appendix B, Table B4.

5.6.1 Field Observations and In Situ Measurements

In 2023, six (6) in situ measurements were collected from LB Pond during each of the April to September sampling events.

In 2023, a range of in situ measurements were collected from LB Pond for pH (7.10 to 9.32), electrical conductivity (2.48 to 3800 µs/cm), hardness (120 to 800 ppm), alkalinity (80 to 800 ppm), water temperature (7.3 to 23.1 °C) and no flow.

In 2023, no in situ measurements were collected from the upstream (LBDB-WUS and LBDB-EUS) or downstream (LBDB-WDS and LBDB-EDS) Armor ditches or the laydown drainage (LBDB-LD-MS and LBDB-LD-DS) locations due to dry or frozen conditions.

5.6.2 Freshwater Short-Term Maximum Exceedances

In 2023, BCAWQG-FST exceedances were not measured at the LB Pond location during the April, June, July, and August sampling events; four (4) exceedances were measured in the September sampling event for total and dissolved iron, dissolved aluminum, and total manganese. LB Pond is not a discharge station. Water is not commonly observed to discharge from the LB Pond, but if it does it passes through a limestone lined water management ditch system to the downstream monitoring station.

Water flow from the Armor Ditch sample locations are considered discharge locations but no samples or data was collected here in 2023 due to dry or frozen conditions.

5.6.3 Trend Monitoring and Details of 2023 Sample Results

Sampling at BC Hydro's LBDB area has primarily been limited to sampling at the LB Pond location, therefore comment on trend observations are limited to this location. Trend monitoring will continue in 2024 with the availability of further monthly sampling data. Trend charts are provided in Figures 46 to 57.

At LB Pond, pH values have remained neutral to alkaline with pH values at or above 7.0. Total alkalinity values consistently increase through the year from March to September 2023, which is a similar trend observed to occur in the previous years since 2020. Acidity values measure within a consistent range from 2020 to 2023. Sulphate values show a gradual increasing trend from March to autumn months in both 2022 and 2023, that measures above the BCAWQG-FLT guideline for the five months of sampling in 2023. This differs from a more consistent trend for sulphate values above the BCAWQG-FLT during the 2021 monitoring period. TDS values follow a similar trend to sulphate with a relatively consistent trend in 2021 followed by an increasing seasonal trend in 2022 and 2023. TSS values measure relatively consistent values in 2023, and more variable trends during 2021 and 2022.

Dissolved aluminum measured at LB Pond remains below the short-term BCAWQG-FST guideline in 2023 except in the September 2023 under the BC Ministry guidelines (2021), which changed to long-term BCAWQG-FST guideline in August 2023.

Total and dissolved iron concentrations follow similar trends in 2023 relative to previous years. At LB Pond, total iron exceeds the BCAWQG-FST guideline in September 2023, and dissolved iron exceeds the BCAWQG-FST in September 2023.

Total arsenic, dissolved cadmium, total cobalt, dissolved copper, and total and dissolved zinc do not measure BCAWQG exceedances during 2023, and commonly show a decreasing trend during 2023.

6.0 CONCLUSIONS AND RECOMMENDATIONS

A water quality monitoring program was implemented on behalf of BC Hydro to monitor the water quality at PAG exposure locations from River Road at Blind Corner, South Bank Initial Access Road, BC Hydro Left Bank Debris Boom, and L2 Powerhouse. Upstream, midstream, and downstream and discharge monitoring locations were established to characterize water quality and to maintain a continuous monitoring record commensurate with previous sampling completed in 2016 by Lorax on behalf of PRHP (where applicable). The water quality program is conducted in accordance with the CEMP Rev. 12, Appendix E (Rev. 6.1) Acid Rock Drainage and Metal Leachate Management Plan, Section 5.2.1.7 (BC Hydro, 2023).

The program has incorporated monthly in situ water quality measurements and observations with laboratory analysis outside of frozen or dry conditions. Field observations were recorded from all areas monthly regardless of weather conditions or ability to collect in situ measurements or take samples for lab testing.

Water chemistry is monitored to identify influence of ARD/ML processes on water quality at River Road from construction related exposed PAG shale at Blind Corner, shale exposed in the east and west ditches within SBIAR, and construction PAG shale exposures at the BC Hydro LBDB and L2 Powerhouse areas.

The sampled locations are generally ephemeral. Residence time for water is low in the investigated area ditches due to their small catchment size. The flows in ditches are susceptible to seasonal change and flow rate is highly influenced by local precipitation events, thus the classification of flow in ditches can assist to interpret the source and subsequent chemical fluctuations in water sampled. For example, flows in ditches can be attributed to shallow or regional groundwater, spring freshet or surface run-off, dependent on the season and amount of precipitation recorded before and during the sampling event. Monthly water quality monitoring measures instantaneous water quality and may not be reflective of long-term baseline conditions.

The water quality program is achieving the purpose of evaluating water quality from dam site areas where construction related PAG exposures and PAG contact surface water is identified. The results of the program demonstrate that ARD/ML processes are occurring, however the management and mitigation measures implemented are working and that water quality remains primarily neutral to alkaline with metal concentrations dominantly below the established water quality criteria. The water quality monitoring program provides a framework for identifying water quality concerns from the exposed rock cuts in a timely manner and implementing the required mitigation measures.

6.1 River Road Water Quality Monitoring

Water quality laboratory data was collected from four locations (LBRR-DD, LBRR-EDP, LBRR-LC and RR9) and in situ measurements were collected at five of a total eleven water sample locations along the River Road catchment in 2023. No water quality samples or in situ measurements were collected from RR8 or LBRR-UC in 2023. The LBRR-12+500 location was discontinued and not sampled in 2023.

In situ field measurements of pH within the River Road ditch indicated a neutral to alkaline pH throughout the 2023 sampling year. In 2018 and 2019, acidic waters were collected in the upper portions of the ditch underlying the exposed shale cut-bank. However, in these instances the pH values progressively returned to circumneutral levels at the discharge location in part due to contact with limestone rip-rap in the ditch, and potential alkalinity input from groundwater or outflow from the upper cut-off ditch. The observation of consistent neutral to alkaline pH drainage conditions at all locations in River Road area in 2023 are indicative of changes in the exposed PAG slope over time. Visual observations show that the slope has weathered and developed a partial clay capping surface which may be limiting ARD/ML reactions, and sections of the exposed PAG slope have been observed to have naturally revegetated in localized areas.

Exceedances of total iron, total arsenic, total zinc, dissolved aluminum and chloride were noted in sampling events in March, April and September 2023. The exceedances are primarily attributed to washing, or flushing, of sediment and secondary mineral precipitate during freshet (or precipitation following a dry period), as water contacted accumulated sediment within the ditch in addition to the exposed shale, colluvium, and overburden cut-banks. It is anticipated that sediment in the ditch will continue to accumulate a small amount of secondary mineral formed by up-gradient ARD/ML processes. These minerals commonly contain an elevated concentration of metals related to

ML and mineral precipitation from acid neutralizing reactions. Sediment is also introduced into the ditch from the roadway.

Review, in previous years, of the Peace River monitoring data from Ecofish show that there are seasonal fluctuations in total metals concentrations and concentrations are highest during initial freshet in the Peace River. Additionally, Ecofish has reported that there were natural exceedances in the Peace River of the BCWQG for the protection of aquatic life, including total iron at upstream Peace River location, and these natural exceedances occurred predominantly during the freshet period (April to June) and observed at all sample sites (Ecofish, 2022). Exceedances were most often associated with elevated concentrations of suspended solids in the Peace River (Ecofish, 2022). During the sampling events in 2023, the highest turbidity measured in the Peace River was for the May 19, 2023 sample event, which does not appear to correlate with significantly higher TSS or BCAWQG-FST exceedances in May 2023 for the water quality monitoring.

ARD/ML management and mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone rip-rap lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone rip-rap to provide neutralization potential and mitigate against acidic drainage.

Chemical efficiency of the limestone to buffer acidic water is decreased when coated in precipitate. The formation of mineral scale can concentrate metals from solution as a result of the aqueous acid-base reactions. The mineral scale and sludge are susceptible to scouring and being washed during heavier rain events which has potential to reduce overall water quality conveyed down-gradient. The limestone rip-rap in the River Road ditch was replaced in July 2021, due to the accumulation of mineral scale onto the limestone, and sample events in July and August 2021 was limited due to dry or frozen conditions. Visual inspection of the limestone during 2022 and 2023 showed minimal precipitate formation in the surfaces, although some limestone rip-rap was obscured due to road sediment entering the ditches. The analytical results from 2023, combined with visual inspection, support that the limestone is effective in the maintenance of neutral alkaline drainage conditions and managing metal concentrations. The effectiveness and impact of the limestone rip-rap will continue to be monitored in future sampling events and analyzed for trend analysis over time.

The seasonal flows in ditches are important to consider when interpreting fluctuations and exceedances in parameters measured in water quality guidelines. The source of TSS is primarily from River Road run-off, scouring of sediment deposited within the River Road ditch and washing from the cut-slopes. Seasonally, elevated TSS levels have been noted to occur during spring melt and freshet season, typically April, when water flow can wash elevated precipitates from rock. The March 2023 sampling event represents both a warming event with melting and early spring freshet conditions.

There is limited data available at River Road in 2023. In March 2023, TSS measurements at LBRR-EDP and RR9 measure higher than the LBRR-DD and LBRR-LC locations. Total iron, total arsenic, total cobalt and total zinc are also elevated at LBRR-EDP and RR9 in March 2023.

The discharge locations to the Peace River of LBRR-DD and RR9 measure discharge flow and BCAWQG-FST exceedances in 2023. An estimated flow of 1 L/s at LBRR-DD measured one exceedance in total iron in March 2023. At RR9, an estimated flow of 1 L/s measured one exceedance in total iron in March, and an estimated flow of 0.075 L/s measured two exceedances in total iron and chloride in September 2023. No flow or samples were collected from the RR8 discharge location in 2023.

The measured lab pH of 8.19 (LBRR-DD), pH of 7.88 to 8.11 (LBRR-EDP) and pH of 7.92 and 8.05 at RR9 are within the acceptable range for BCAWQG-FST and indicate neutral to alkaline conditions. Low pH water has capacity to dissolve metals more readily than neutral, or alkaline, water.

The purpose of the diversion pipe is to address erosion and sediment control by transport of run-off water into an elongated ditchline to reduce flow velocities and to promote settlement of suspended sediment prior to discharge at RR8 and RR9. Inlets to culverts RR9 and RR8 are slightly elevated from the ditch base which will allow water to pond within the ditch and infiltrate or discharge via the culverts only if water levels reach sufficient height. In previous years it was noted that the diversion pipe was successfully reducing the amount of direct high TSS discharge into the Peace River by allowing the water to be collected and slowly infiltrate into the River Road ditch.

The estimated 1 L/s flow discharge rate from RR9 in March 2023 measured one BCAWQG-FST exceedance in total iron, which is interpreted to be related to freshet and the subsequent increase in turbidity and TSS, as shown in the EcoFish data. Exceedances are often associated with elevated concentrations of suspended solids in the Peace River.

The lower chimney (water quality monitored at LBRR-LC) drains into the River Road ditch down-gradient of LBRR 12+500 and up-gradient of LBRR-RR9. The LBRR-LC location was measured once in 2023 during March with no BCAWQG-FST exceedances. The upper chimney LBRR-UC location was not sampled in 2023. Since there is minimal data available for 2023, there is no to minimal indication that sediment accumulation is occurring on the limestone of the lower chimney ditch.

Recommendations for River Road

The River Road sampling stations demonstrate consistent neutral to alkaline drainage conditions in 2023. Additional slope mitigation is not required, however, disturbance of the shale slope is to be avoided as it may re-initiate ARD/ML processes if fresh surfaces are exposed. If erosion or scouring of the shale slope and fresh surface exposures are noted, additional short-term in situ monitoring in the River Road ditch should be evaluated to quantify the effect of fresh shale exposure on water quality, and if required additional mitigation should be considered.

The sediment source for elevated TSS is mainly attributed to scouring of accumulated sediment within the ditch from road grading and run-off from previous events, which includes washing, or flushing, of the exposed shale, colluvium, and overburden cut-banks. Continued management of the drainage system is required to reduce the amount of sediment infilling to the ditch from road grading operations as this sediment encases the limestone which reduces chemical efficiency for ARD mitigation and prematurely fills the cistern, which limits its performance to supress TSS.

The limestone rip-rap lining was last replaced in July 2021 and continues to be monitored to assess needs for maintenance, cleaning, descaling and/or removal and replacement of new limestone. With increased use of River Road, sediment and erosion control measures will be needed to address the management of sediment load coming from the road into the ditch, until such time that River Road is paved. The limestone is monitored for accumulation of precipitates and sediment and refreshed either by cleaning or replacement as needed, which was not determined to be required during 2022 or 2023.

During the sampling events in 2023, discharge from River Road to the Peace River was noted during March and September, with BCAWQG-FST exceedances measured at RR9 in March and September, and LBRR-DD in March 2023. No discharge at RR8 was observed from 2020 to 2023. It is recommended that in situ water quality measurements are collected from any discharge observed from culvert RR8 and/or RR9 during high flow events even if outside of regular sampling events.

As per CEMP Appendix E Section 5.2.1.7, it is recommended that water quality monitoring is continued on a monthly basis within the River Road catchment at the downstream stations. Continuous monthly monitoring will evaluate the effectiveness of ARD/ML mitigation strategies. There may be opportunities to reduce in situ sampling analysis at the upstream locations given the consistency of in situ measurements over time. The sampling locations and frequency of monitoring will be reviewed with BC Hydro for the 2024 sampling year.

6.2 SBIAR Water Quality Monitoring

Water quality data was collected from four established sampling locations in 2023 that measure water directly from within the SBIAR ditch locations. The ditch samples provide long-term characterization of SBIAR water management and water quality originating from the SBIAR PAG slope at the upstream and downstream location in the east and west ditches. In May 2023, changes were made with respect to water conveyance in Area 21 up-gradient of SBIAR western slope. The corrugated pipes which were used to divert surface flow from Area 21 down the shale slope and along the ditch, to avoid creating PAG contact water were removed. There is no evidence that this had any effect on the overall water quality of the SBIAR monitoring locations.

Water flowing through the SBIAR ditch has no direct downstream receptor, and all water in the east and west ditches is conveyed directly to the PRHP RSEM R6 pond which is an approved PAG contact water management facility. Downstream water quality is monitored by PRHP within the PRHP RSEM R6 pond for management prior to discharge into the Peace River.

Evidence of active ARD/ML processes are observed on the shale slopes in SBIAR through observation of secondary iron hydroxide mineral formation. Alkalinity and pH indicate that the waters in SBIAR ditches have consistently remained alkaline during the monitoring periods from 2017 through 2023.

During the 2023 sampling period, sulphate values remained below the BCAWQG-FLT long-term guidelines at SBIAR sample locations, with exception to the two measurements in March 2023. From 2017 to 2019, the upstream location in both east and west ditches showed relatively low and consistent sulphate values. In July 2020, sulphate values at the RBSBIAR-US location sharply increased then remained at an elevated level through 2021 and 2022. In 2022, sulphate values remained below BCAWQG-FLT, which continued within a similar range of values during 2023 except for the RBSBIAR-DS and RBSBIAR-EDS locations in March 2023.

Screening of analytical data during 2023 for the downstream ditch locations resulted in BCAWQG-FST guideline exceedances at RBSBIAR-DS for total iron (2), dissolved iron (1), dissolved aluminum (2), total arsenic (2), total zinc (1), total cobalt (1) and dissolved cadmium (1) in three of six total samples analyzed in 2023. Exceedances at RBSBIAR-EDS were measured for total iron (1), total arsenic (1) and total zinc (1) in the one sample analyzed in 2023 (March).

Recommendations for SBIAR Water Quality Monitoring

The collection of one up-gradient and one down-gradient water sample from both the western and eastern SBIAR ditch is suggested to continue through 2024 for comparative purposes.

Changes to the vicinity of RBSBIAR-US have resulted in lower flows due to sediment and construction activities in 2023, therefore minimal samples were possible. Continued observations are required in 2024.

Downstream water is collected within the PRHP RSEM R6 pond for management prior to discharge into the Peace River. As per CEMP Appendix E, Section 5.2.1.7, since there is low to moderate risk of negative downstream effects on water quality, monitoring of water quality within SBIAR is recommended to be continued on a monthly basis in 2024. It is recommended that BC Hydro implement a long-term solution for the Site C operations phase for the exposed shale slope due to potential for ongoing ARD/ML processes.

6.3 L2 Powerhouse Water Quality Monitoring

Water conveyed to AFDE RSEM R6 pond from the L2 Powerhouse area is non-PAG contact. Water that is acidic or elevated in metals from the L2 Powerhouse area is pumped to the water treatment facility which discharges treated water to the RSEM R6 pond. Water is monitored by PRHP prior to discharge from the RSEM R6 pond.

During 2023, ongoing construction of the Powerhouse adjacent to the L2 slope included concrete works which may have mixed with drainage at the base of the L2 slope. Water quality sampling did not occur at L2-DS in 2023 and continued for January through March 2023 at L2-US before discontinuation of the sample location. Construction in 2023 extended to cover the locations of the L2 water quality sampling sites and sampling of the sites was terminated in April 2023.

One BCAWQG-FST exceedance was observed at L2-US in January, and none in February or March 2023. Due to the complex construction activities and water management that diverts water around the site, the sample stations may be influenced by factors outside of the shale excavations.

Recommendations for L2 Powerhouse Water Quality Monitoring

It may be important to continue to evaluate the potential for changing flow patterns and modification needed in relation to construction changes.

There are no current recommendations to reestablish sampling locations or continue sampling at L2 Powerhouse for the 2024 monitoring period.

6.4 BC Hydro Left Bank Debris Boom Monitoring

Sampling at BC Hydro's LBDB area commenced in 2020 and initially included sampling at LB Pond and a Peace River side channel location, which is now flooded. Additional sample locations were added in July 2021 following a review of the area to monitor construction contact water. The added monitoring locations are located in the armor ditches at the toe of the exposed construction PAG faces and laydown drainages downstream of the LB Pond. All locations were monitored in 2023 and sampled monthly outside of dry or frozen conditions.

Water management structures and ditch linings were amended in 2021 to improve flow management, prevent erosion and provide acid buffering capacity with limestone lining of ditches. These were proactive measures to manage signs of erosion and initial signs of ARD/ML generation on the exposed shale slopes. Mitigation and management controls were implemented in the LBDB area as discussed in Section 3.4. The exposed PAG slopes are temporary and PAG exposures are planned to be fully inundated by the reservoir filling when further flooding of the Peace River occurs, forecasted in the August of 2024.

The LB Pond station is the only station that has had consistent sample collection monthly during 2023. The other sampling stations are generally dry except after heavy rainfall events. No sampling of the armor ditches and laydown drainage occurred in 2023 due to dry or frozen conditions.

At LB Pond, in six sampling events between April to September 2023 there were BCAWQG-FST exceedances measured for total iron (1), dissolved iron (1), dissolved aluminum (1) and total manganese (1) in the month of September 2023. No BCAWQG-FST exceedances were measured in the months of April to August 2023 at LB Pond. Water is not commonly observed to discharge from the LB Pond, but if it does it passes through a limestone lined water management ditch system.

The LBDB ditches are designed to drain to sufficiently sized sumps to retain water from the ditches should there be increased water inputs such as rainfall events, which did not occur in 2023. Field samplers confirmed that there was no direct discharge to the Peace River in 2023, and that the sampled ditches were dry or frozen in 2023.

Recommendations for LBDB Water Quality Monitoring

BC Hydro should continue to monitor water quality on a monthly frequency to monitor future construction related activities in and around the catchment area. The exposed PAG slopes should continue to be monitored for evidence of ARD/ML processes including precipitate formation and oxidation staining until it is inundated by the reservoir.

LB Pond is the only location within the area that has been consistently available for sampling. Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LB Pond location, is immediately following significant precipitation. Field sampling staff are instructed to sample these locations outside of regular monitoring events, if possible, when high rainfall is observed.

7.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

PROFESSIONAL
PROVINCE OF
E. A. MASSEY
56480
BRITISH COLUMBIA
GEOSCIENTIST

2024-03-27

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
PERMIT NUMBER: 1001972

Prepared by:
Erica Massey, M.Sc., P.Geo.
Geoscientist
Mining Practice
Direct Line: 250.862.4832
erica.massey@tetratech.com

Reviewed by:
Lara Reggin, P.Geo.
Principal Consultant
Mining Practice
Direct Line: 604.608.8631
lara.reggin@tetratech.com

/bi

REFERENCES

Bai, Z., Dong, Y., Wang, Z and Zhu, T. (2006). Emission of ammonia from indoor concrete wall and assessment of human exposure. *Environment International*. 32(3):303-11. DOI: 10.1016/j.envint.2005.06.002.

BC Hydro (2023). Construction Environmental Management Plan, Site C Clean Energy Project, Section 5.2.1.7 Revision 5.0 (February 19, 2019), Revision 5.1 (April 19, 2019), Revision 6.0 (July 15, 2019), and Revision 6.1 (December 12, 2019), Revision 7 (September 4, 2020), Revision 8 (June 21, 2021), Revision 10 (March 9, 2022). Revision 11 (October 10, 2022), Revision 12 (October 23, 2023), Appendix E (Rev.6.1).

BC Hydro (2022). Site C Meteorological and Air Quality Stations. Retrieved: https://envistaweb.env.gov.bc.ca

BC Ministry of Energy and Mines (1998). Policy for Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia. July 1998.

BC Ministry of Environment, BC MoE (2013). B.C. Field Sampling Manual: 2013 – For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples.

BC Ministry of Environment, BC MoE (2013). B.C. Field Sampling Manual, Part E Water and Wastewater Sampling. Accessed: https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual

BC Ministry of Environment, BC MoE (2021) BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report. Water Protection & Sustainability Branch. Clark, M.J.R., editor (2003) British Columbia Field Sampling Manual. Water, Air and Climate Change Branch, Ministry of Water, Land and Air Protection, Victoria, BC, Canada. 312pp.

BC Ministry of Environment, BC MoE (2023) BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report. Water Protection & Sustainability Branch. Clark, M.J.R., editor (2003) British Columbia Field Sampling Manual. Water, Air and Climate Change Branch, Ministry of Water, Land and Air Protection, Victoria, BC, Canada. 312pp.

BC Biotic Ligand Model software provided by the BC Ministry of Environment and Climate Change Strategy Water Protection & Sustainability Branch (BC MoE).

Ecofish Research Ltd. (2022). PAG Contact RSEM Pond Monitoring: Peace River Surface Water Quality and Pond Toxicity 2021 Annual Report. March 10, 2022.

EcoFish Research Ltd. (2023a). PAG Contact RSEM Pond Monitoring: Peace River Surface Water Quality and Pond Toxicity 2022 Annual Report.

EcoFish Research Ltd. (2024a). PAG Contact RSEM Pond Monitoring: Peace River Surface Water Quality and Pond Toxicity 2023 Annual Report.

EcoFish (2024b) PAM 2023 Data for Tetra Tech. Reviewed January 30, 2024.

Hemmera Envirochem Inc. and BGC Engineering Inc. (2012) Environmental Impact Statement, Site C Clean Energy Project, Volume 2, Appendix F, Groundwater Regime Technical Data Report, document number 06-105, December 2012.

Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. (2015) Site C Clean Energy Project: Implementation design geochemical characterization status at the end of 2014.

Lorax Environmental Services (2024). Site C Clean Energy Project Acid Rock Drainage and Metal Leachate Management 2023 Annual Report.

Price, W.A. 2009. MEND Report 1.20.1: Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials.

Tetra Tech (2018) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road and L3 Creek 2017 Annual Report. IFU March 15, 2018.

Tetra Tech (2019) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, and L3 Creek 2018 Annual Report. IFU March 15, 2019.

Tetra Tech (2020) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, and L3 Creek 2019 Annual Report. IFU March 31, 2020.

Tetra Tech (2021) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, L3 Creek, Left Bank Debris Boom and L2 Powerhouse 2020 Annual Report. IFU March 4, 2021.

Tetra Tech (2022) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, L3 Creek, BC Hydro Left Bank Debris Boom and L2 Powerhouse 2021 Annual Report. IFU March 30, 2022.

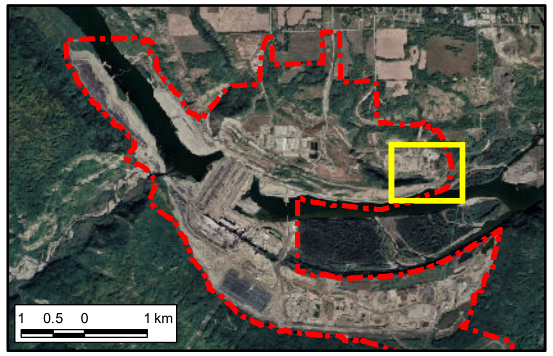
Tetra Tech (2023) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, BC Hydro Left Bank Debris Boom and L2 Powerhouse 2022 Annual Report. IFU March 28, 2023.

FIGURES

LEGEND

- Water Sample (Insitu Testing Only)
- Water Sample (Insitu Testing & External Lab Testing)
- Discharge Location
- Culvert
- Ditch
- Ditch Diversion
- Howe Pit
- Blind Corner Outcrop
- Site C Project Boundary

Sample ID	Easting	Northing
LBRR-RR8	632262	6229624
LBRR-RR9	632460	6229680
LBRR-EDP	632715	6229832
LBRR-DD	632853	6229862
LBRR-LC	632856	6229899
LBRR-12+500	632914	6229921
LBRR-12+600	632948	6229983
LBRR-12+700	632992	6230078
LBRR-12+810	633039	6230195
LBRR-12+920	633000	6230282
LBRR-UC	633018	6230253



NOTES
Base data source:
Imagery provided by Google; Maxar (May 2023).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2023 ANNUAL REPORT

Left Bank - River Road

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:3,500
50 25 0 50
Metres

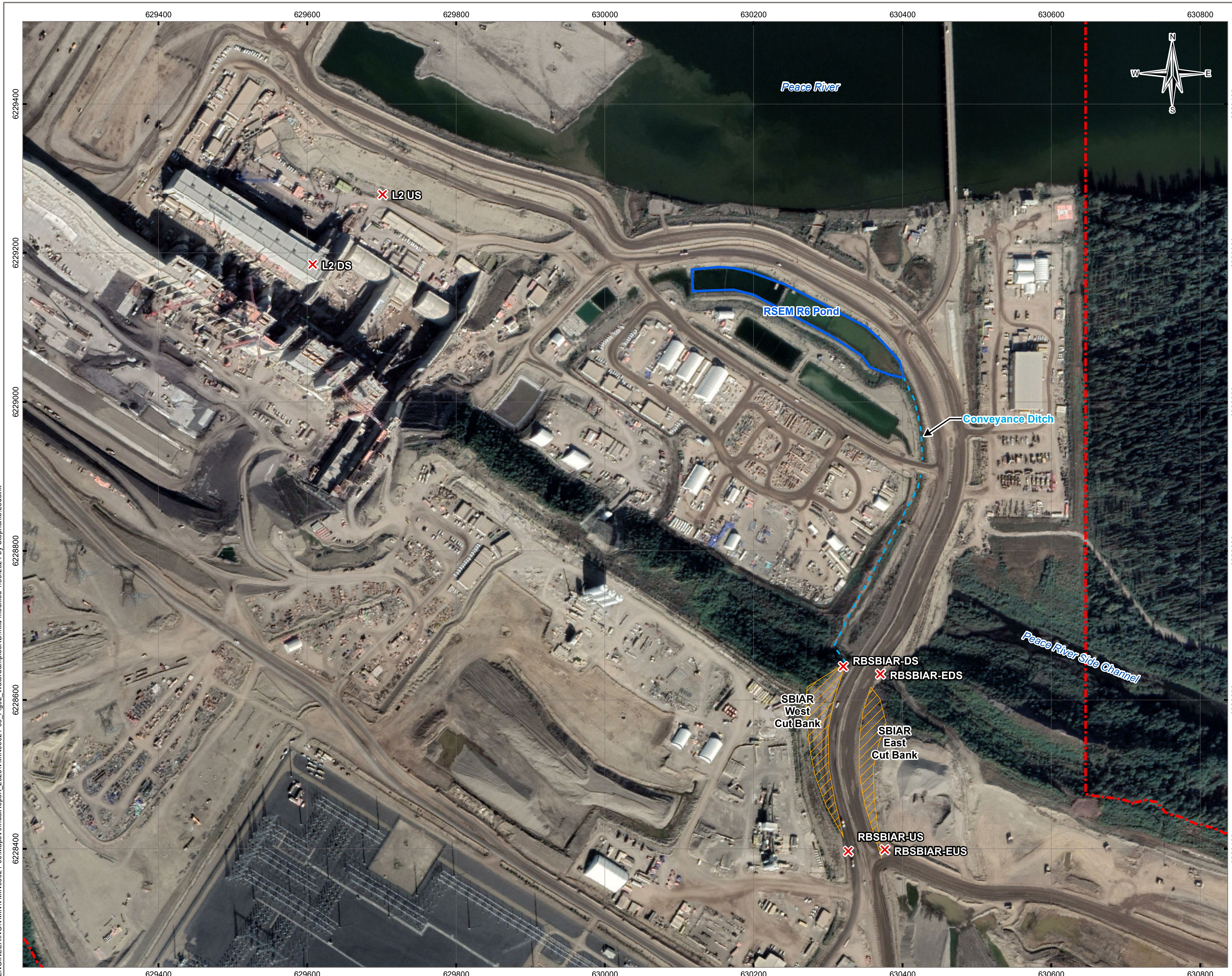
TETRA TECH

FILE NO.: VMIN03021-06_Fig01_WaterSamplesLBRR.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

DATE: January 31, 2024
PROJECT NO.: ENG.VMIN03021-06

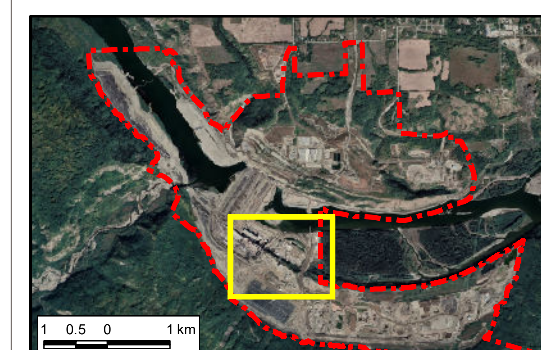
Figure 1



LEGEND

- ✕ Water Sample (Insitu Testing & External Lab Testing)
- Ditch
- Cut Bank
- RSEM R6 Pond
- Site C Project Boundary

Sample ID	Easting	Northing
RBSBIAR-US	630327	6228397
RBSBIAR-EUS	630376	6228399
RBSBIAR-DS	630320	6228645
RBSBIAR-EDS	630370	6228635
L2 US	629701	6229279
L2 DS	629607	6229185



NOTES
Base data source:
Imagery provided by Google; Maxar (2022).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2023 ANNUAL REPORT

Right Bank - SBIAR and L2 Powerhouse

PROJECTION UTM Zone 10
DATUM NAD83
CLIENT BC Hydro Power smart

Scale: 1:5,000
100 50 0 100
Metres

TETRA TECH

FILE NO.
VMIN03021-06_Fig02_WaterSamplesRB.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

DATE January 30, 2024
PROJECT NO. ENG.VMIN03021-06

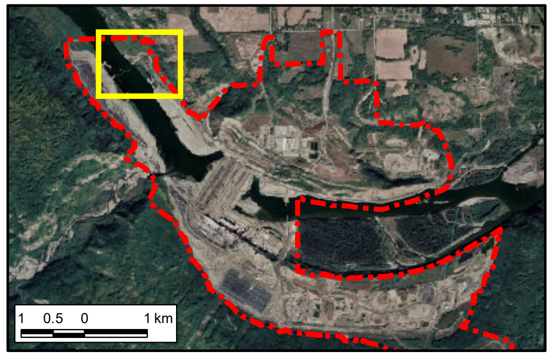
Figure 2

G:\ENGINEERING\VMIN\VMIN03021-06\Maps\AnnualReport_2023\VMIN03021-06_Fig02_WaterSamplesRB.mxd modified 1/30/2024 by Stephanie Leusink

LEGEND

- Water Sample (Insitu Testing & External Lab Testing)
- Discharge Location
- Site C Project Boundary

Sampe ID	Easting	Northing
LBDB-EDS	627994	6231856
LBDB-EUS	628202	6231908
LBDB-LD-DS	628093	6231766
LBDB-LD-MS	628147	6231844
LBDB-LD-US	628257	6231876
LBDB-WDS	627969	6231883
LBDB-WUS	628189	6231933
LBP-Pond	628227	6231885
LBDB Side Channel E	628311	6231511



NOTES
Base data source:
Imagery provided by Google; Maxar (May 2023).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2023 ANNUAL REPORT

Left Bank Debris Boom (LBDB)

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:4,000
80 40 0 80
Metres

FILE NO.: VMIN03021-06_Fig03_WaterSamplesLBDB.mxd

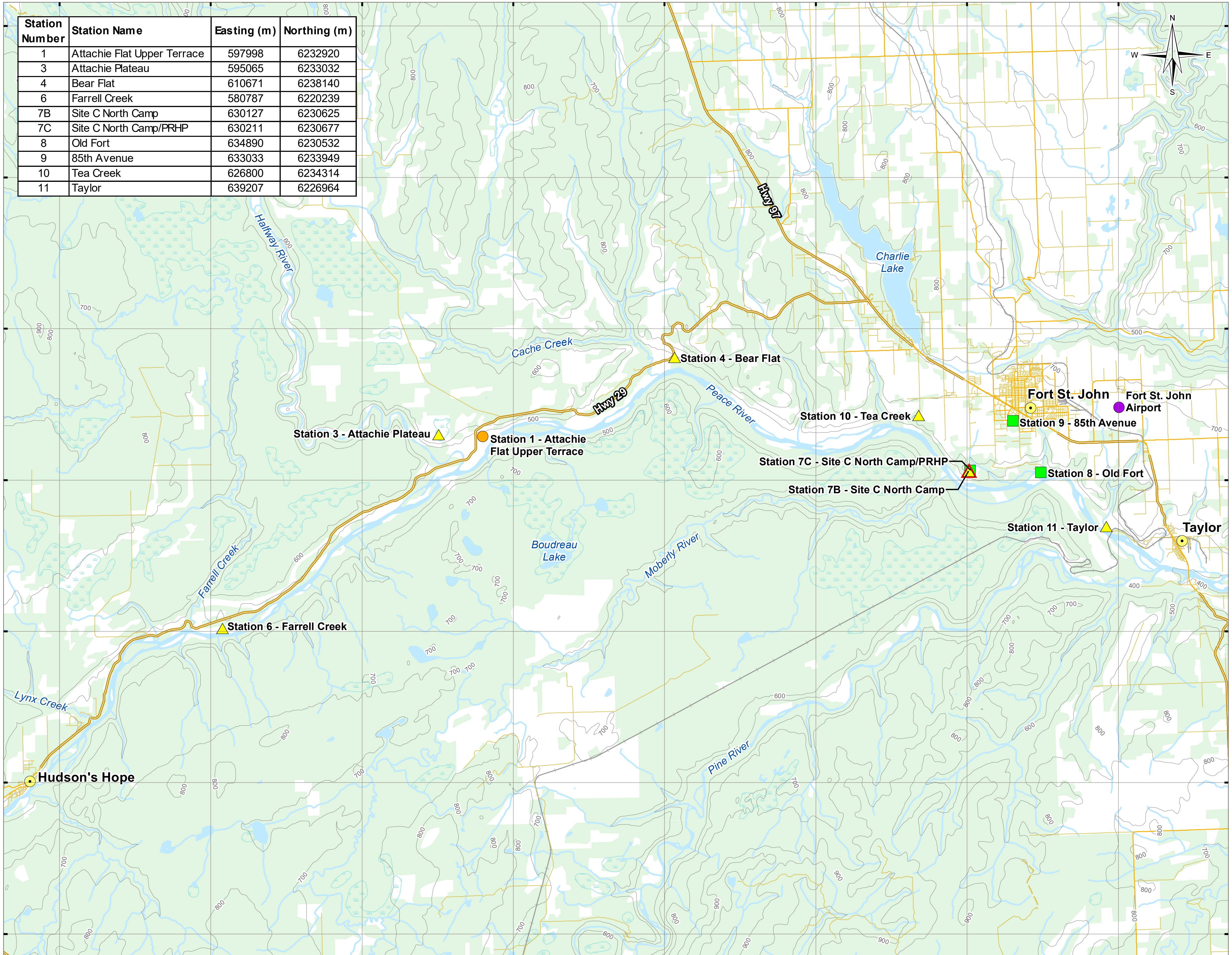
TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

DATE: January 31, 2024
PROJECT NO.: ENG.VMIN03021-06

Figure 3

G:\ENGINEERING\VMIN\VMIN03021-06\Maps\AnnualReport_2023\VMIN03021-06_Fig03_WaterSamplesLBDB.mxd modified 1/31/2024 by Stephanie Leusink



Station Number	Station Name	Easting (m)	Northing (m)
1	Attachie Flat Upper Terrace	597998	6232920
3	Attachie Plateau	595065	6233032
4	Bear Flat	610671	6238140
6	Farrell Creek	580787	6220239
7B	Site C North Camp	630127	6230625
7C	Site C North Camp/PRHP	630211	6230677
8	Old Fort	634890	6230532
9	85th Avenue	633033	6233949
10	Tea Creek	626800	6234314
11	Taylor	639207	6226964

LEGEND

Station Type

- Meteorological Only - used for Temperature and Precipitation data
- Meteorological Only
- Air Quality Only
- Meteorological and Air Quality
- Environment Canada Meteorological Station

Base Features

- City/District Municipality
- Highway
- Main Road
- Local Road
- Resource/Recreational Road
- Railway
- Residential Area
- Contour (100 m)
- Watercourse
- Waterbody
- Wetland
- Wooded Area

NOTES
Station locations provided by BC Hydro and RWDI (September 2017).
Base data source: CanVec 1:250,000.

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2023 ANNUAL REPORT

Site C Meteorological and Air Quality Stations

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:250,000
Kilometres

TETRA TECH

FILE NO.: VMIN03021-06_Fig04_BCH_ClimateStations.mxd

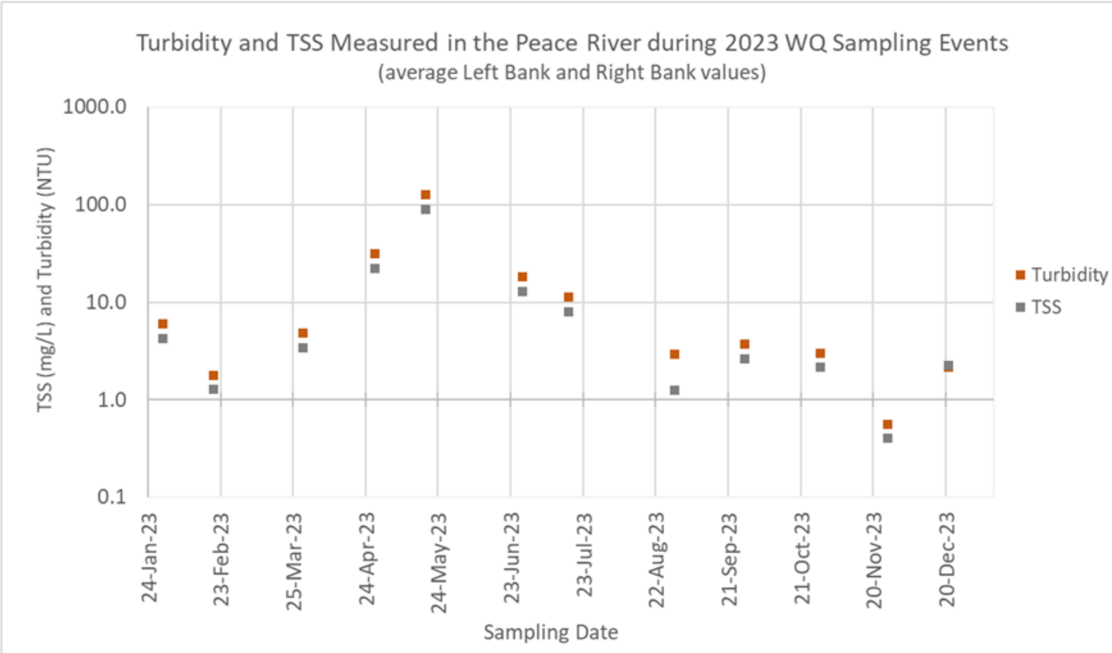
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	YL	EM	0

DATE: January 30, 2024
PROJECT NO.: ENG.VMIN03021-06

Figure 4

G:\ENGINEERING\VMIN\VMIN03021-06\Maps\AnnualReport_2023\VMIN03021-06_Fig04_BCH_ClimateStations.mxd modified 1/30/2024 by Stephanie.Leusink

Figure 5: Turbidity and TSS Measured in the Peace River



**Average turbidity and TSS across the Peace River include both left bank and right bank.*

EcoFish Disclaimer: TSS:turbidity relationship used was the same all year. Note, these relationships are specific to a particular make/model of sensor. Please exercise caution if relationship applied to any data collected.

Figure 6: pH at River Road Locations

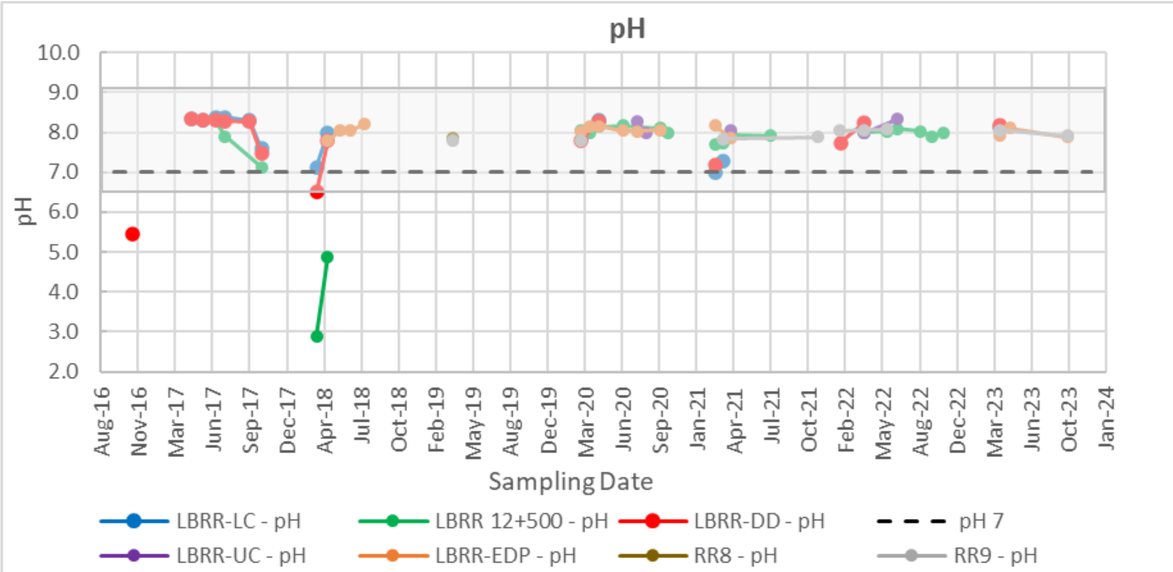


Figure 7: Total Alkalinity at River Road Locations

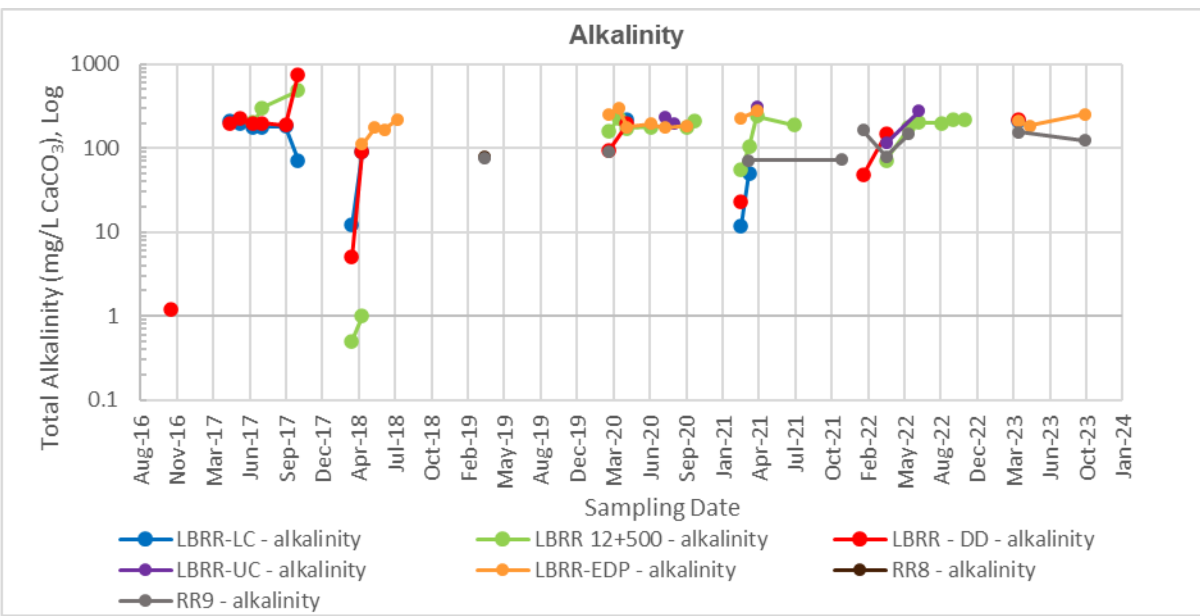


Figure 8: Acidity at River Road Locations

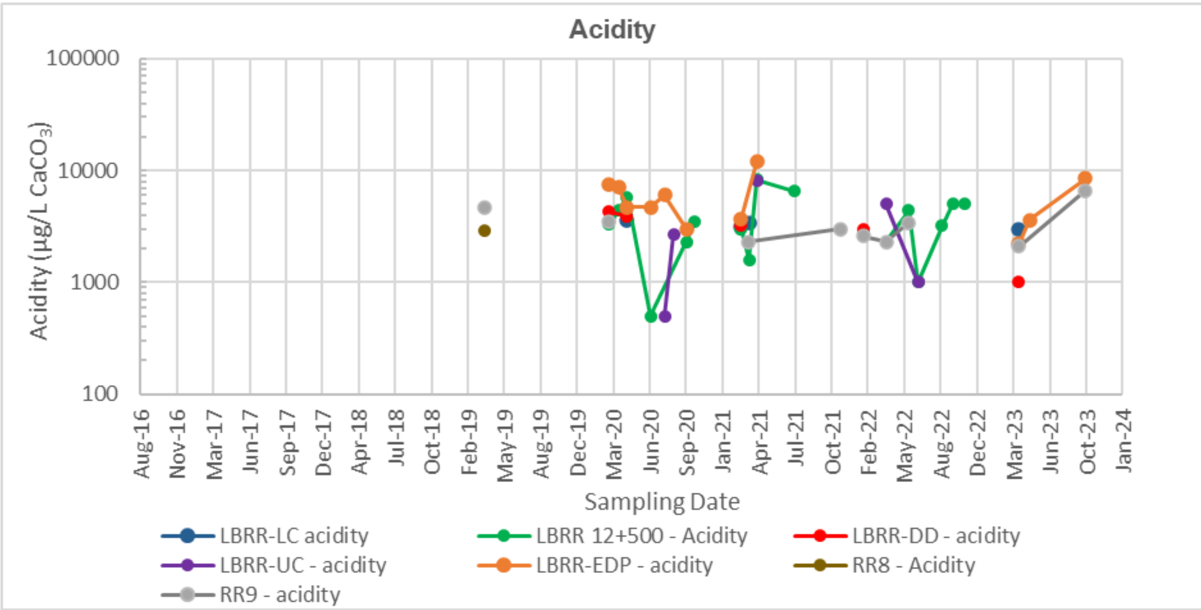


Figure 9: Sulphate at River Road Locations

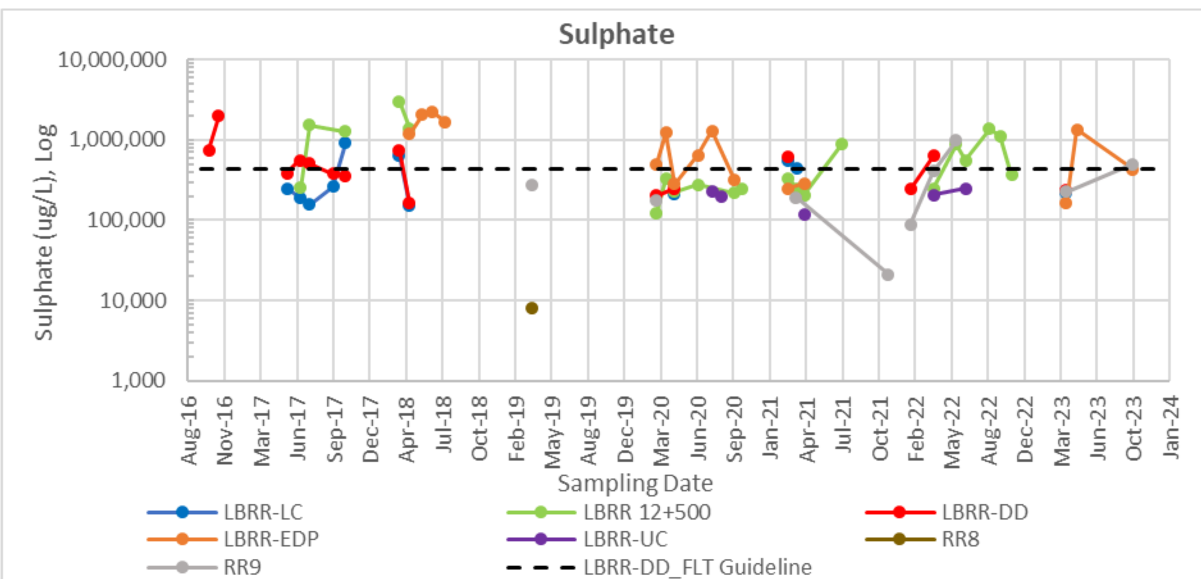


Figure 10a: Total Dissolved Solids (TDS) at River Road Locations

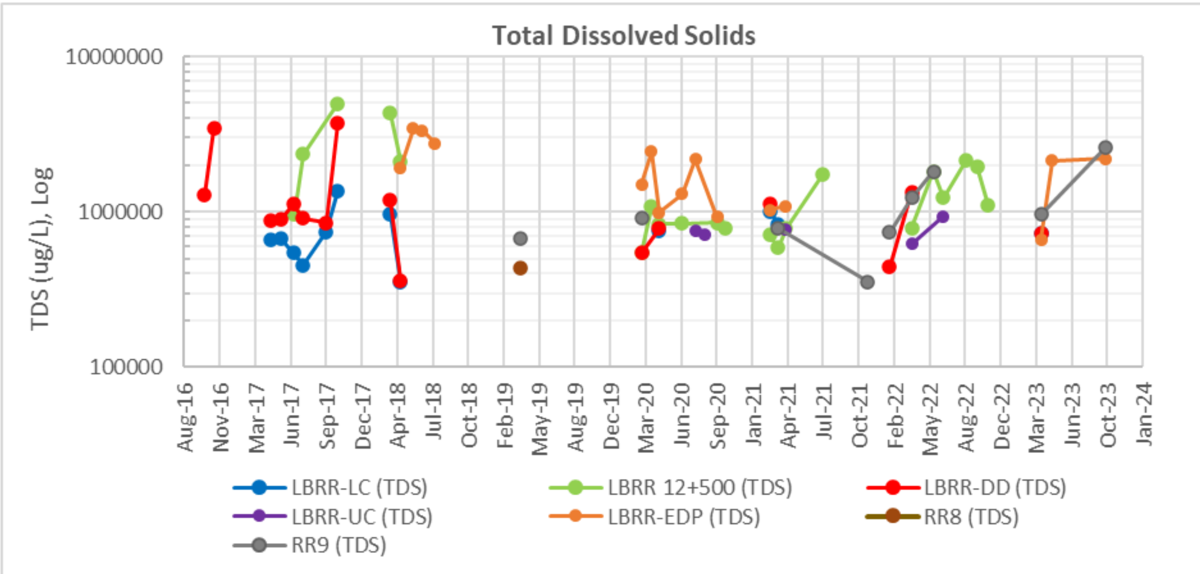


Figure 10b: Total Suspended Solids (TSS) at River Road Locations

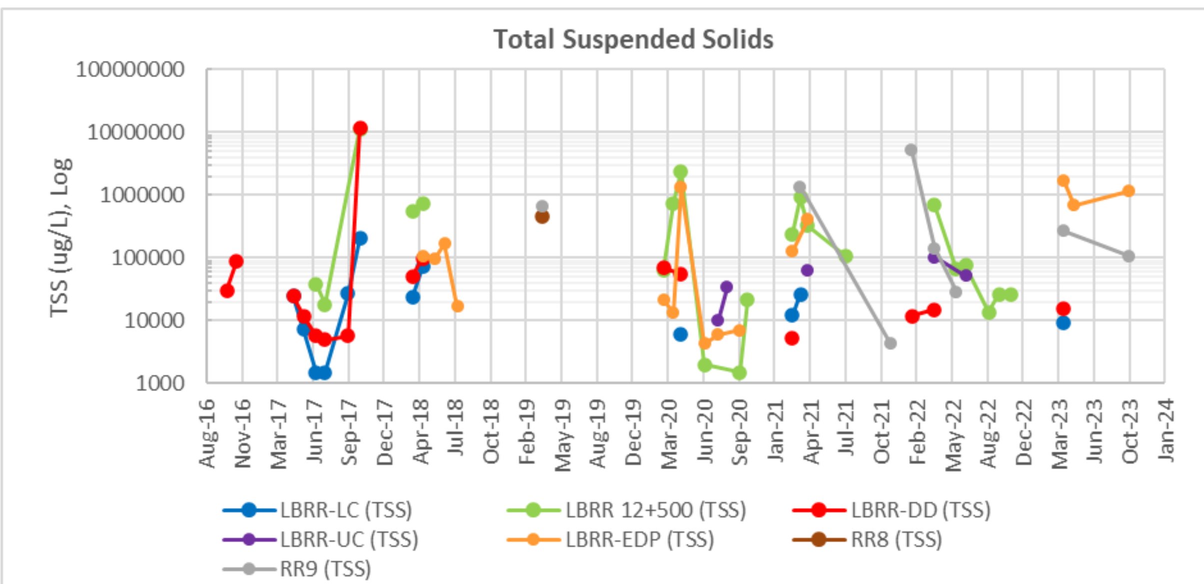


Figure 11a: Total Aluminum at River Road Locations

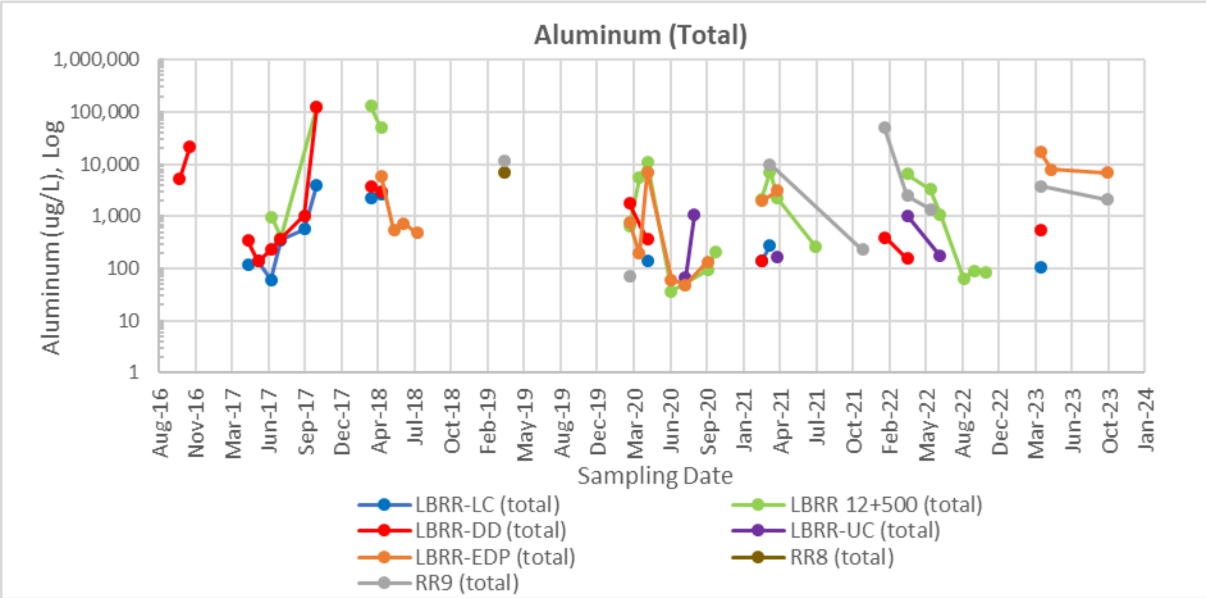


Figure 11b: Dissolved Aluminum at River Road Locations

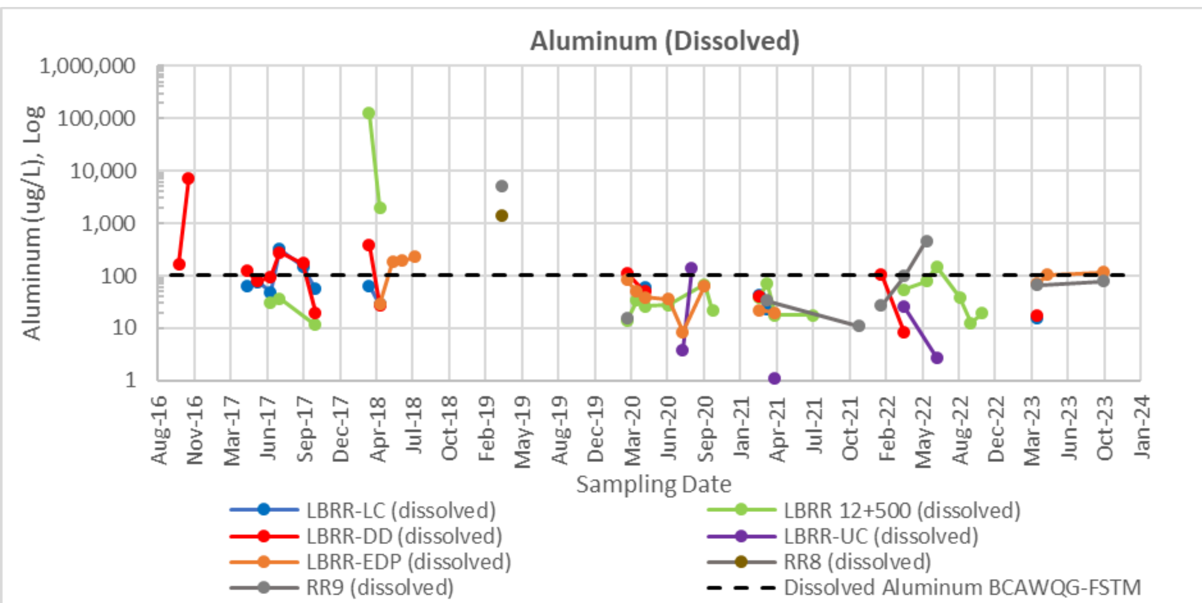


Figure 12a: Total Iron at River Road Locations

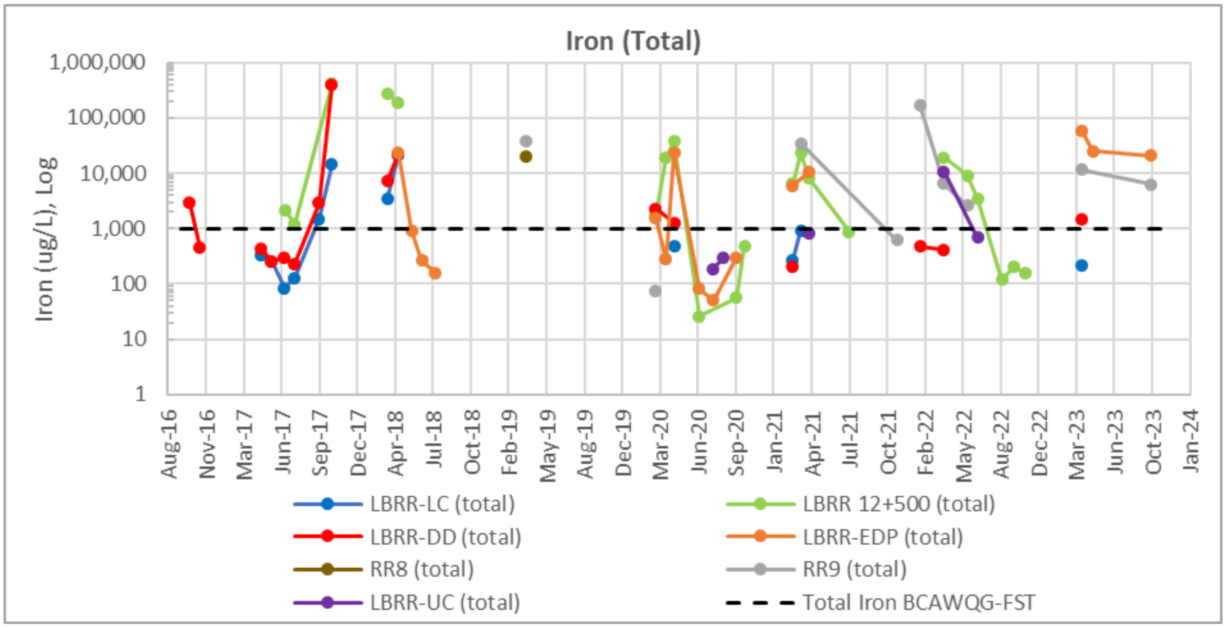


Figure 12b: Dissolved Iron at River Road Locations

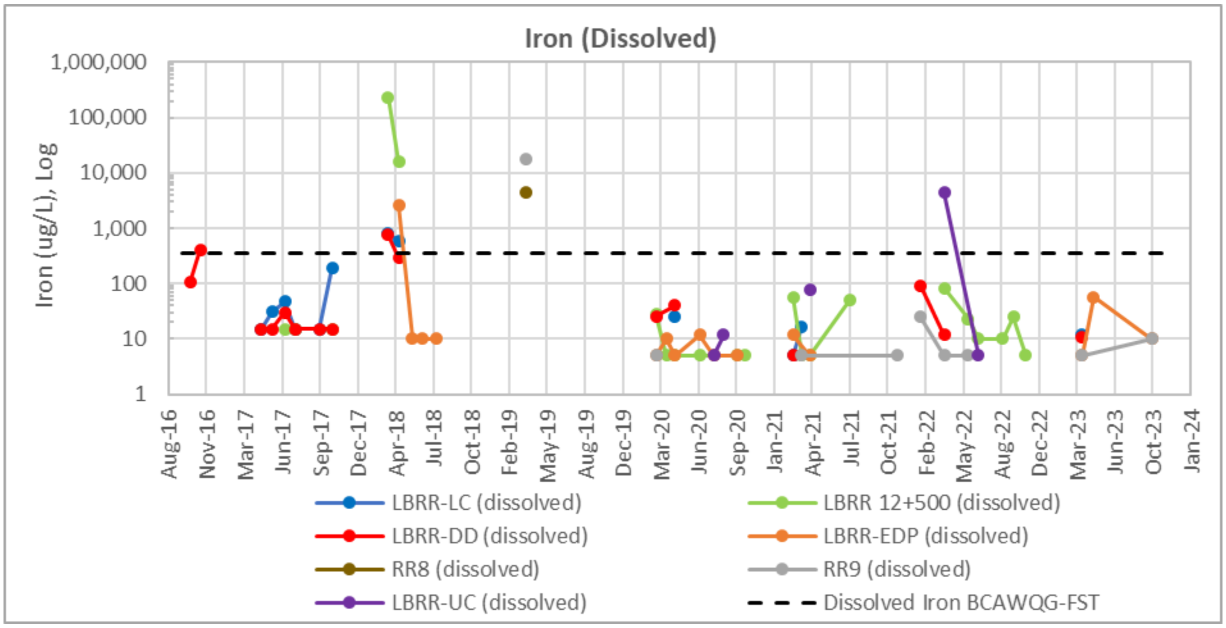


Figure 13: Total Arsenic at River Road Locations

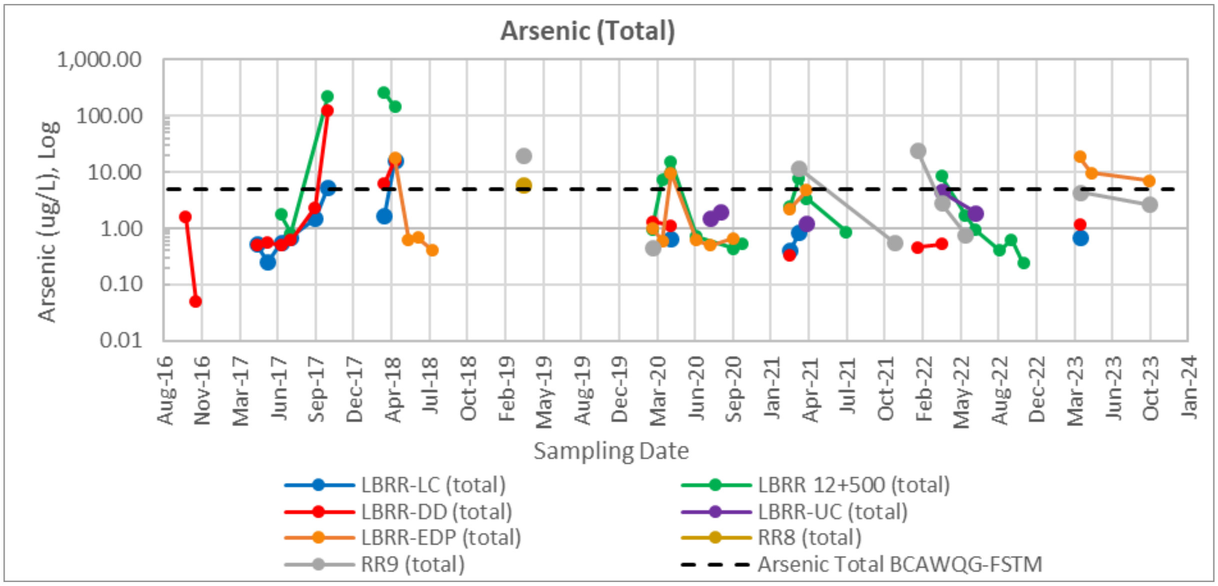


Figure 14: Dissolved Cadmium at River Road Locations

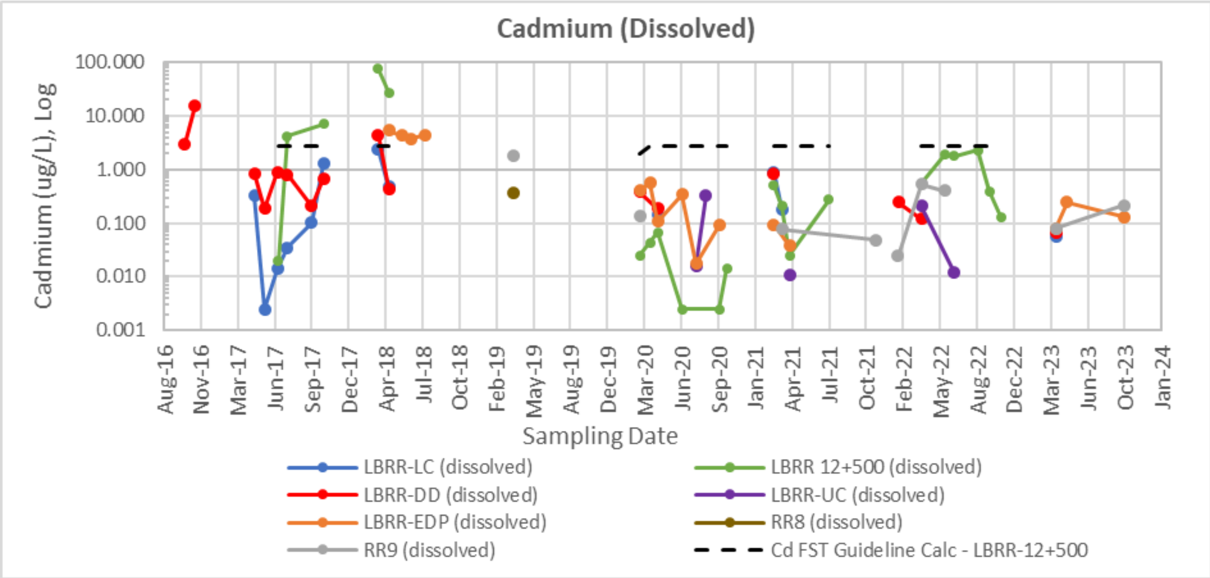


Figure 15: Total Cobalt at River Road Locations

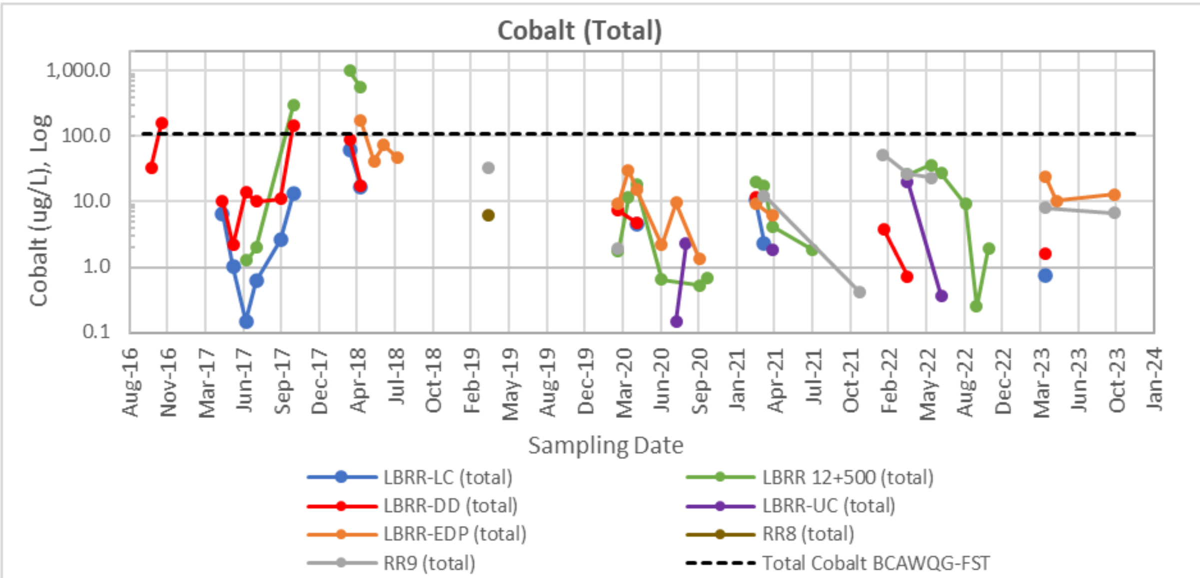


Figure 16: Dissolved Copper at River Road Locations

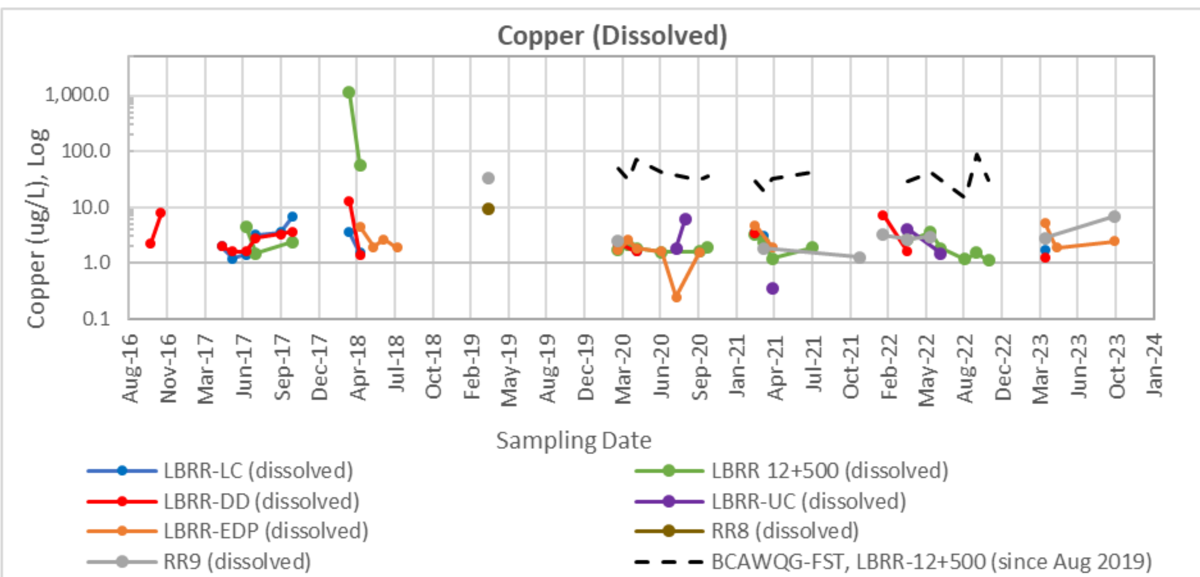


Figure 17a: Total Zinc at River Road Locations

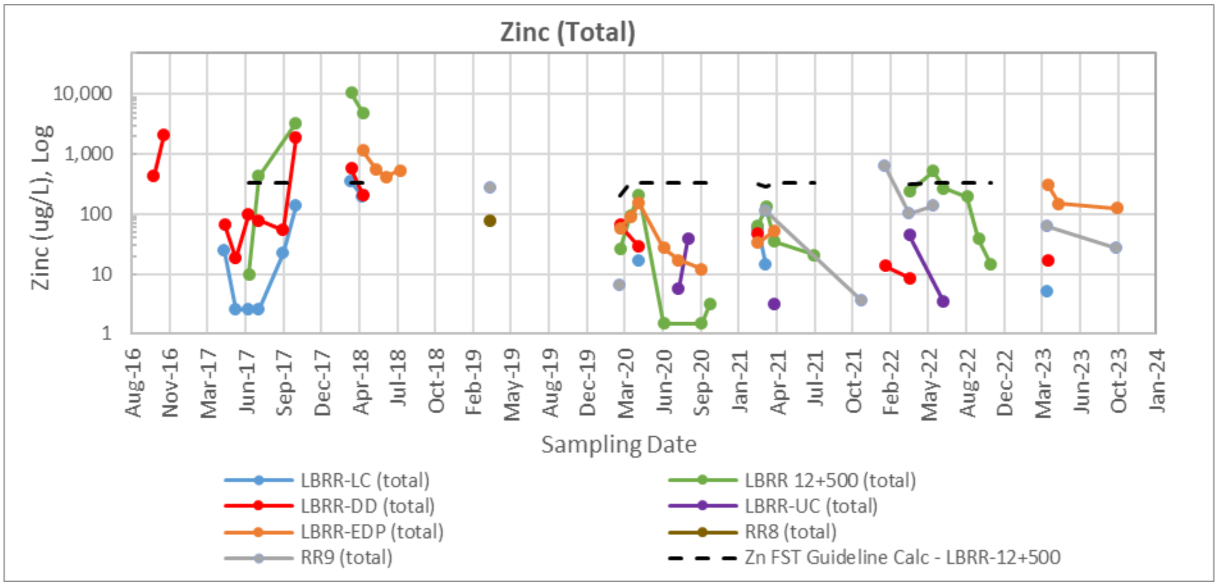


Figure 17b: Dissolved Zinc at River Road Locations

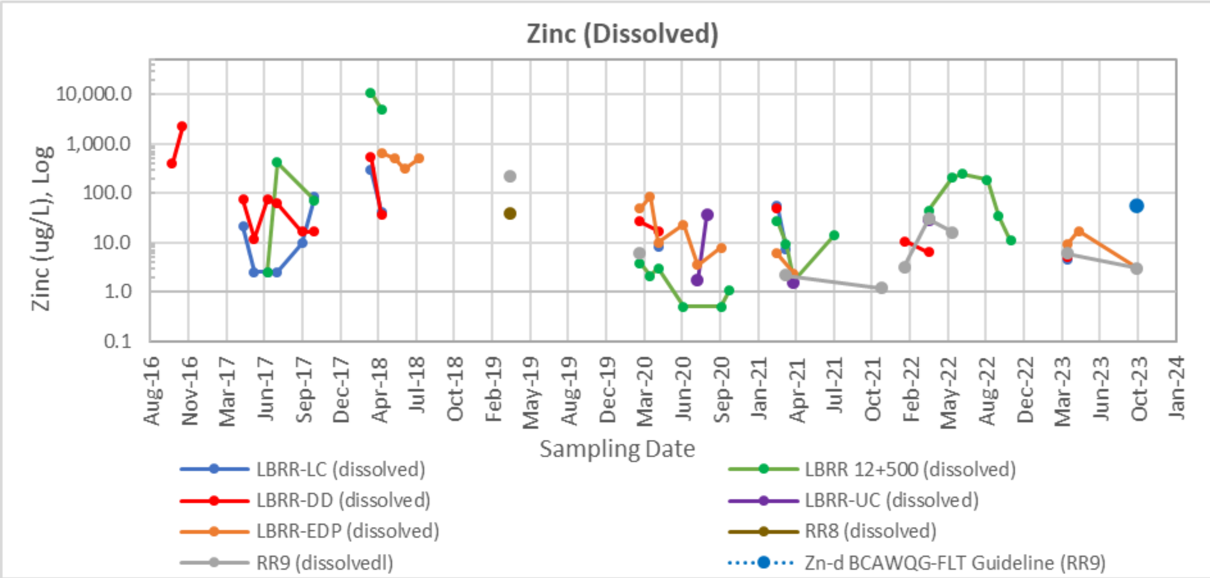


Figure 18: pH at RBSBIAR Locations

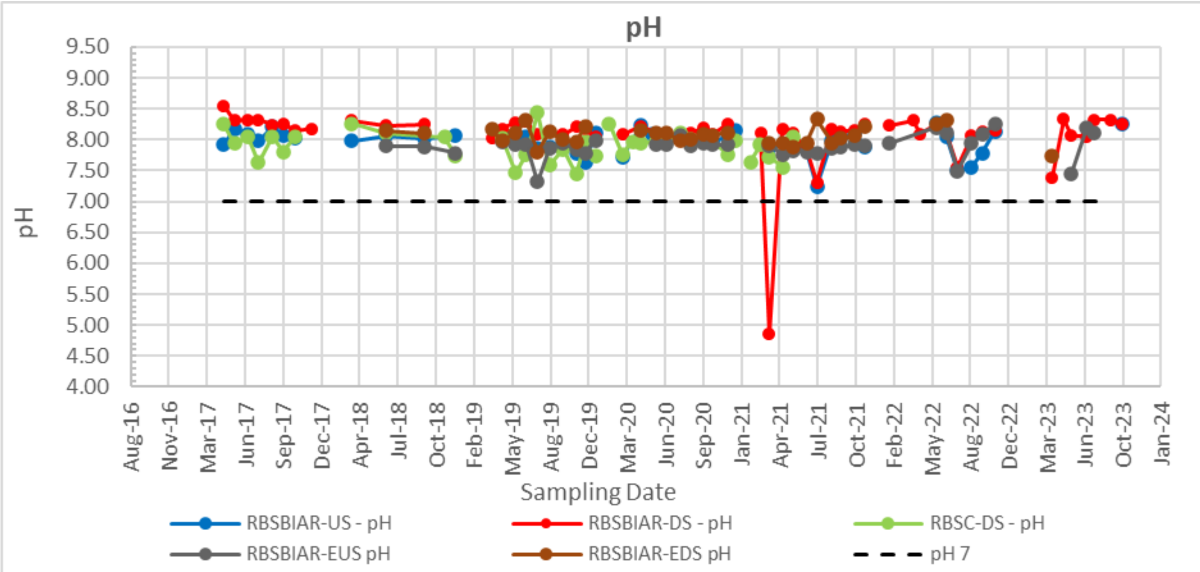


Figure 19: Total Alkalinity at RBSBIAR Locations

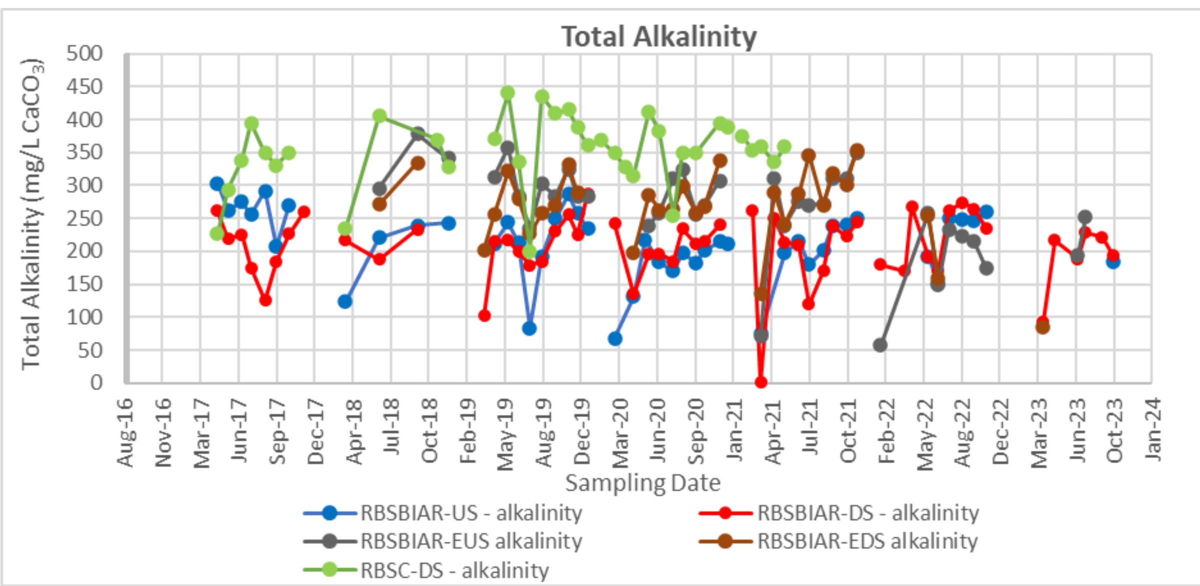


Figure 20: Acidity at RBSBIAR Locations

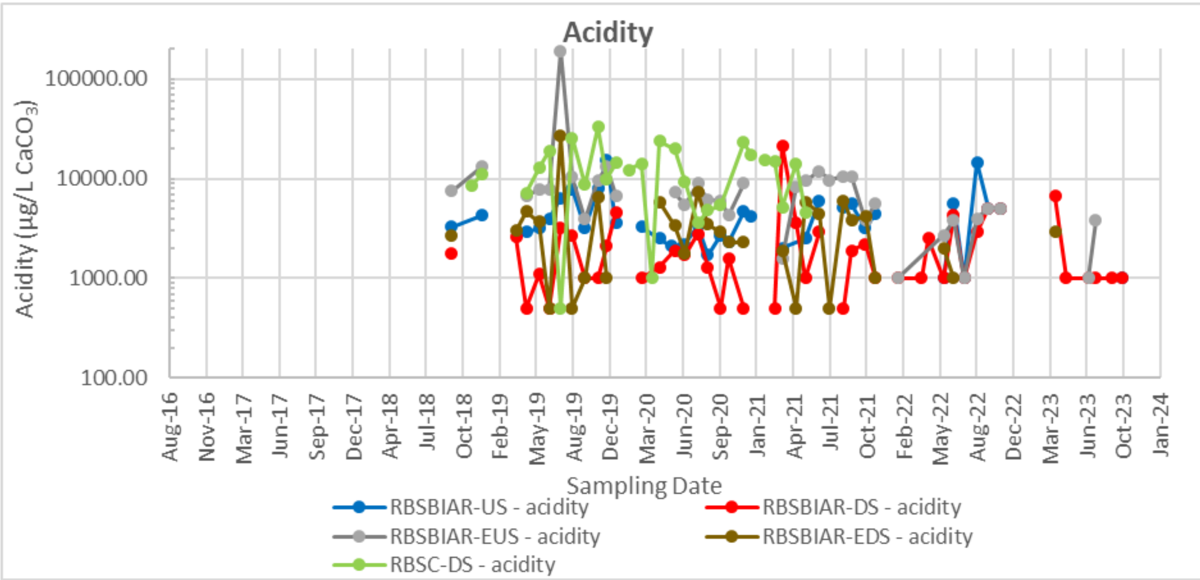


Figure 21: Sulphate at RBSBIAR Locations

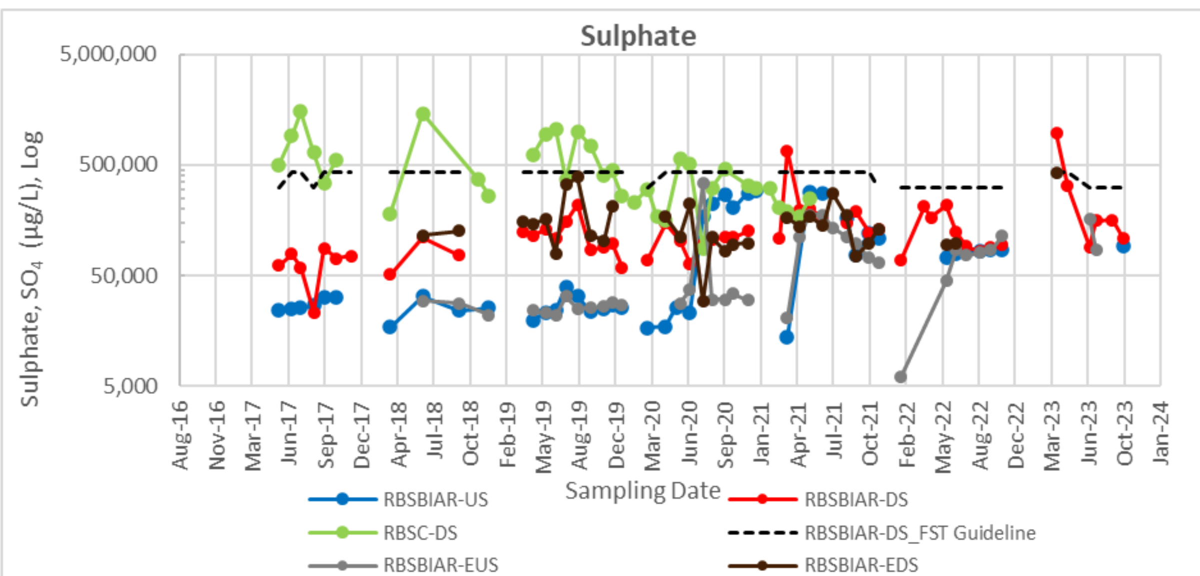


Figure 22a: Total Dissolved Solids (TDS) at RBSBIAR Locations

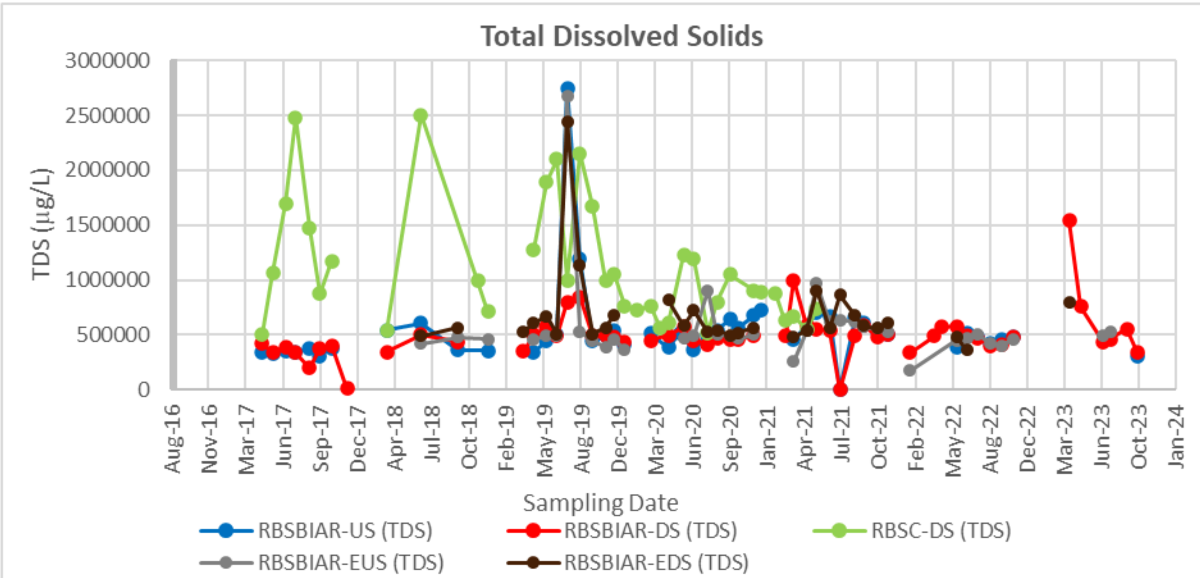


Figure 22b: Total Suspended Solids (TSS) at RBSBIAR Locations

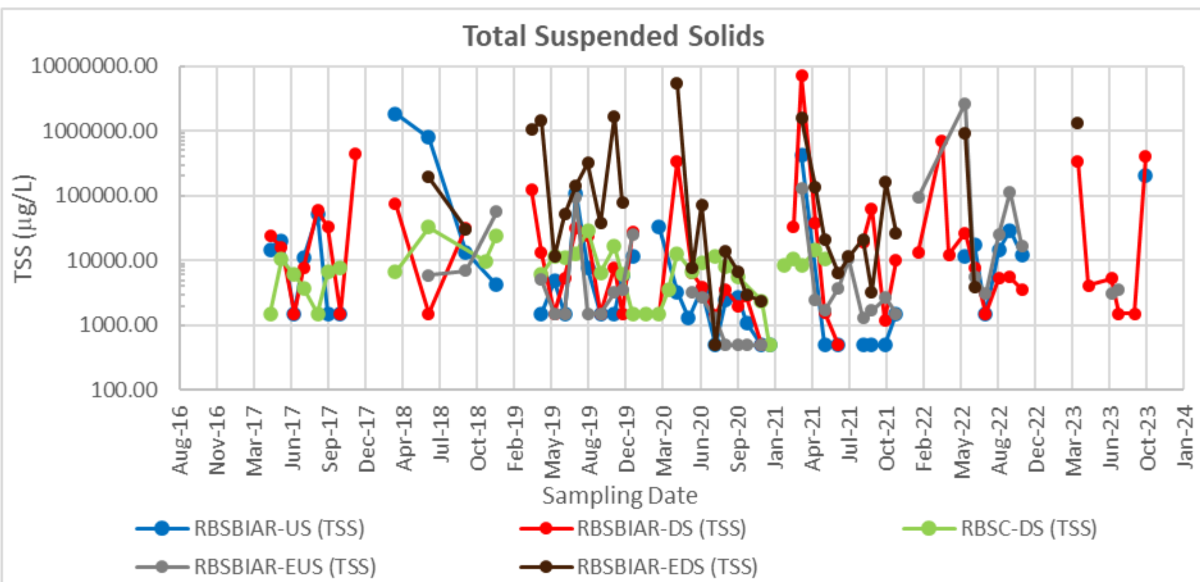


Figure 23a: Total Aluminum at RBSBIAR Locations

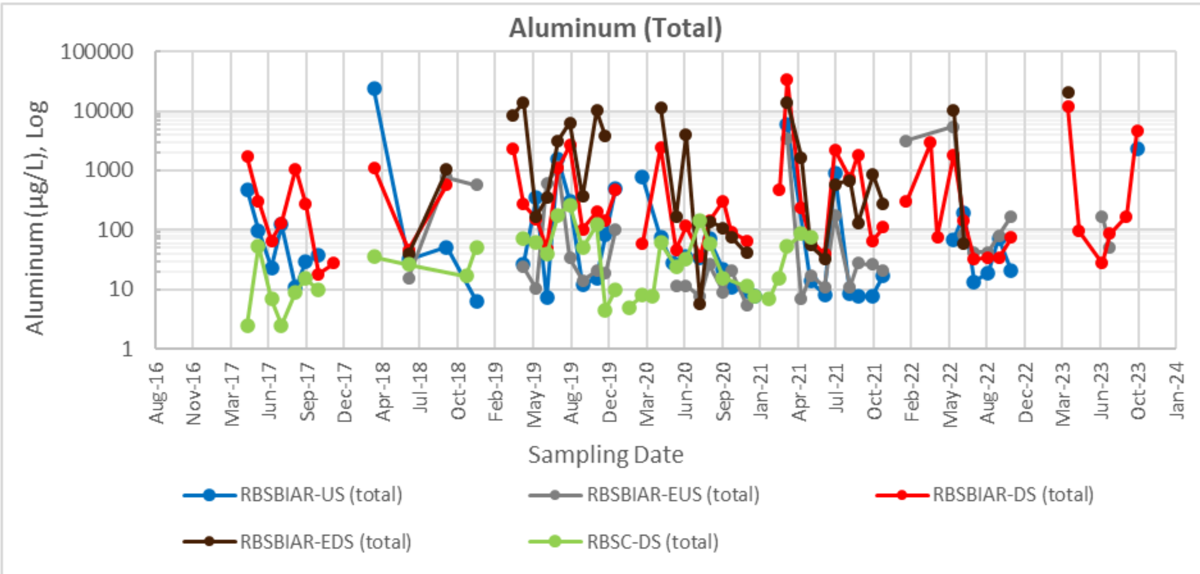
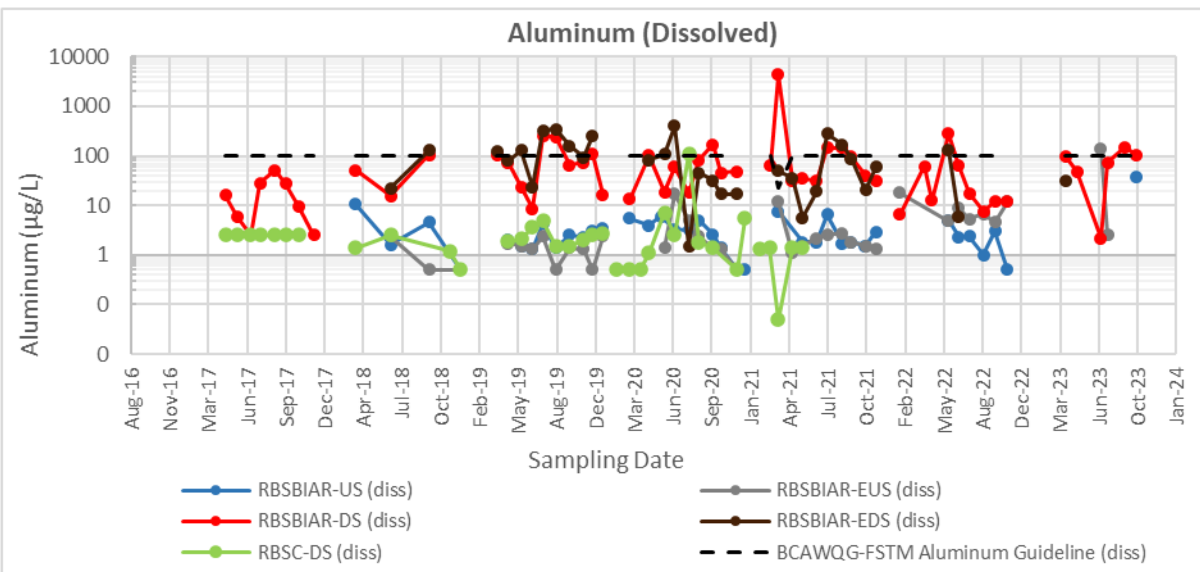


Figure 23b: Dissolved Aluminum at RBSBIAR Locations



TETRA TECH

Figure 24a: Total Iron at RBSBIAR Locations

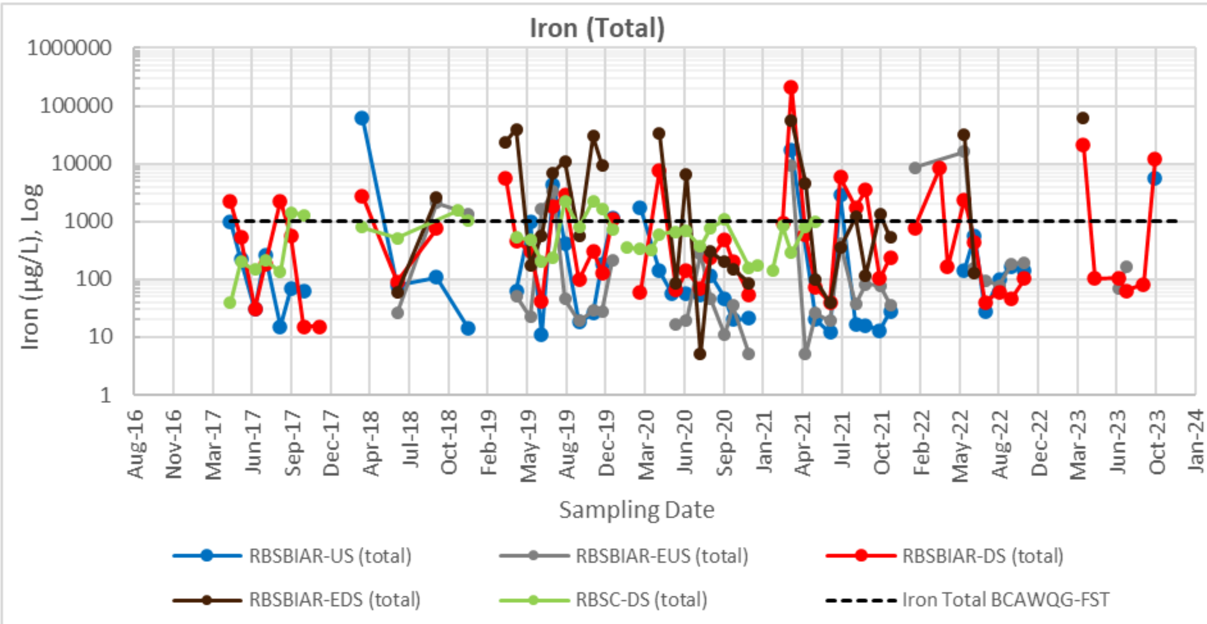


Figure 24b: Dissolved Iron at RBSBIAR Locations

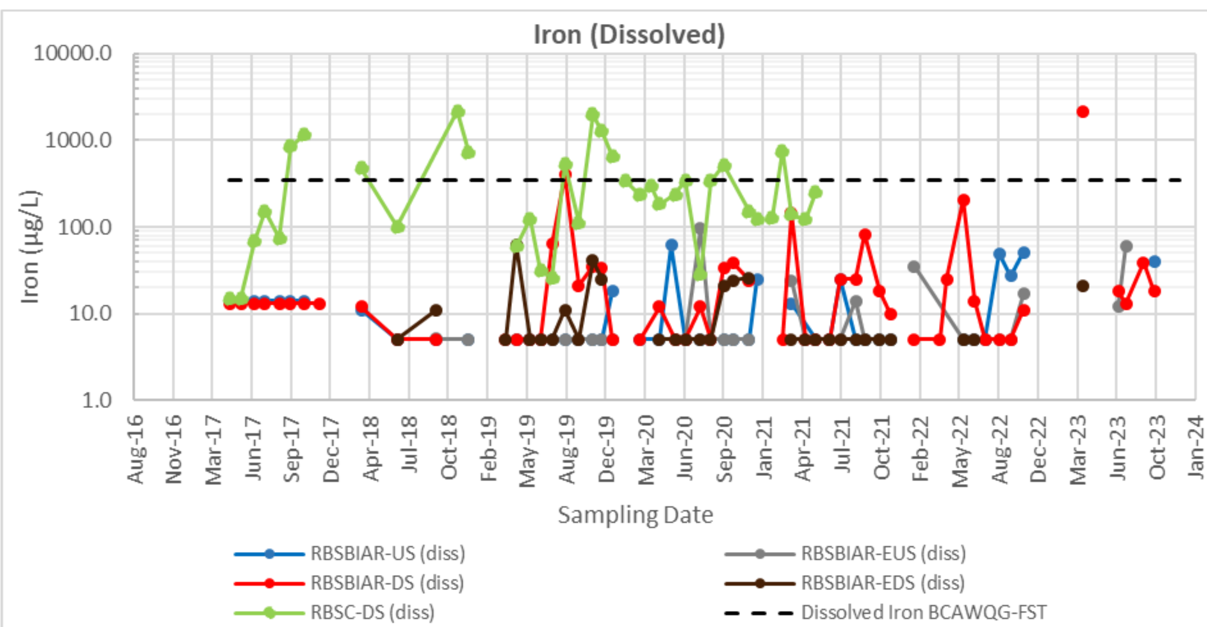


Figure 25: Total Arsenic at RBSBIAR Locations

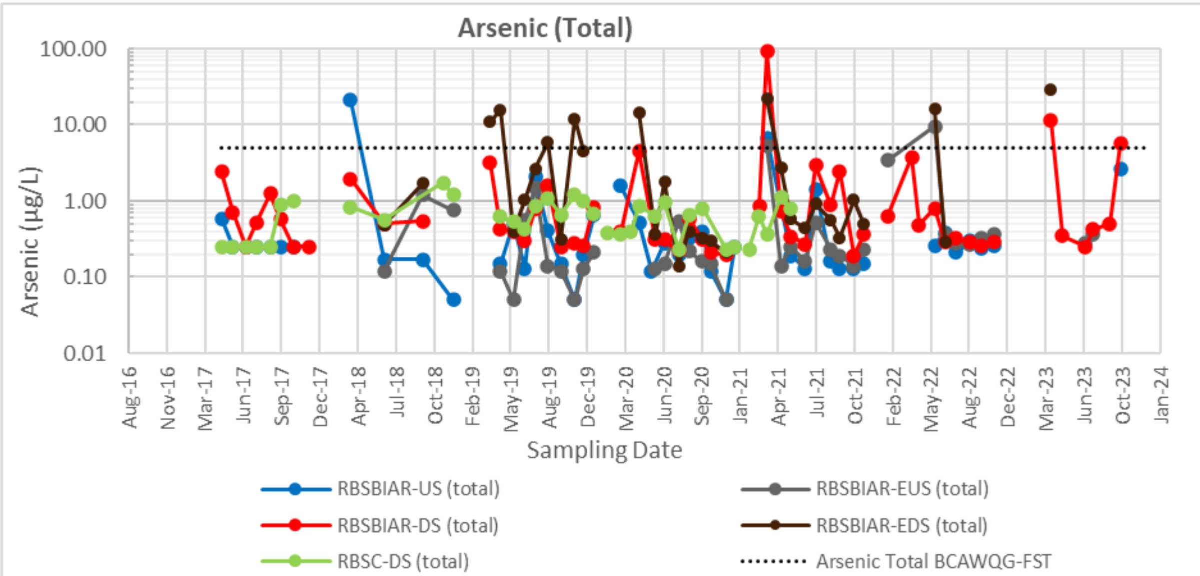


Figure 26: Dissolved Cadmium at RBSBIAR Locations

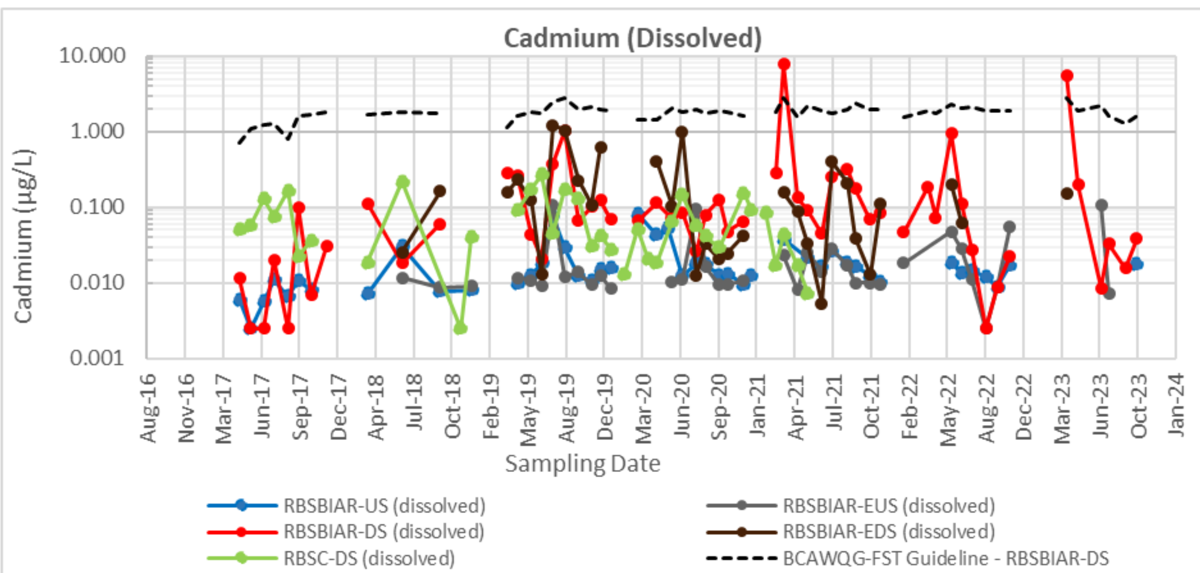


Figure 27: Total Cobalt at RBSBIAR Locations

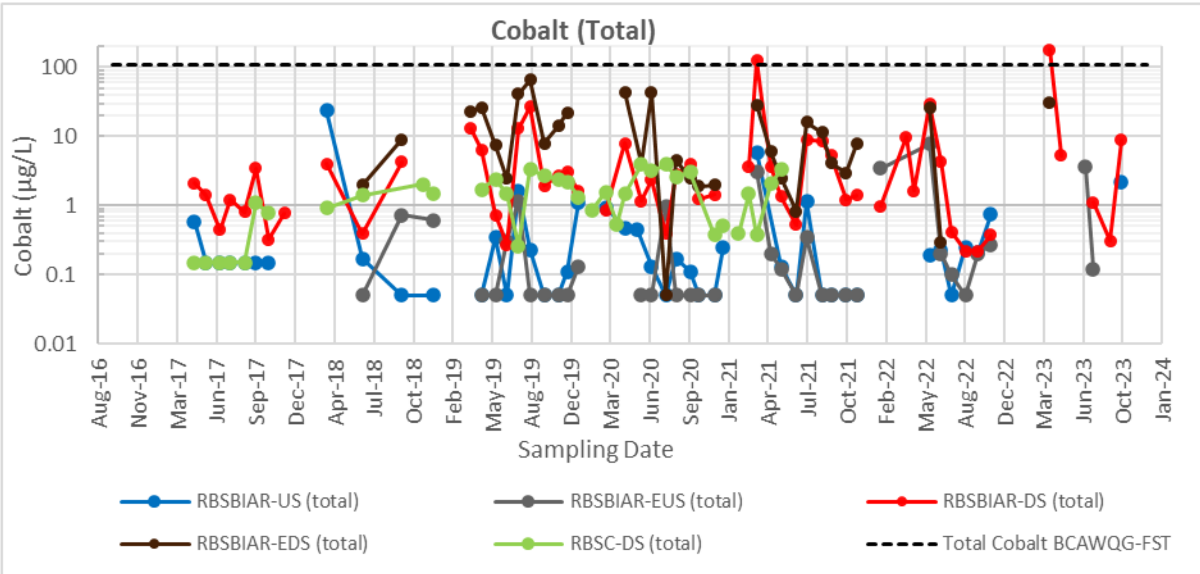


Figure 28: Dissolved Copper at RBSBIAR Locations

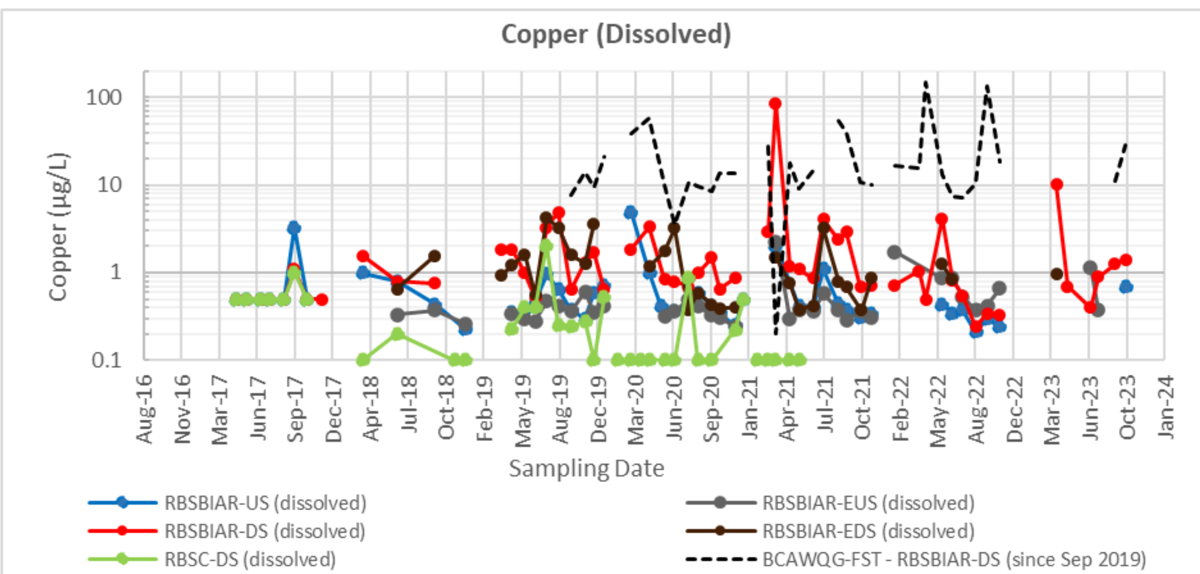


Figure 29a: Total Zinc at RBSBIAR Locations

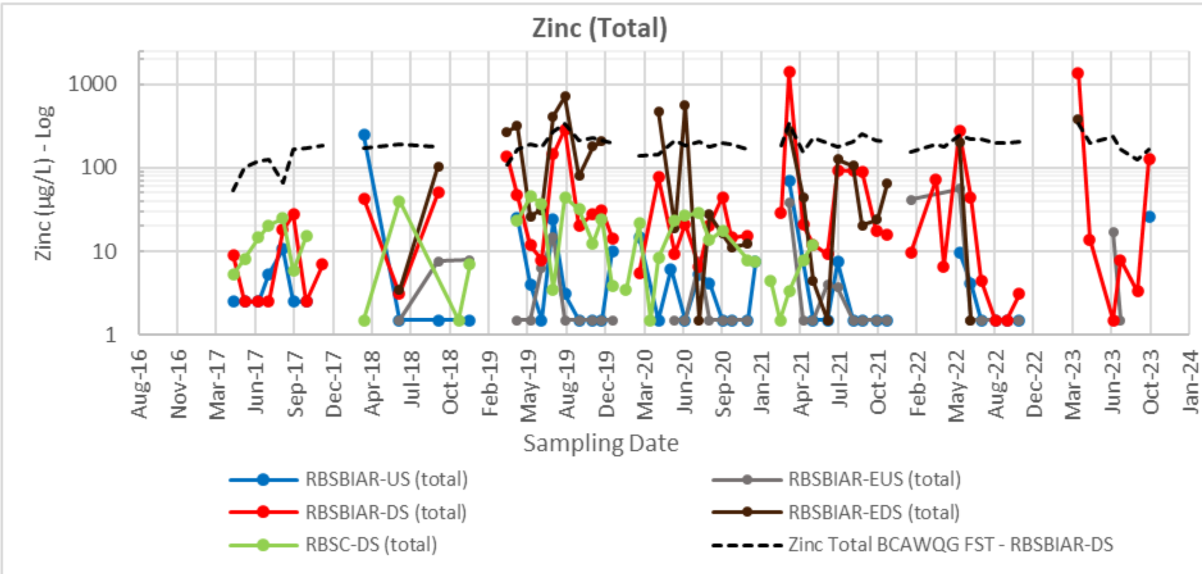


Figure 29b: Dissolved Zinc at RBSBIAR Locations

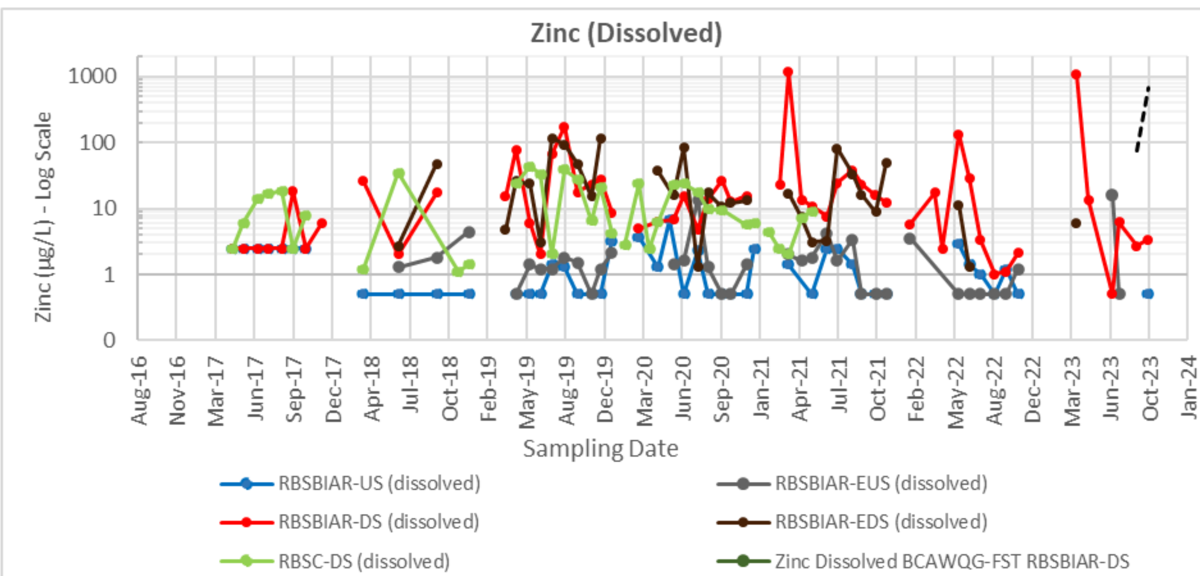


Figure 30a: RBSBIAR West Ditch Downstream (DS) / Upstream (US) Ratio - Total Zinc

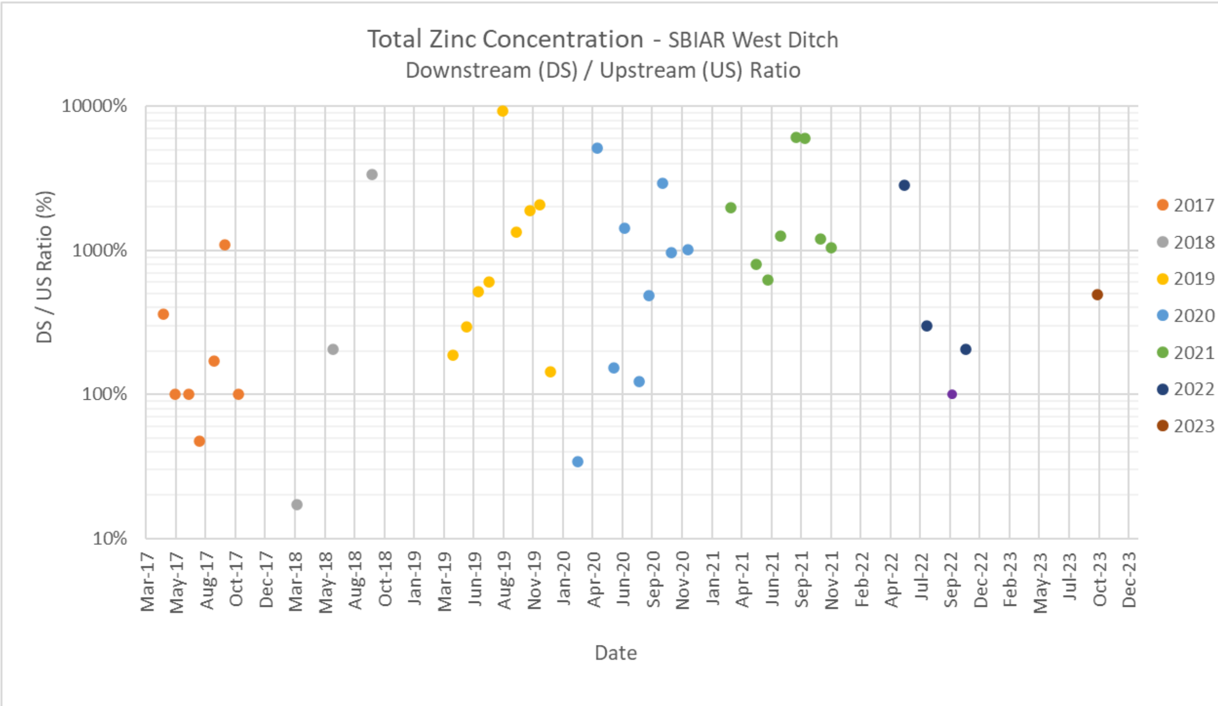


Figure 30b: RBSBIAR East Ditch Downstream (EDS), Upstream (EUS) Ratio - Total Zinc

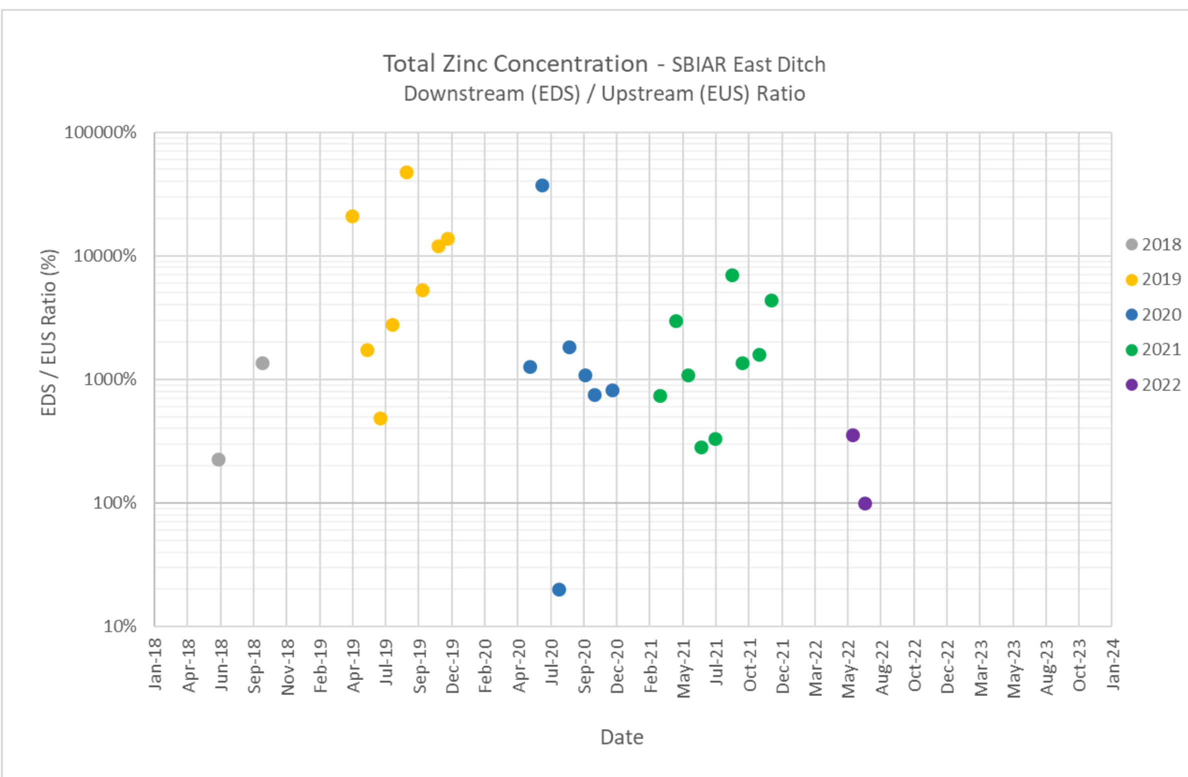


Figure 31: Dissolved Zinc at RBSBIAR Locations

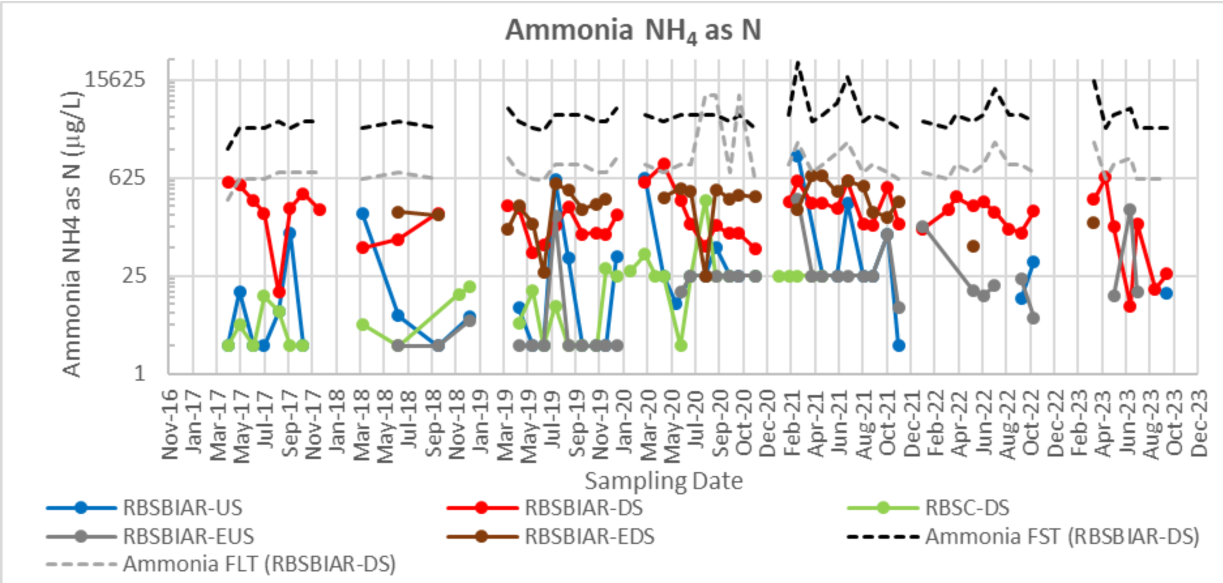


Figure 32: pH at L2 Powerhouse Locations

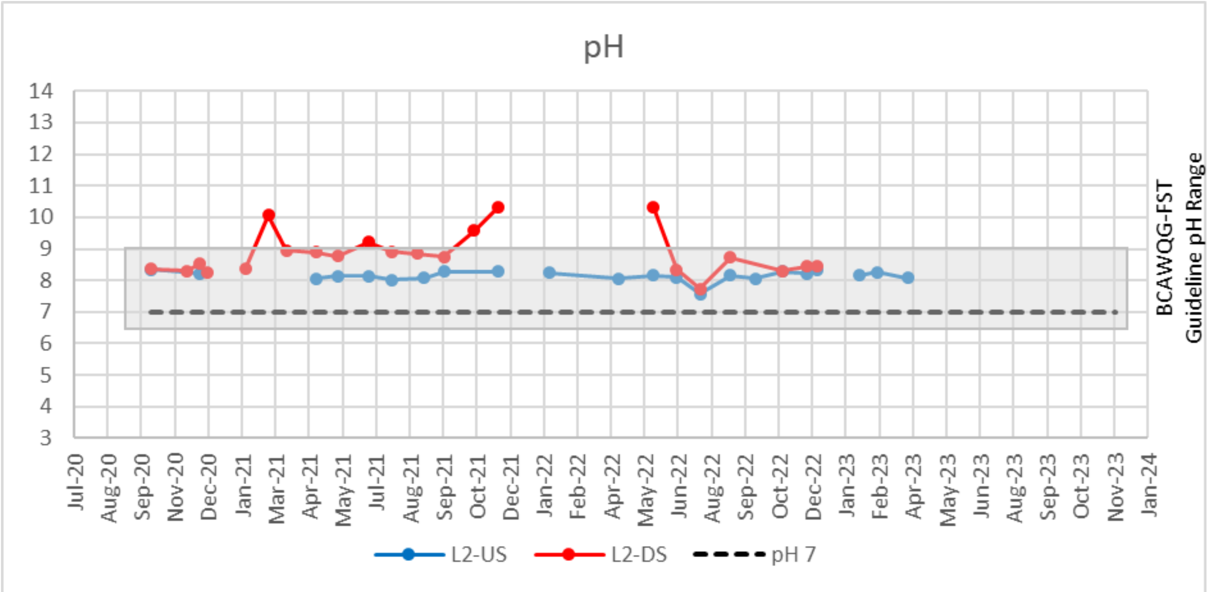


Figure 33: Total Alkalinity at L2 Powerhouse Locations

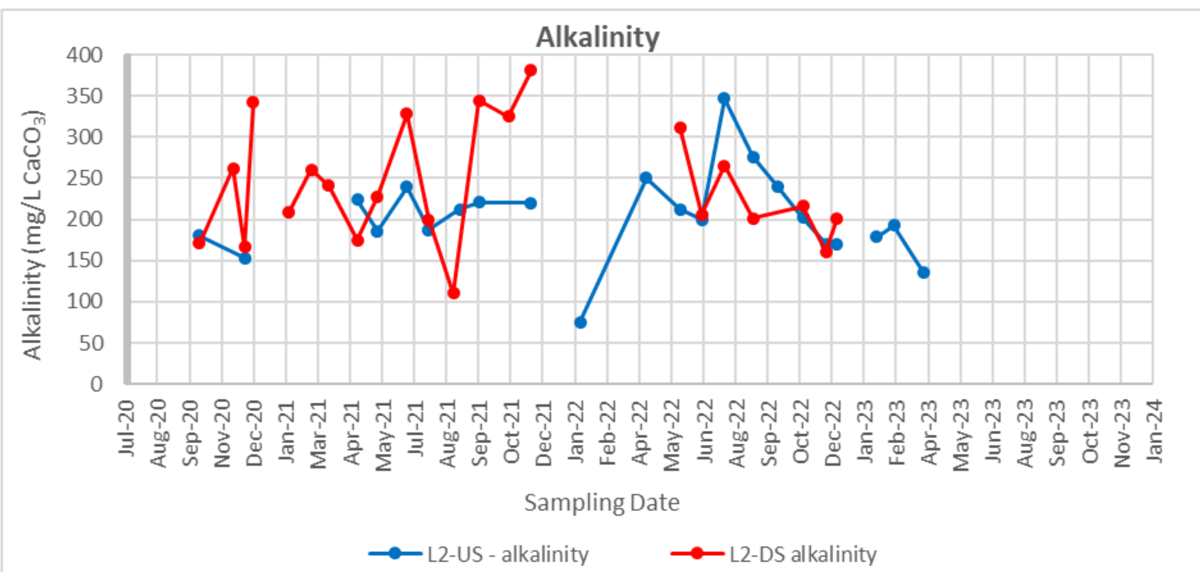


Figure 34: Acidity at L2 Powerhouse Locations

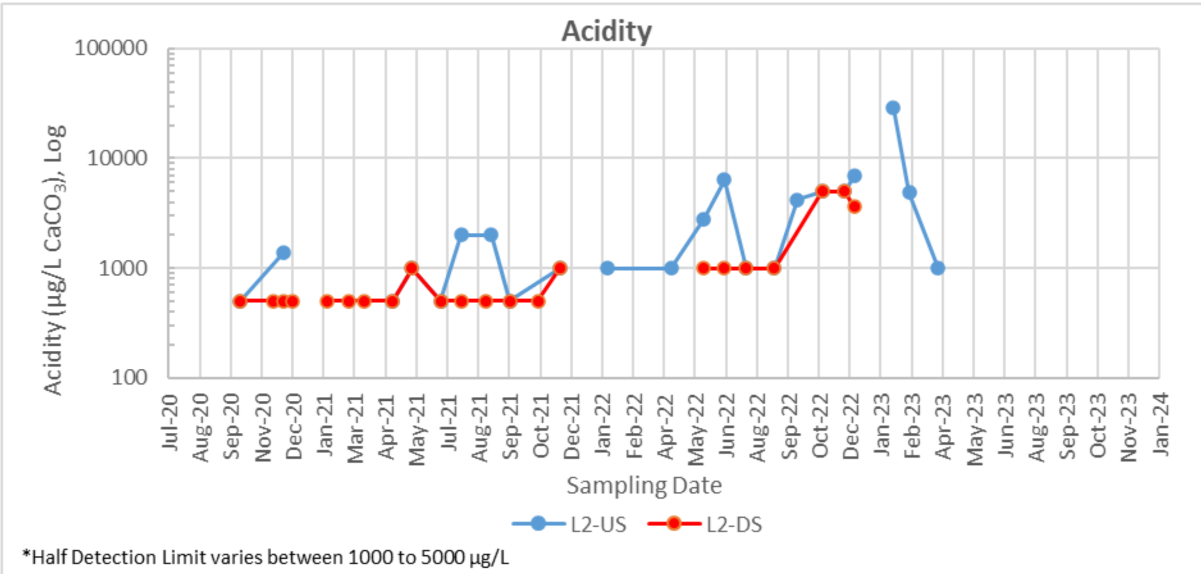


Figure 35: Sulphate at L2 Powerhouse Locations

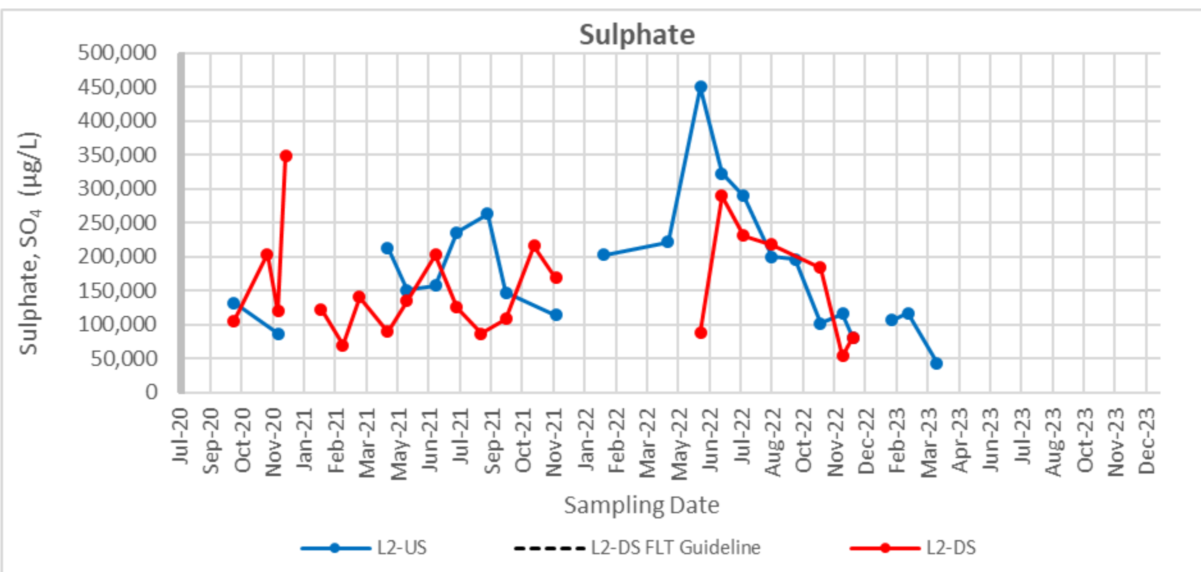


Figure 36a: Total Dissolved Solids (TDS) at L2 Powerhouse Locations

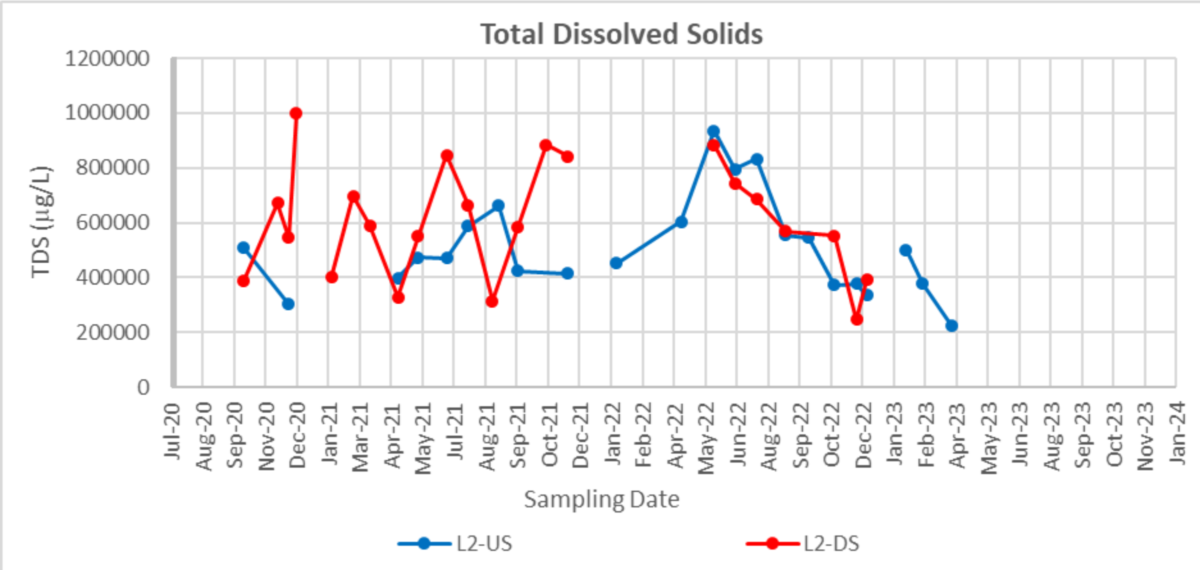


Figure 36b: Total Suspended Solids (TSS) at L2 Powerhouse Locations

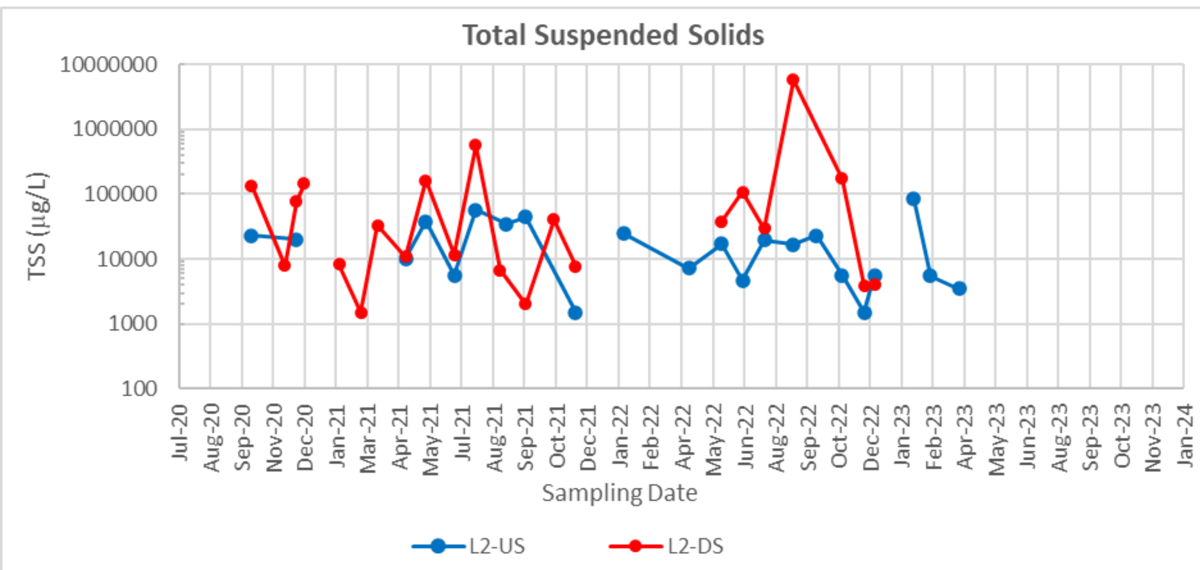


Figure 37a: Total Aluminum at L2 Powerhouse Locations

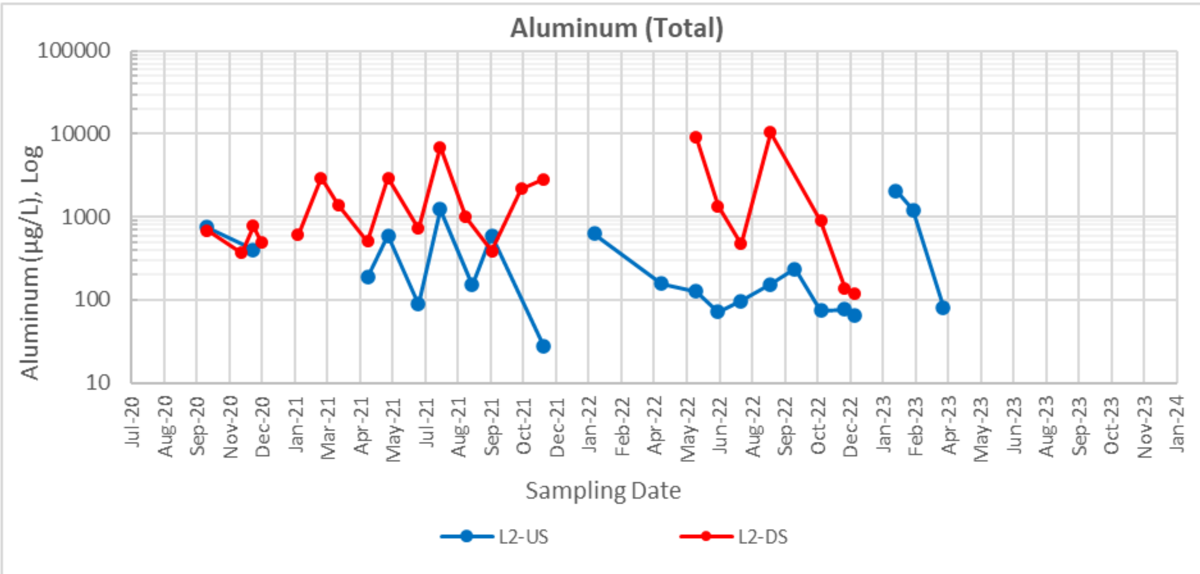


Figure 37b: Dissolved Aluminum at L2 Powerhouse Locations

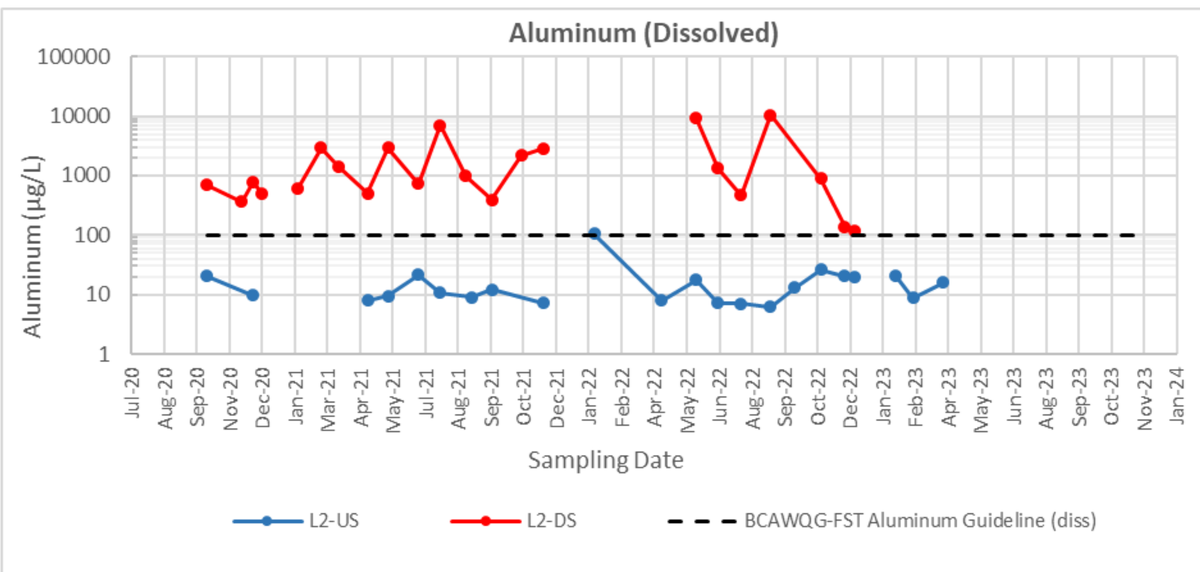


Figure 38a: Total Iron at L2 Powerhouse Locations

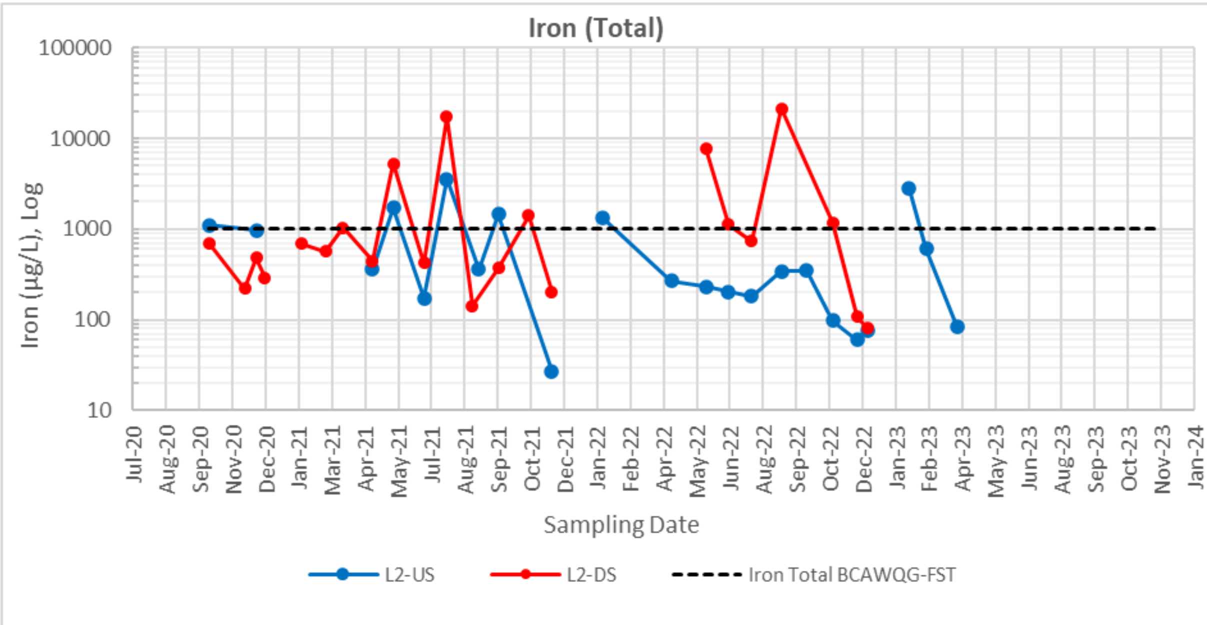


Figure 38b: Dissolved Iron at L2 Powerhouse Locations

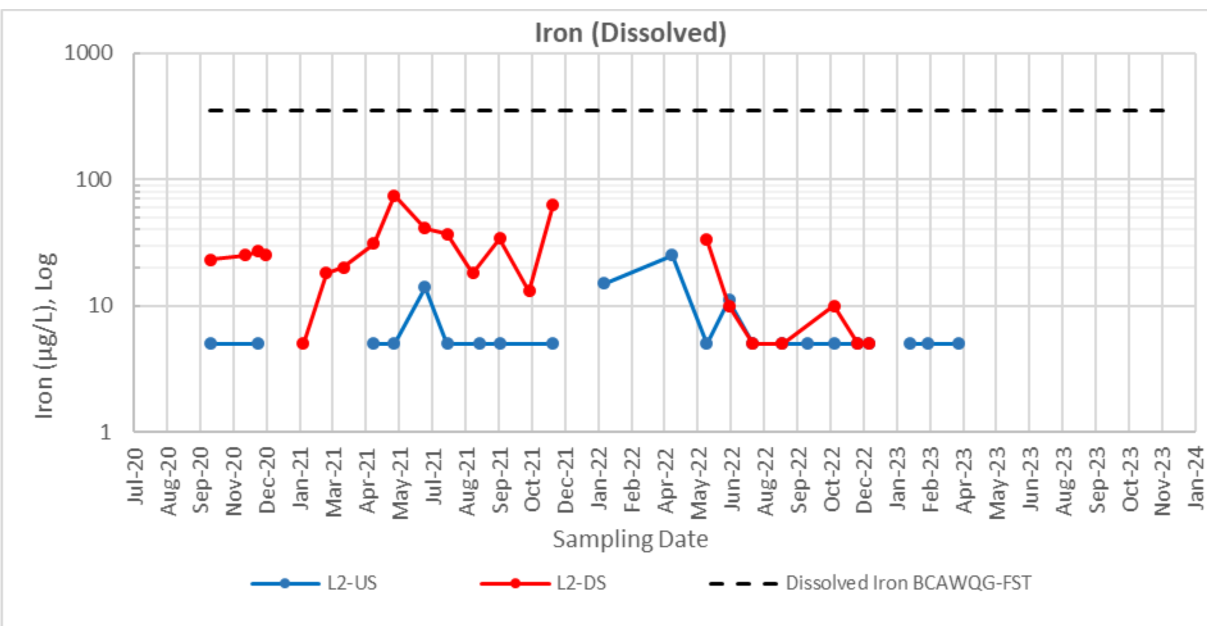


Figure 39: Total Arsenic at L2 Powerhouse Locations

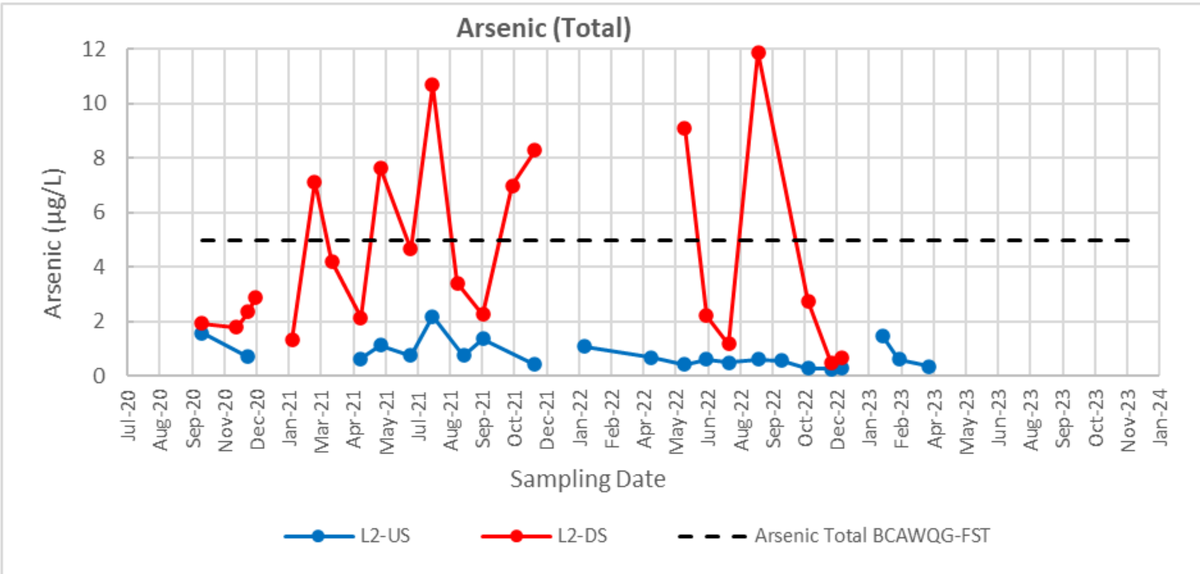


Figure 40: Dissolved Cadmium at L2 Powerhouse Locations

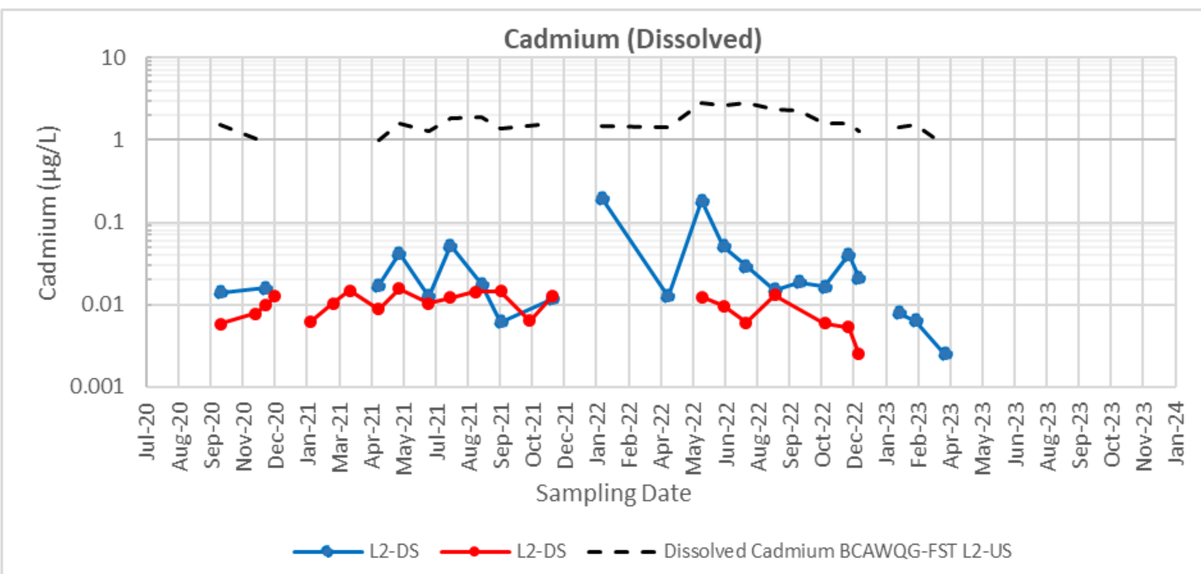


Figure 41: Total Cobalt at L2 Powerhouse Locations

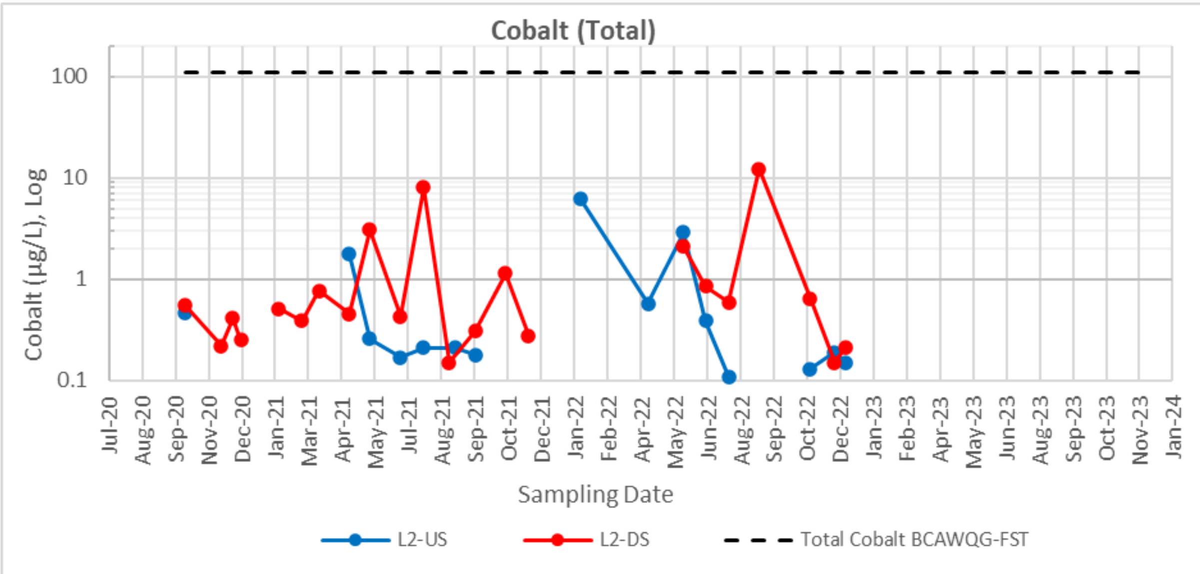


Figure 42: Dissolved Copper at L2 Powerhouse Locations

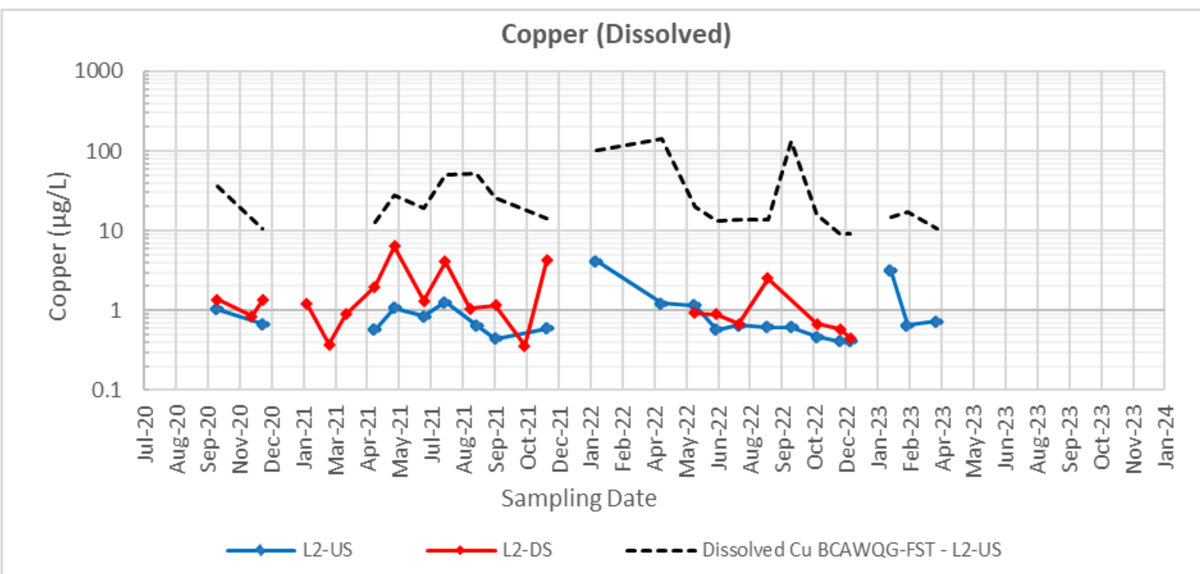


Figure 43a: Total Zinc at L2 Powerhouse Locations

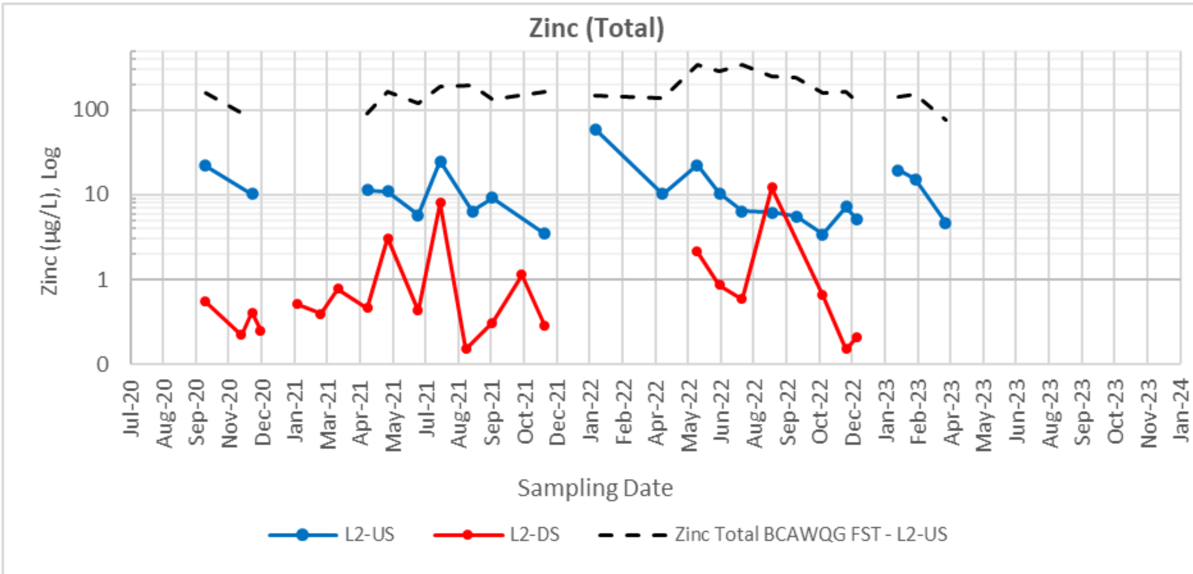


Figure 43b: Dissolved Zinc at L2 Powerhouse Locations

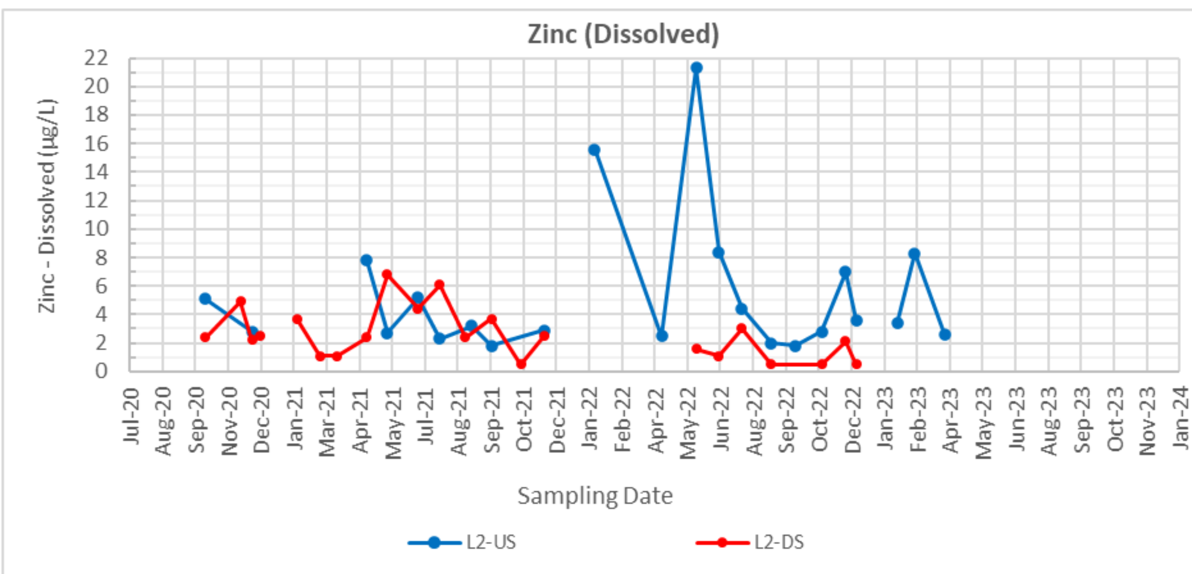


Figure 44a: Total Selenium at L2 Powerhouse Locations

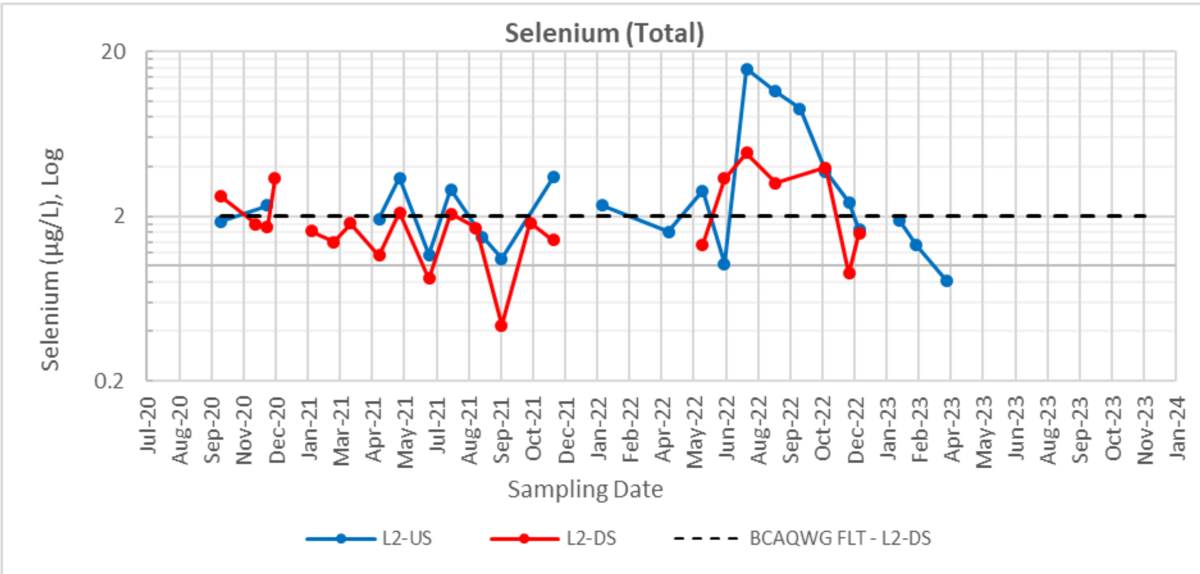


Figure 44b: Dissolved Selenium at L2 Powerhouse Locations

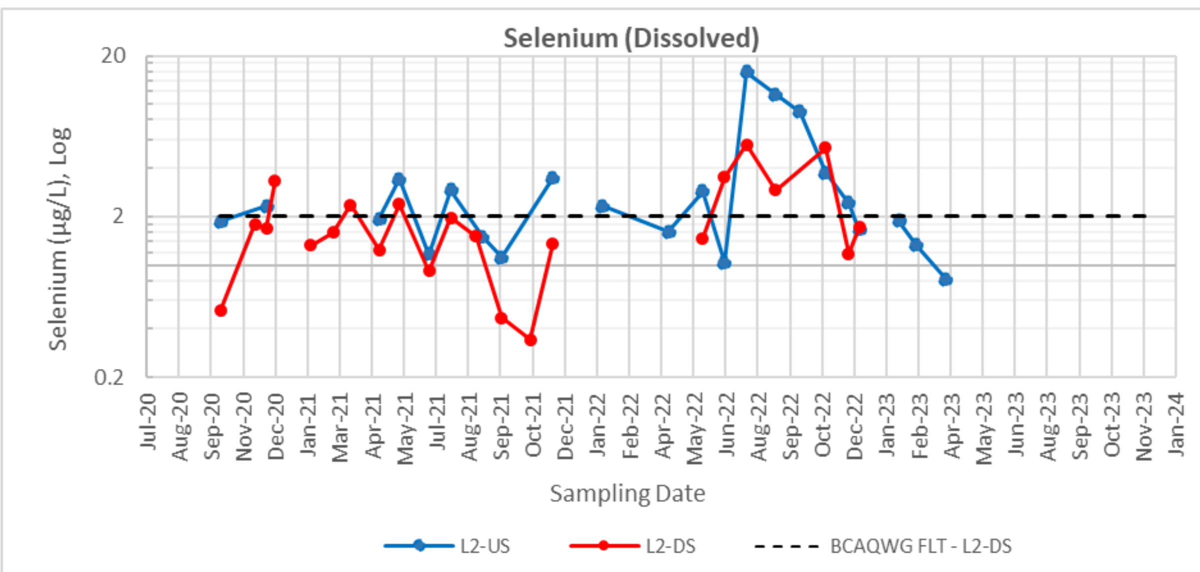


Figure 45: Ammonia (NH_4 as N) at L2 Powerhouse Locations

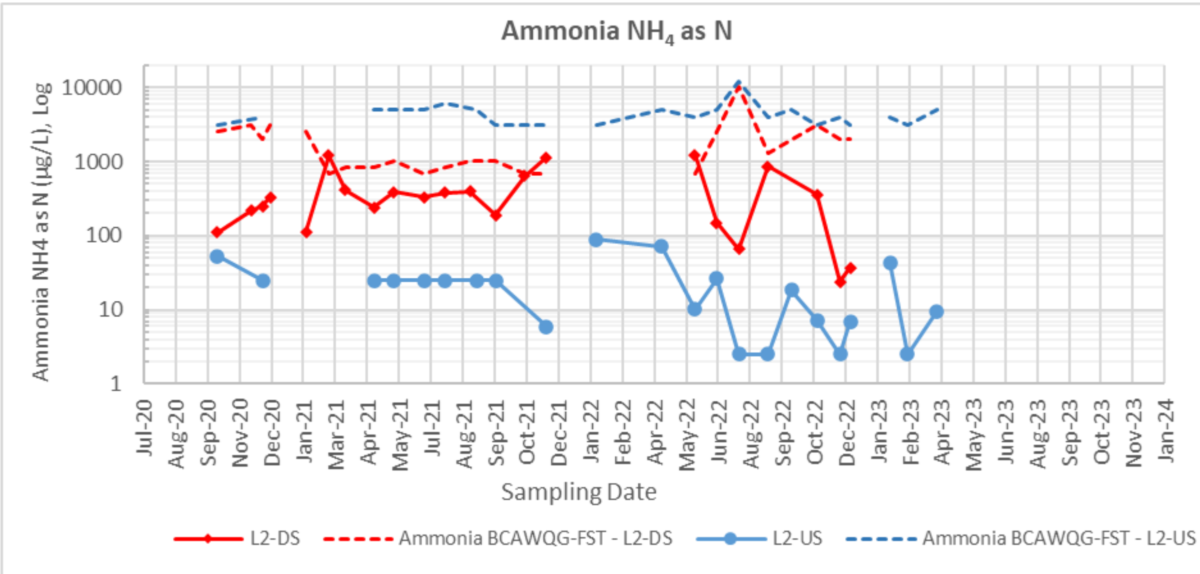


Figure 46: pH at LBDB Locations

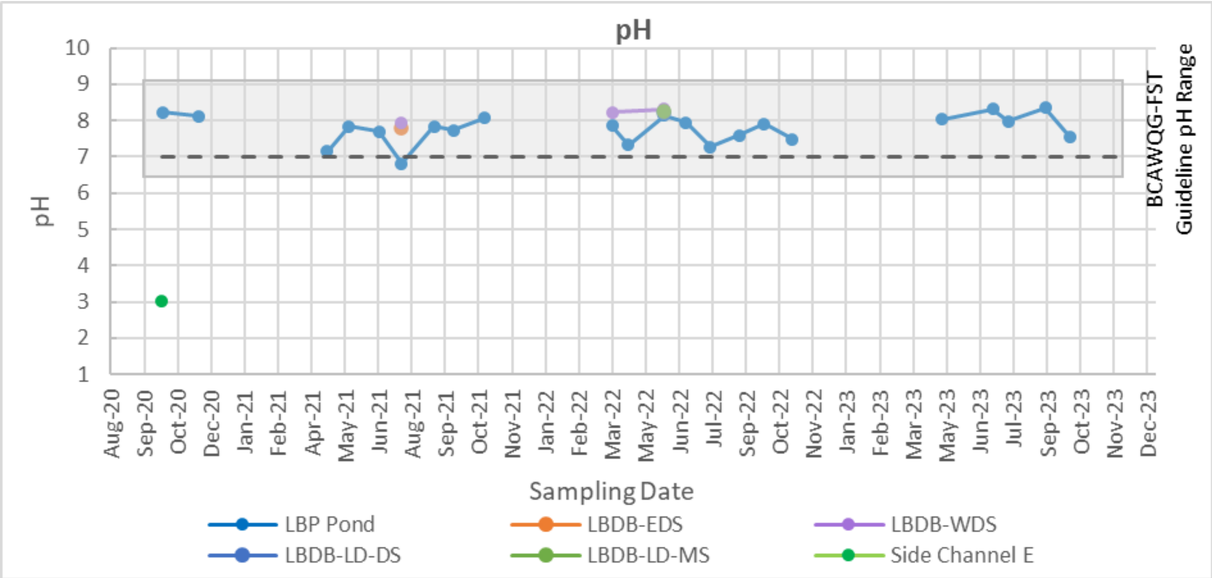


Figure 47: Total Alkalinity at LBDB Locations

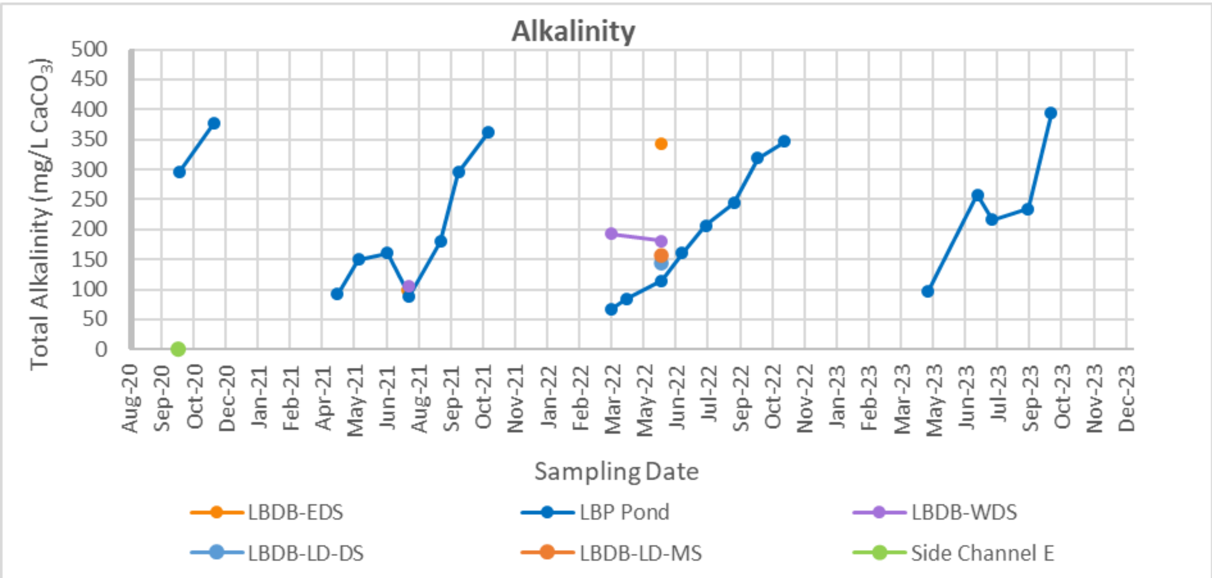


Figure 48: Acidity at LBDB Locations

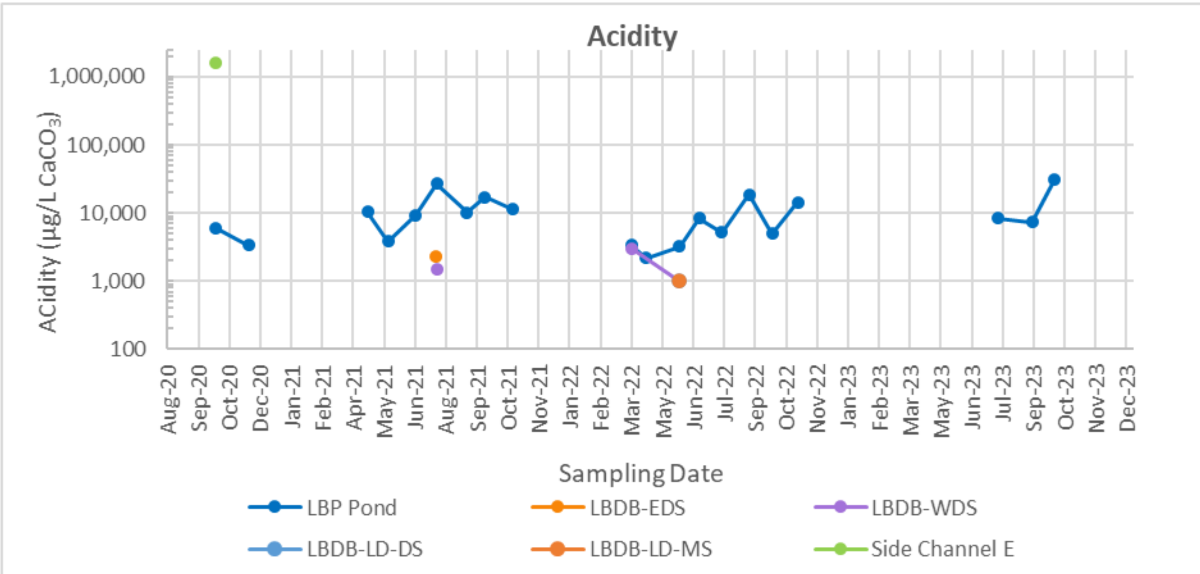


Figure 49: Sulphate at LBDB Locations

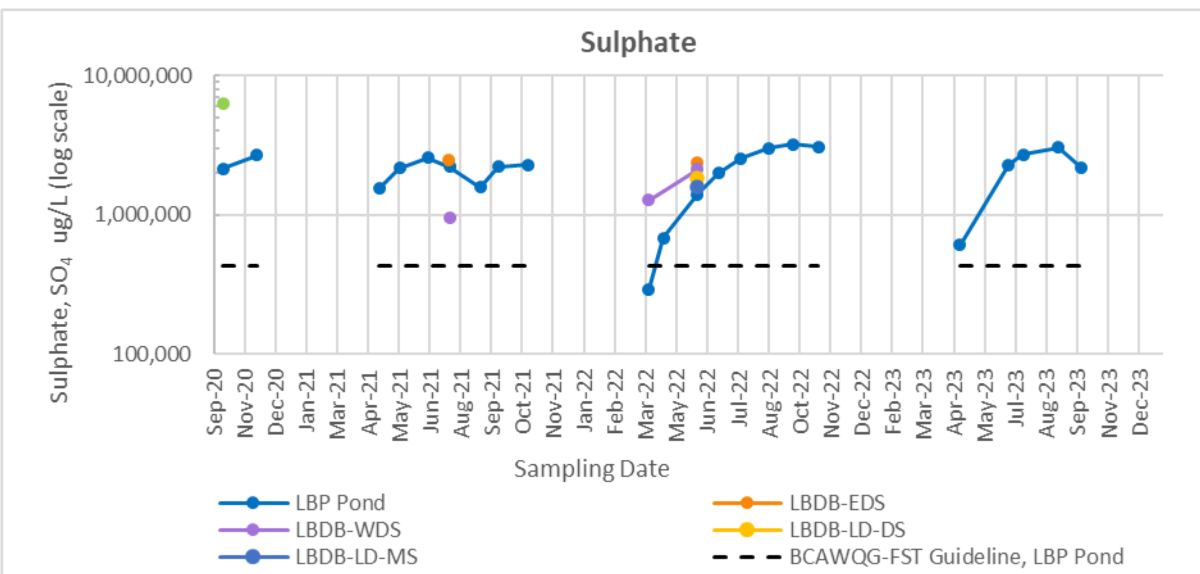


Figure 50a: Total Dissolved Solids (TDS) at LBDB Locations

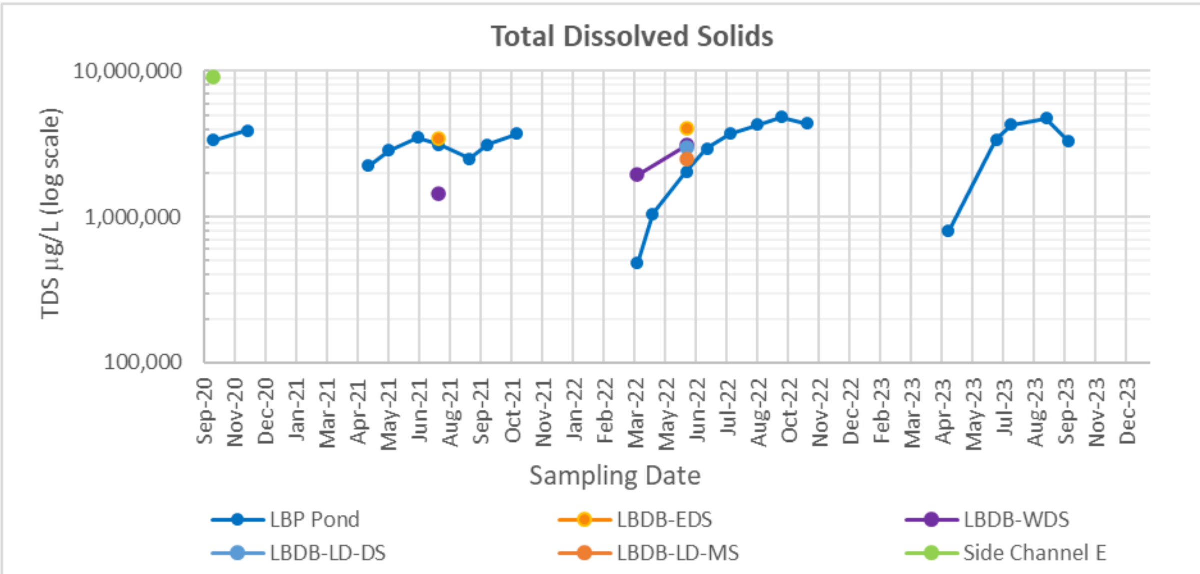


Figure 50b: Total Suspended Solids (TSS) at LBDB Locations

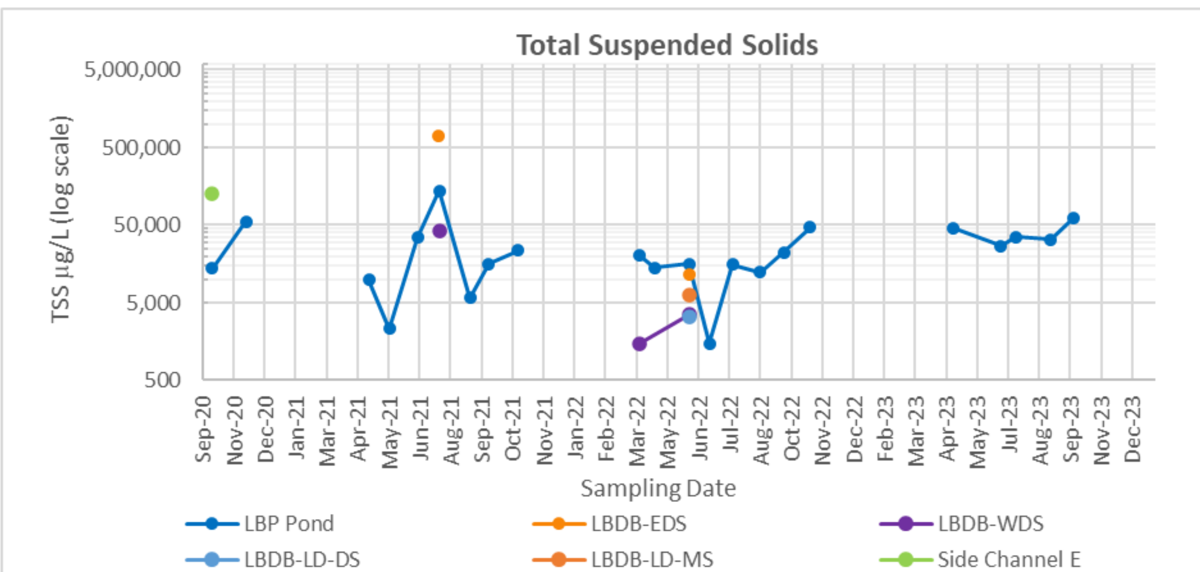


Figure 51a: Total Aluminum at LBDB Locations

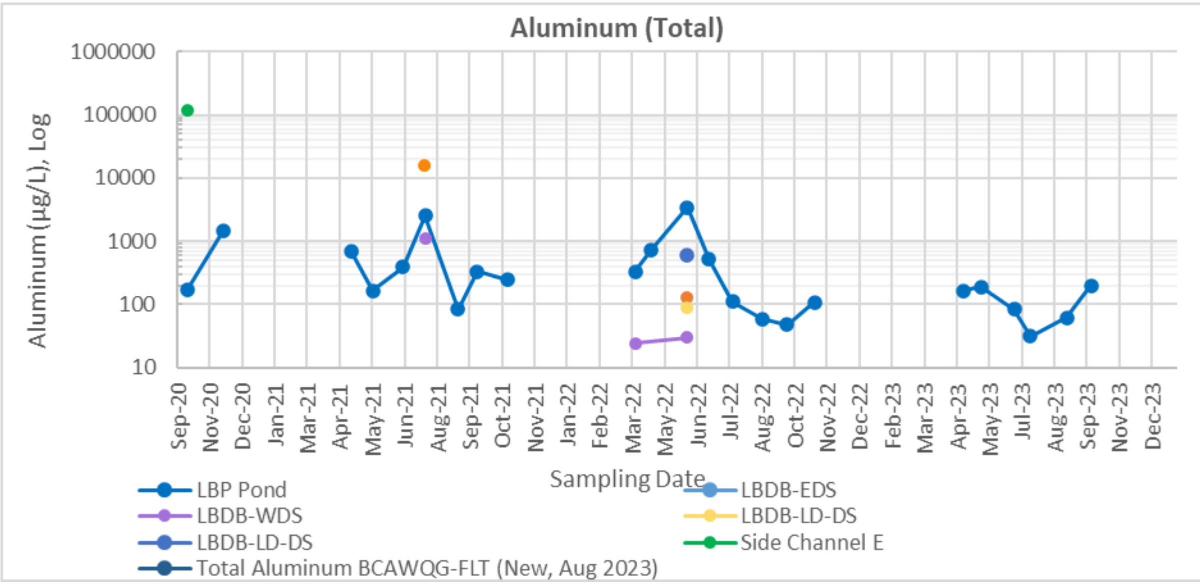


Figure 51b: Dissolved Aluminum at LBDB Locations

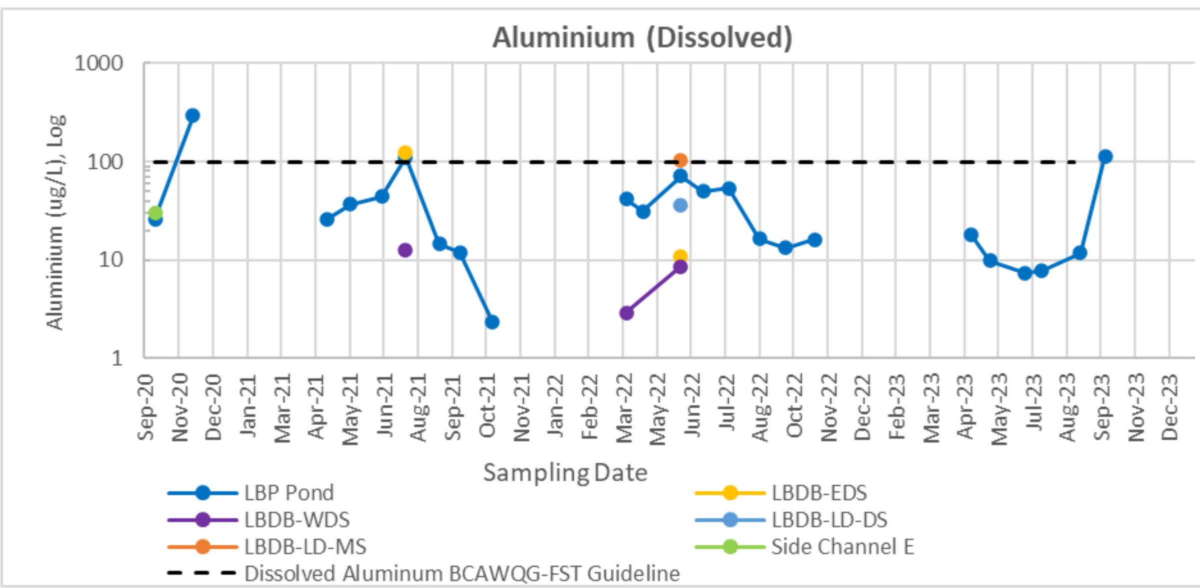


Figure 52a: Total Iron at LBDB Locations

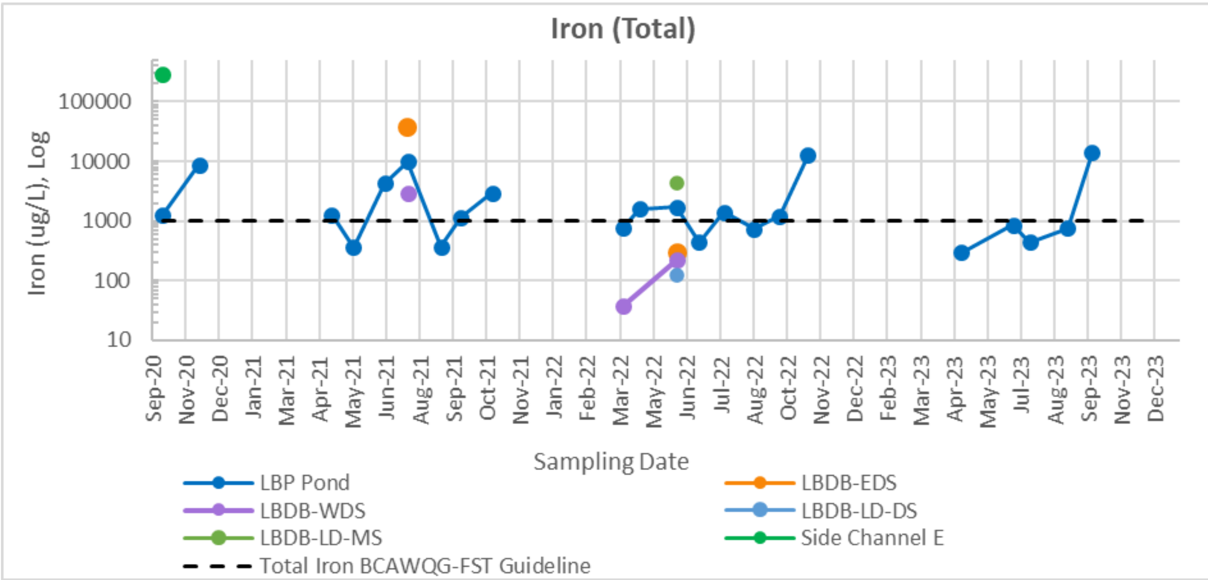


Figure 52b: Dissolved Iron at LBDB Locations

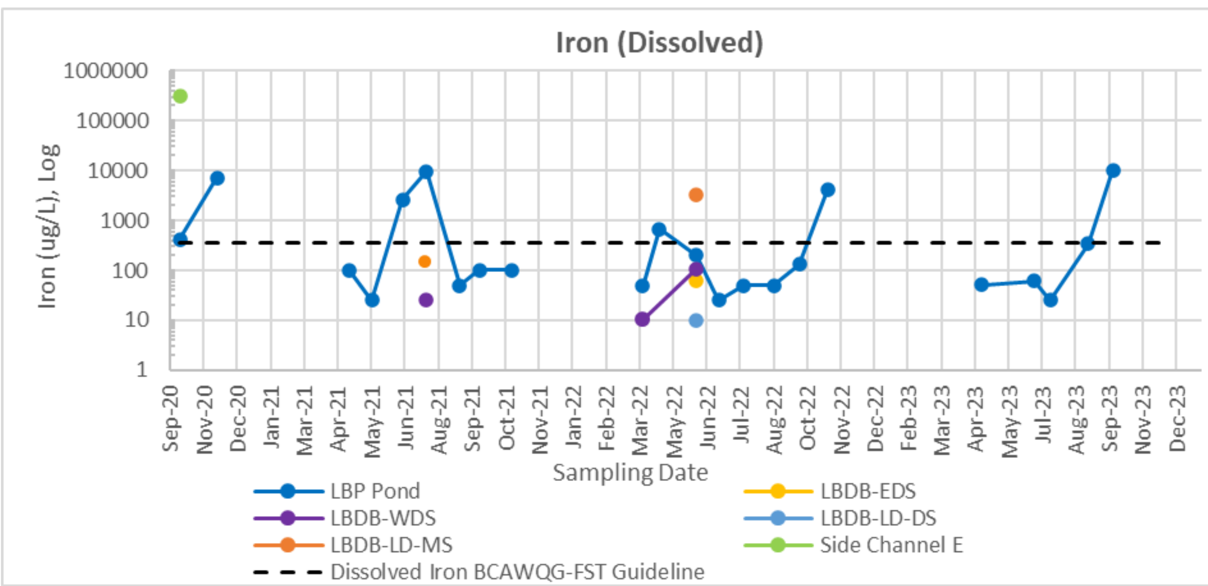


Figure 53: Total Arsenic at LBDB Locations

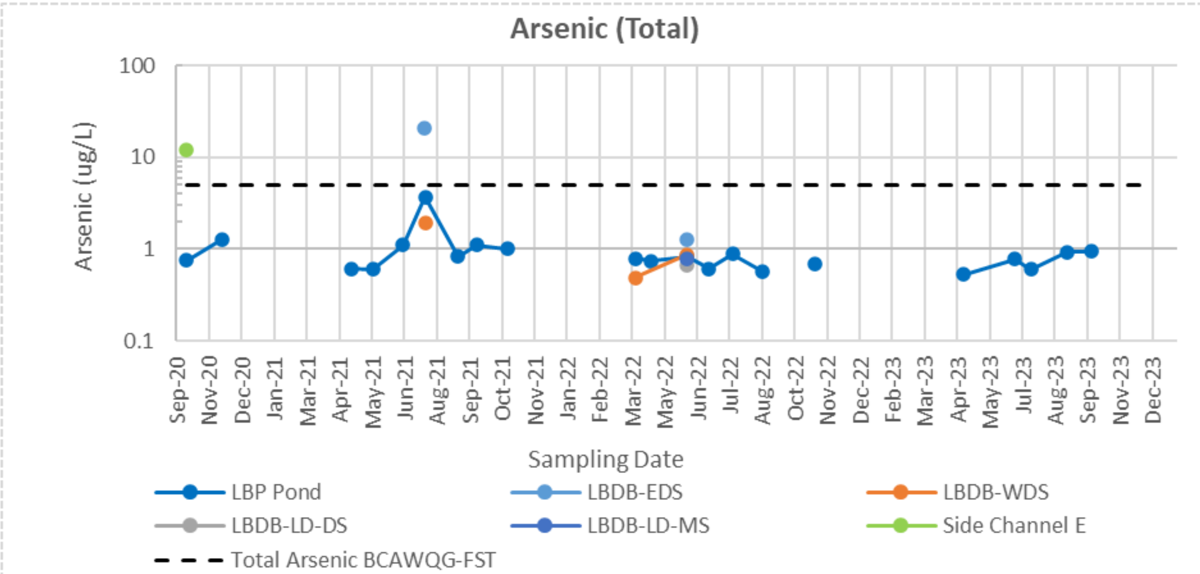


Figure 54: Dissolved Cadmium at LBDB Locations

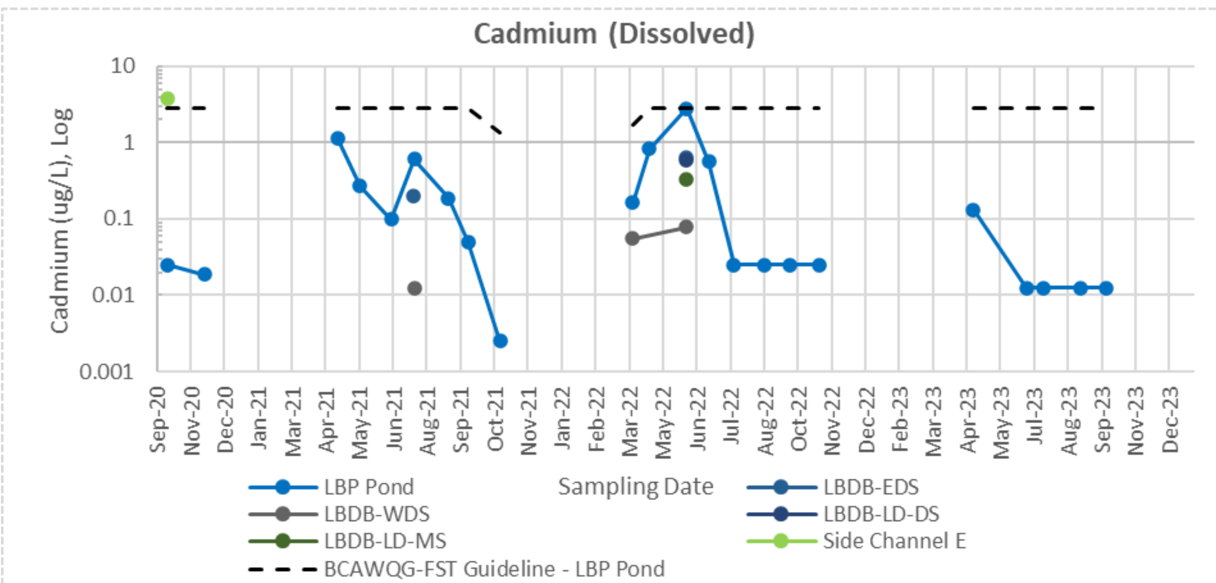


Figure 55: Total Cobalt at LBDB Locations

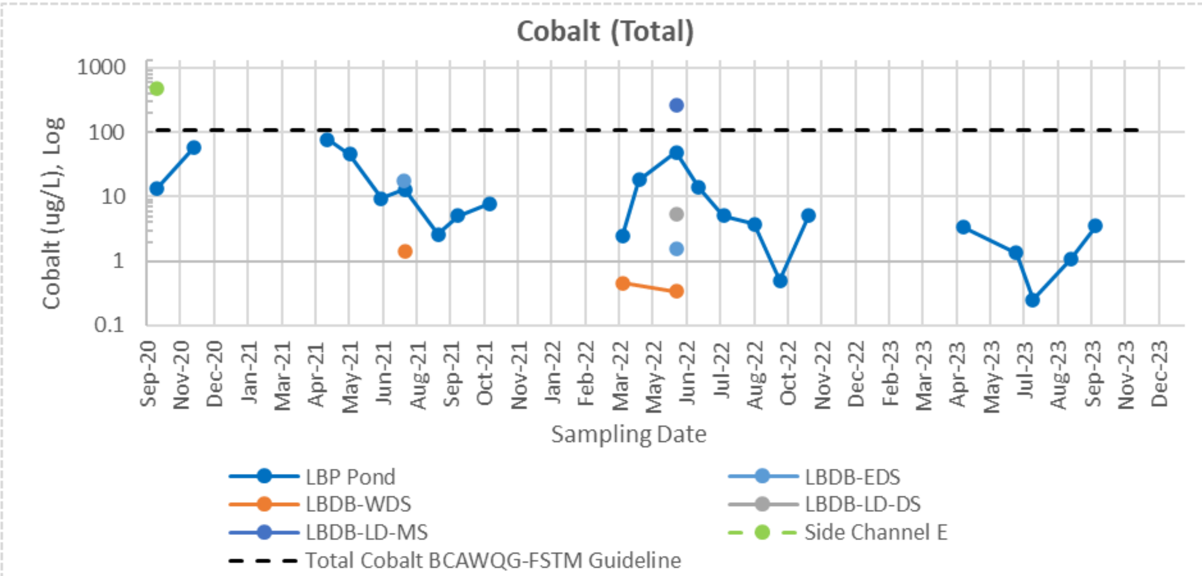


Figure 56: Dissolved Copper at LBDB Locations

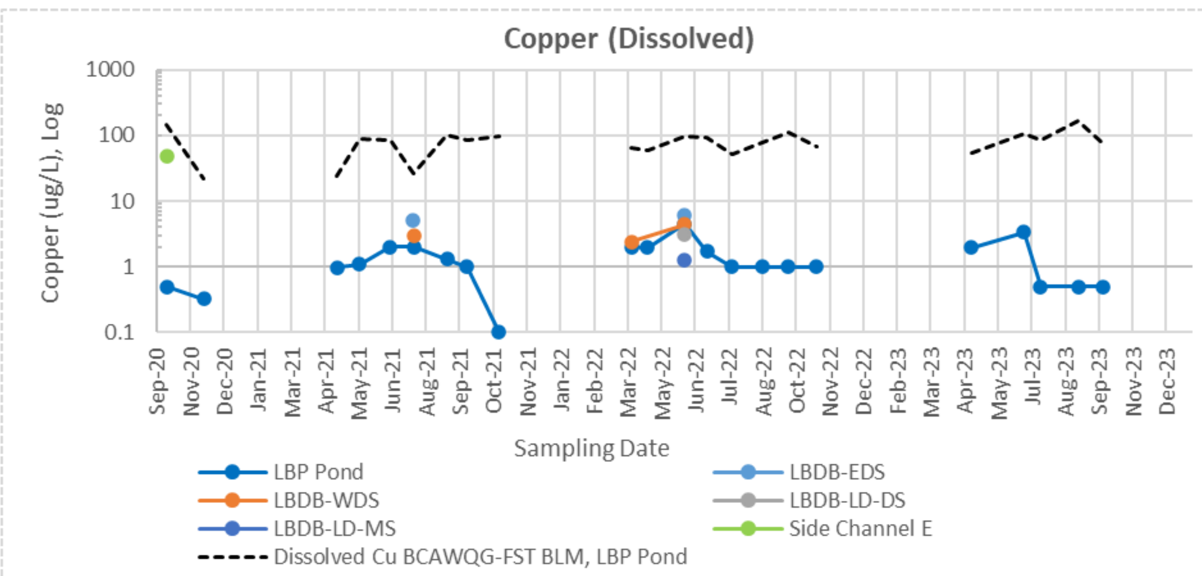


Figure 57a: Total Zinc at LBDB Locations

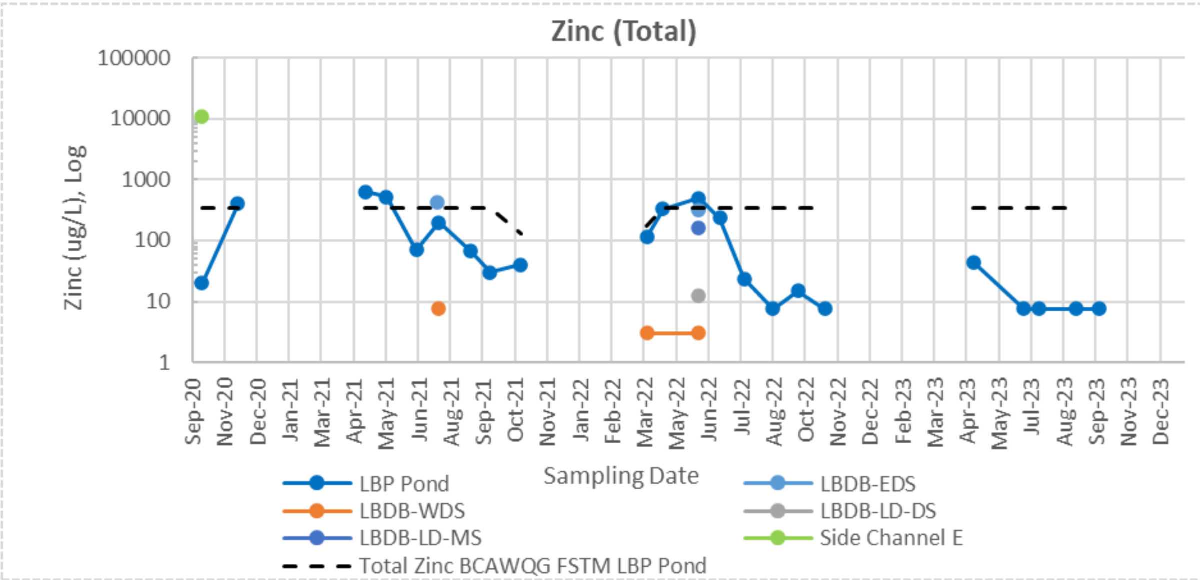
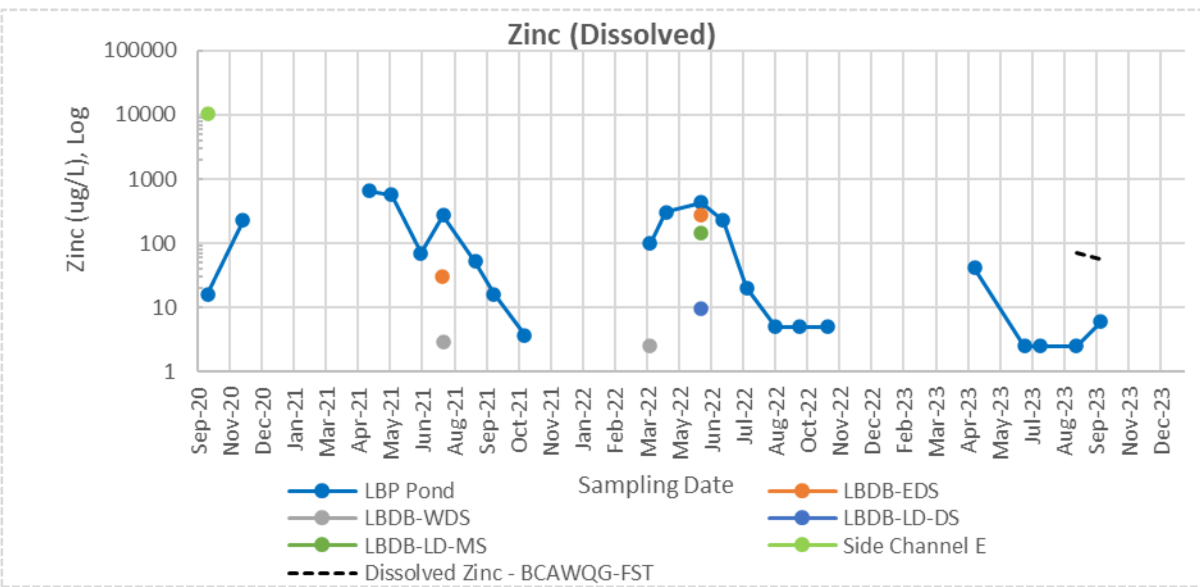


Figure 57b: Dissolved Zinc at LBDB Locations



TABLES

Table 1: Water Sampling Locations and In Situ and Lab Events

		Routine Memo Number:			-		1				2				3				4				-		-		-	
		Sampling Event Number:			1		2		3		4		5		6		7		8		9		10		11		12	
Catchment	Sample Site	UTM Coordinates Zone 10 (NAD83)		Elevation	30-Jan-23		20-Feb-23		29-Mar-23		28-Apr-23		19-May-23		28-Jun-23		17-Jul-23		30-Aug-23		28-Sep-23		29-Oct-23		26-Nov-23		21-Dec-23	
		Easting	Northing		In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab
Right Bank - South Bank Initial Access Road	RBSBIAR-US	630327	6228397	468.0																	✓	✓						
	RBSBIAR-DS	630320	6228645	445.2					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
	RBSBIAR-EUS	630376	6228399	464.6					✓		✓		✓	✓	✓	✓	✓	✓	✓		✓							
	RBSBIAR-EDS	630370	6228635	437.4					✓	✓																		
	RBSC-DS	630475	6228672	418.6																								
Left Bank River Road	LBRR-DD*	632853	6229862	422.0					✓	✓																		
	LBRR-EDP	632715	6229832	416.4					✓	✓	✓	✓									✓	✓						
	LBRR-LC	632856	6229899	427.2					✓	✓																		
	LBRR-UC	633018	6230253	463.2																								
	LBRR-12+500	632914	6229921	432																								
	LBRR-12+600	632948	6229983	436																								
	LBRR-12+700	632992	6230078	443																								
	LBRR-12+810	633039	6230195	454																								
	LBRR-12+920	633000	6230282	463					✓		✓		✓		✓		✓		✓		✓							
	RR8*	632262	6229624	412																								
	RR9*	632460	6229680	413					✓	✓											✓	✓						
Left Bank Debris Boom	LB Pond	628227	6231885	458							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
	LBDB-WUS	628189	6231933	-																								
	LBDB-WDS	627969	6231883	-																								
	LBDB-EUS	628202	6231908	-																								
	LBDB-EDS	627994	6231856	-																								
	LBDB-LD-US	628257	6231876	-																								
	LBDB-LD-MS	628147	6231844	-																								
	LBDB-LD-DS*	628093	6231766	-																								
L2 Powerhouse	L2 DS	629607	6229185	385																								
	L2 US	629701	6229279	414	✓	✓	✓	✓	✓	✓																		

*Discharge Location.

No sampling in December 2021 due to frozen condtions at all locations

All elevations are approximate

Table 2: Daily and 7-Day Mean Temperature and Precipitation

Date	Time	Precipitation[1]		Temperature[1]			Summary
Sample Event Date Bolded	Time Period	Precipitation Event	Total (mm)	Mean (°C)	Minimum (°C)	Maximum (°C)	24 Hr and 7 Day Precipitation
January 23-29, 2023	7 days	Jan 22, 26 and 27	1.08	-3.4	-20.8	8.4	Minimal (1.08 mm) precipitation.
January 29, 2023	24 hrs.	none	0.00	-15.2	-20.8	-9.8	No precipitation.
January 30, 2023	**24 hrs.**	**30-Jan**	**0.91**	**-11.3**	**-15.3**	**-8.1**	**Minimal (0.91 mm) precipitation**
February 13-18, 2023	7 days	Feb 13, 14, 18 and 19	2.36	-8.4	-17.9	4.7	minimal precipitation (2.36mm) on Feb 13, 14, 18, 19
February 19, 2023	24 hrs.	19-Feb	0.11	-10.2	-13.9	-6	minimal precipitation (0.11mm) on Feb 19
February 20, 2023	**24 hrs.**	**20-Feb**	**0.21**	**-10.2**	**-14.7**	**-7.6**	**Minimal precipitation (0.21 mm) on Feb 20**
March 22-28, 2023	7 days	Mar 26 only	0.44	0.3	-6.9	10.1	Minimal precipitation (0.44 mm) Mar 26
March 28, 2023	24 hrs.	none	0.00	1.2	-6.9	8.8	No precipitation.
March 29, 2023	**24 hrs.**	**29-Mar**	**1.03**	**1.1**	**-0.7**	**2.5**	**Minimal precipitation (1.03 mm) on Mar 29**
April 21-27, 2023	7 days	**Apr 23, 24 and 26**	**3.38**	**6**	**-0.9**	**13.9**	Minimal precipitation (3.38 mm) on April 23, 24, 26
April 27, 2023	24 hrs.	**none**	**0.00**	**9.1**	**2.6**	**13.9**	No precipitation.
April 28, 2023	**24 hrs.**	**none**	**0.00**	**12**	**5.5**	**17.6**	**No precipitation.**
May 12-18, 2023	7 days	none	0.00	17.8	6.9	32.1	No precipitation.
May 18, 2023	24 hrs.	none	0.00	15	6.9	22.5	No precipitation.
May 19, 2023	**24 hrs.**	**none**	**0.00**	**14.1**	**9.2**	**19.6**	**No precipitation.**
June 17-23, 2021	7 days	Jun 22, 24, 25 and 27	9.31	19.4	6.6	28.4	Moderate (9.31 mm) precipitation on June 22, 24, 25, 27
June 27, 2023	24 hrs.	27-Jun	0.71	20.4	14.6	28.3	Minimal (0.71 mm) precipitation.
June 28, 2023	**24 hrs.**	**28-Jun**	**0.10**	**21.1**	**12.2**	**29.8**	**Minimal (0.10 mm) precipitation.**
July 10-16	7 days	Jul 10-11 and 13-16	3.20	20	12.5	28.5	Minimal precipitation (3.20 mm) on June 10-11, 13-16
July 16, 2023	24 hrs.	none	0.07	18	12.7	23.7	Minimal (0.07 mm) precipitation
July 17, 2023	**24 hrs.**	**none**	**0.00**	**16.8**	**12.5**	**23**	**Moderate precipitation on July 20 (6.72 mm) and July 21 (22.95 mm)**
August 22-29, 2023	7 days	Aug 23 and 24	0.37	19.4	8.8	30.6	Minimal (0.37 mm) precipitation on Aug 23, 24
August 29, 2023	24 hrs.	none	0.00	17.3	11.1	25.3	No precipitation.
August 30, 2023	**24 hrs.**	**30-Aug**	**0.28**	**18**	**11.5**	**27.1**	**Minimal (0.28 mm) precipitation**
September 21-27, 2023	7 days	Sep 24, 25 and 27	12.31	12	3.1	26.2	Moderate (12.31 mm) precipitation Sep 24, 25, 27
September 27, 2023	24 hrs.	27-Sep	2.52	11.1	8.4	13.9	Minimal (2.52 mm) precipitation.
September 28, 2023	**24 hrs.**	**28-Sep**	**8.67**	**8.7**	**7.0**	**9.7**	**Moderate (8.67 mm) precipitation.**
October 22-28, 2023	7 days	Oct 22 and 23	4.63	-5.8	-14.7	3.3	Minimal (4.63 mm) precipitation Oct 22, 23
October 28, 2023	24 hrs.	none	0.00	-2.7	-7.3	3.3	No precipitation
October 29, 2023	**24 hrs.**	**none**	**0.00**	**-3.8**	**-7.4**	**0.3**	**No precipitation**
November 19-25, 2023	7 days	Nov 20 and 25	0.57	-3.7	-12.4	7.8	Minimal (0.57 mm) precipitation
November 25, 2023	24 hrs.	25-Nov	**0.12**	0.7	-1.5	2.9	Minimal (0.12 mm) precipitation
November 26, 2023	**24 hrs.**	**none**	**0.00**	**-1.7**	**-3.3**	**1.5**	**No precipitation**
December 14-20, 2023	7 days	Dec 19 only	3.55	-2.0	-9.5	0.49	**Minimal (3.55 mm) precipitation**
December 20, 2023	24 hrs.	none	0.00	-3.0	-7.4	4.2	**No precipitation**
December 21, 2023	**24 hrs.**	**none**	**0.00**	**-1.0**	**-2.5**	**1.4**	**No precipitation**

[1] BC Ministry of Environment, BC Air quality data: Fort St John North Camp C_Met_60 weather station. https://envistaweb.env.gov.bc.ca/.

Table 3: Classification of Flows in Ditch

Sample Event Date Bolded	Time Period	Precipitation Event	Total (mm)	Mean (°C)	24 Hr and 7 Day Precipitation	Classification
January 23-29, 2023	7 days	Jan 22, 26 and 27	1.08	-3.4	Minimal (1.08 mm) precipitation.	Regional groundwater flow; frozen conditions.
January 29, 2023	24 hrs.	none	0.00	-15.2	No precipitation.	
January 30, 2023	**24 hrs.**	**30-Jan**	**0.91**	**-11.3**	**Minimal (0.91 mm) precipitation**	
February 13-18, 2023	7 days	Feb 13, 14, 18 and 19	2.36	-8.4	minimal precipitation (2.36mm) on Feb 13, 14, 18, 19	Regional groundwater flow; frozen conditions.
February 19, 2023	24 hrs.	19-Feb	0.11	-10.2	minimal precipitation (0.11mm) on Feb 19	
February 20, 2023	**24 hrs.**	**20-Feb**	**0.21**	**-10.2**	**Minimal precipitation (0.21 mm) on Feb 20**	
March 22-28, 2023	7 days	Mar 26 only	0.44	0.3	Minimal precipitation (0.44 mm) Mar 26	Regional groundwater flow; slight warming conditions
March 28, 2023	24 hrs.	none	0.00	1.2	No precipitation.	
March 29, 2023	**24 hrs.**	**29-Mar**	**1.03**	**1.1**	**Minimal precipitation (1.03 mm) on Mar 29**	
April 21-27, 2023	7 days	**Apr 23, 24 and 26**	**3.38**	**6.0**	Minimal precipitation (3.38 mm) on April 23, 24, 26	Surface runoff and early spring freshet; melting and warming conditions.
April 27, 2023	24 hrs.	**none**	**0.00**	**9.1**	No precipitation.	
April 28, 2023	**24 hrs.**	**none**	**0.00**	**12.0**	**No precipitation.**	
May 12-18, 2023	7 days	none	0.00	17.8	No precipitation.	Surface runoff and spring freshet; melting and warming conditions.
May 18, 2023	24 hrs.	none	0.00	15	No precipitation.	
May 19, 2023	**24 hrs.**	**none**	**0.00**	**14.1**	**No precipitation.**	
June 17-23, 2021	7 days	Jun 22, 24, 25 and 27	9.31	19.4	Moderate (9.31 mm) precipitation on June 22, 24, 25, 27	Late freshet surface runoff, shallow and regional groundwater flow.
June 27, 2023	24 hrs.	27-Jun	0.71	20.4	Minimal (0.71 mm) precipitation.	
June 28, 2023	**24 hrs.**	**28-Jun**	**0.10**	**21.1**	**Minimal (0.10 mm) precipitation.**	
July 10-16	7 days	Jul 10-11 and 13-16	3.20	20.0	Minimal precipitation (3.20 mm) on June 10-11, 13-16	Shallow or regional groundwater flow; warm temperatures.
July 16, 2023	24 hrs.	none	0.07	18.0	Minimal (0.07 mm) precipitation	
July 17, 2023	**24 hrs.**	**none**	**0.00**	**16.8**	**Moderate precipitation on July 20 (6.72 mm) and July 21 (22.95 mm)**	
August 22-29, 2023	7 days	Aug 23 and 24	0.37	19.4	Minimal (0.37 mm) precipitation on Aug 23, 24	Shallow or regional groundwater flow; warm temperatures.
August 29, 2023	24 hrs.	none	0.00	17.3	No precipitation.	
August 30, 2023	**24 hrs.**	**30-Aug**	**0.28**	**18.0**	**Minimal (0.28 mm) precipitation**	
September 21-27, 2023	7 days	Sep 24, 25 and 27	12.31	12.0	Moderate (12.31 mm) precipitation Sep 24, 25, 27	Shallow or regional groundwater flow and surface runoff; cooling temperatures.
September 27, 2023	24 hrs.	27-Sep	2.52	11.1	Minimal (2.52 mm) precipitation.	
September 28, 2023	**24 hrs.**	**28-Sep**	**8.67**	**8.7**	**Moderate (8.67 mm) precipitation.**	
October 22-28, 2023	7 days	Oct 22 and 23	4.63	-5.8	Minimal (4.63 mm) precipitation Oct 22, 23	Regional groundwater flow; frozen conditions.
October 28, 2023	24 hrs.	none	0.00	-2.7	No precipitation	
October 29, 2023	**24 hrs.**	**none**	**0.00**	**-3.8**	**No precipitation**	
November 19-25, 2023	7 days	Nov 20 and 25	0.57	-3.7	Minimal (0.57 mm) precipitation	Regional groundwater flow; frozen conditions.
November 25, 2023	24 hrs.	25-Nov	**0.12**	0.7	Minimal (0.12 mm) precipitation	
November 26, 2023	**24 hrs.**	**none**	**0.00**	**-1.7**	**No precipitation**	
December 14-20, 2023	7 days	Dec 19 only	3.55	-2.0	**Minimal (3.55 mm) precipitation**	Regional groundwater flow; frozen conditions.
December 20, 2023	24 hrs.	none	0.00	-3.0	**No precipitation**	
December 21, 2023	**24 hrs.**	**none**	**0.00**	**-1.0**	**No precipitation**	

Table 4: Turbidity and TSS of the Peace River for Water Sampling Events

Date	Turbidity (Daily Mean) and TSS Measurements and Calculations - Peace River above Moberly River			
Sampling Event Date Bolded	**Left Bank**		**Right Bank**	
	NTU [1]	**TSS [1] (mg/L)**	**NTU [1]**	**TSS [1] (mg/L)**
January 23-29, 2023	4.4	3.1	6.6	4.7
January 29, 2023	2.5	1.8	2.5	1.7
January 30, 2023	**4.6**	**3.3**	**7.5**	**5.3**
January 31, 2023	5.0	3.6	6.4	4.6
February 13-19, 2023	4.0	2.8	4.7	3.3
February 19, 2023	2.3	1.7	2.9	2.0
February 20, 2023	**2.2**	**1.6**	**1.4**	**1.0**
February 21, 2023	2.7	1.9	0.9	0.7
April 22-28, 2023	5.7	4.1	4.1	2.9
March 28, 2023	7.6	5.4	5.4	3.9
March 29, 2023	**6.1**	**4.3**	**3.5**	**2.5**
March 30, 2023	8.7	6.2	5.3	3.8
April 21-27, 2023	20.2	14.3	16.1	11.4
April 27, 2023	24.8	17.6	23.3	16.5
April 28, 2023	**28.9**	**20.6**	**33.2**	**23.6**
April 29, 2023	33.6	23.8	41.7	29.6
May 12-18, 2023	170.1	120.8	130.4	92.6
May 18, 2023	237.8	168.8	153.8	109.2
May 19, 2023	**146.4**	**103.9**	**104.0**	**73.9**
May 20, 2023	112.3	79.7	81.5	57.9
June 21-27, 2023	9.4	6.6	10.7	7.6
June 27, 2023	13.5	9.6	15.3	10.8
June 28, 2023	**17.3**	**12.3**	**19.2**	**13.6**
June 29, 2023	16.3	11.6	15.2	10.8
July 10-16, 2023	14.3	10.1	8.5	6.0
July 16, 2023	38.9	27.6	12.9	9.2
July 17, 2023	**14.4**	**10.2**	**8.1**	**5.7**
July 18, 2023	11.2	8.0	6.9	4.9
August 23-29, 2023	4.6	3.2	2.4	1.7
August 29, 2023	5.1	3.7	3.6	2.5
August 30, 2023	**3.4**	**2.4**	**1.5**	**1.0**
August 31, 2023	3.5	2.5	1.5	1.1
September 21-27, 2023	3.9	2.8	2.9	2.1
September 27, 2023	4.0	2.8	3.6	2.6
September 28, 2023	**4.3**	**3.0**	**3.1**	**2.2**
September 29, 2023	5.3	3.8	5.2	3.7
October 22-28, 2023	5.3	3.8	4.1	2.9
October 28, 2023	4.6	3.2	2.2	1.5
October 29, 2023	**3.4**	**2.4**	**2.7**	**1.9**
October 30, 2023	4.1	2.9	2.2	1.6
November 19-25, 2023	1.5	1.1	1.3	0.9
November 25, 2023	0.7	0.5	0.5	0.3
November 26, 2023	**0.7**	**0.5**	**0.4**	**0.3**
November 27, 2023	0.7	0.5	0.5	0.3
December 14-20, 2023	4.2	3.0	4.5	3.2
December 20, 2023	2.5	1.8	2.7	1.9
December 21, 2023	**2.5**	**1.8**	**2.7**	**1.9**
December 22, 2023	2.5	1.8	2.6	1.9

[1] NTU (Nephelometric Turbidity Unit) and TSS (total suspended sediment) data provided by Ecofish Ltd., January 26, 2024.

NTU: to some extent, measures (scattered light at 90 degrees from the incident light beam) how much light reflects for a given amount of particulates dependent upon properties of the particles, e.g. their shape, color, and reflectivity.

Note: 7-day average turbidity values are calculated as the average turbidity measured during the prior seven days to the sampling event.

Table 5a: QAQC - Travel and Field Blanks

Ua	Unit	RDL	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Travel Blank	Field Blank
			30-Jan-23	30-Jan-23	20-Feb-23	20-Feb-23	29-Mar-23	29-Mar-23	28-Apr-23	28-Apr-23	19-May-23	19-May-23	28-Jun-23	28-Jun-23	17-Jul-23	17-Jul-23	30-Aug-23	30-Aug-23	28-Sep-23	28-Sep-23
Physical Parameters																				
Acidity (as $CaCO_3$)	µg/L	1000	<2000	<2000	2200	2200	<2000	<2000	<2000	<2000	2200	2200	<2000	<2000	2300	2400	2200	2100	2300	2300
Alkalinity (Total as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Electrical Conductivity (EC)	µS/cm	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness as $CaCO_3$, dissolved	µg/L	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardness as $CaCO_3$, from total Ca/Mg	µg/L	600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600	<600
pH	pH Units	0.1	5.43	5.46	5.31	5.53	5.42	5.36	5.32	5.56	5.17	5.15	5.69	5.36	5.46	5.42	5.28	5.26	5.40	5.39
Total Dissolved Solids (TDS)	µg/L	10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Total Suspended Solids (TSS)	µg/L	3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000
Alkalinity (Hydroxide as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Anions and Nutrients																				
Ammonia (NH_4 as N)	µg/L	5.0	<5	<5	**15.9**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride (Cl^-)	µg/L	500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Nitrate (NO_3^- as N)	µg/L	5.0	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Nitrite (NO_2^- as N)	µg/L	1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO_4)	µg/L	300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Dissolved Organic Carbon (DOC)	µg/L	500																		
Metals, Total																				
Aluminum	µg/L	3.0	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Antimony	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beryllium	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium	µg/L	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cesium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	0.10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	µg/L	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Lead	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	µg/L	1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	µg/L	5.0	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Manganese	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosphorus	µg/L	50.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Rubidium	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Silicon	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Silver	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Strontium	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfur	µg/L	500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Tellurium	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	µg/L	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	3.0	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zirconium	µg/L	0.06	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Ua	Unit	RDL	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Travel Blank	Field Blank
			30-Jan-23	30-Jan-23	20-Feb-23	20-Feb-23	29-Mar-23	29-Mar-23	28-Apr-23	28-Apr-23	19-May-23	19-May-23	28-Jun-23	28-Jun-23	17-Jul-23	17-Jul-23	30-Aug-23	30-Aug-23	28-Sep-23	28-Sep-23
Metals, Dissolved																				
Aluminum	µg/L	1.0																		
Antimony	µg/L	0.10																		
Arsenic	µg/L	0.10																		
Barium	µg/L	0.10																		
Beryllium	µg/L	0.10																		
Bismuth	µg/L	0.05																		
Boron	µg/L	10.0																		
Cadmium	µg/L	0.005																		
Calcium	µg/L	50.0																		
Cesium	µg/L	0.01																		
Chromium	µg/L	0.10																		
Cobalt	µg/L	0.10																		
Copper	µg/L	0.20																		
Iron	µg/L	10.0																		
Lead	µg/L	0.05																		
Lithium	µg/L	1.0																		
Magnesium	µg/L	5.0																		
Manganese	µg/L	0.10																		
Mercury	µg/L	0.005																		
Molybdenum	µg/L	0.05																		
Nickel	µg/L	0.50																		
Phosphorus	µg/L	50.0																		
Potassium	µg/L	50.0																		
Rubidium	µg/L	0.20																		
Selenium	µg/L	0.05																		
Silicon	µg/L	50.0																		
Silver	µg/L	0.01																		
Sodium	µg/L	50.0																		
Strontium	µg/L	0.2																		
Sulfur	µg/L	500																		
Tellurium	µg/L	0.20																		
Thallium	µg/L	0.01																		
Thorium	µg/L	0.10																		
Tin	µg/L	0.10																		
Titanium	µg/L	0.30																		
Tungsten	µg/L	0.10																		
Uranium	µg/L	0.01																		
Vanadium	µg/L	0.50																		
Zinc	µg/L	1.0																		
Zirconium	µg/L	0.06																		
Laboratory Work Order Number			FJ2300206	FJ2300206	FJ2300373	FJ2300373	FJ2300677	FJ2300677	FJ2300936	FJ2300936	FJ2301129	FJ2301129	FJ2301553	FJ2301553	FJ2301738	FJ2301738	FJ2302196	FJ2302196	FJ23020574	FJ2302574

Notes:

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (ABS[(difference between two values)]/((sum of two values/2))*100

Blank indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results is less than detection limits or within 5 times the RDL.

Shaded gray only - exceeds BCAWQG-FSTM guideline.

Blank - not analyzed.

Table 5b: 2023 Quality Assurance/Quality Control for Water Quality Sample Results - Field Replicate Samples

Parameter	Unit	RDL	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	L2-US	L2-US-R	RPD %	L2-US	L2-US-R	RPD%	LBP-Pond	LBP-Pond-R	RPD %	LBP-Pond	LBP-Pond-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-US	RBSBIAR-US-R	RPD %
			30-Jan-23			20-Feb-23			29-Mar-23			28-Apr-23			19-May-23			28-Jun-23			17-Jul-23			30-Aug-23			28-Sep-23		
Physical Parameters																													
Acidity (as $CaCO_3$)	µg/L	1000	28500	26500	7.27	4900	5700	15.09	<2000	<2000		<2000	<2000		10300	9900	3.96	<2000	<2000		<2000	<2000		<2000	<2000		<2000	<2000	
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	179000	178000	0.56	193000	186000	3.69	136000	134000	1.5	97300	94400	3.03	240000	241000	0.42	189000	198000	4.7	228000	228000	0	222000	218000	1.82	185000	189000	2.14
Electrical Conductivity (EC)	µS/cm	2.0	540	544	0.74	547	547	0.00	340	342	0.6	1270	1270	0.00	2630	2650	0.76	681	781	13.7	821	821	0	820	797	2.84	512	511	0.20
Hardness as $CaCO_3$, dissolved	µg/L	500	238000	247000	3.71	250000	254000	1.59	147000	148000	0.7	506000	519000	2.54	1180000	1190000	0.84	357000	301000	17.0	265000	264000	0.38	210000	211000	0.48	250000	250000	0.00
Hardness as $CaCO_3$, from total Ca/Mg	µg/L		245000	239000	2.48	261000	272000	4.13	148000	150000	1.3	499000	530000	6.03	1200000	1200000	0.00	348000	304000	13.5	280000	271000	3.27	222000	209000	6.03	279000	285000	2.13
pH	pH Units	0.1	8.16	8.17	0.12	8.26	8.26	0.00	8.07	8.06	0.1	8.03	8.05	0.25	8.19	8.18	0.12	8.05	8.19	1.7	8.32	8.30	0.24	8.32	8.31	0.12	8.26	8.25	0.12
Total Dissolved Solids (TDS)	µg/L	10000	440000	434000	1.37	376000	348000	7.73	226000	206000	9.3	796000	960000	18.68	2200000	2250000	2.25	430000	502000	15.5	461000	608000	27.50	551000	543000	1.46	302000	359000	17.25
Total Suspended Solids (TSS)	µg/L	3000	84400	111000	27.2	5500	10500	**62.5**	3500	<3000	15.4	45700	9100	**133.58**	4100	20900	**134.40**	5300	3300	**46.5**	<3000	3700	20.90	<3000	<3000		209000	255000	19.83
Alkalinity (Hydroxide as $CaCO_3$)	µg/L	1000	<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000	
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		5000	3400	**38.10**	2400	1800	**28.57**	<1000	<1000	
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	179000	178000	0.56	193000	186000	3.69	136000	134000	1.5	97300	94400	3.03	240000	241000	0.42	189000	198000	4.7	223000	225000	0.89	219000	216000	1.38	185000	189000	2.14
Anions and Nutrients																													
Ammonia (NH_4 as N)	µg/L	5.0	43.5	40.1	8.13	<5	<5		9.5	10.2	7.1	10	10.3	2.96	12.3	10.5	15.79	9.4	241	**185.0**	140	140	0.00	16.4	16.4	0.00	14.2	16.8	16.77
Chloride (Cl^-)	µg/L	500	10200	10600	3.85	12600	13000	3.13	3460	3460	0.0	8560	6860	22.05	<10000	<10000		59600	42500	33.5	34400	33900	1.46	30600	27700	9.95	12700	13500	6.11
Nitrate (NO_3^- as N)	µg/L	5.0	352	352	0.00	331	324	2.14	164	164	0.0	89.9	<25	**112.97**	<100	<100		640	152	**123.2**	191	186	2.65	309	280	9.85	69.7	62.4	11.05
Nitrite (NO_2^- as N)	µg/L	1.0	1.1	1.1	0.00	1.3	1.4	7.41	3.9	3.9	0.0	<5	<5		<20	<20		4.8	20.4	**123.8**	50.4	51.5	2.16	21.2	20.2	4.83	3.4	4	16.22
Sulphate (SO_4)	µg/L	300	106000	109000	2.79	117000	118000	0.85	42900	42800	0.2	604000	602000	0.33	1370000	1390000	1.45	90300	165000	**58.5**	156000	154000	1.29	159000	142000	11.30	91300	91300	0.00
Dissolved Organic Carbon (DOC)	µg/L		3.00	1.71	**54.78**	2440	2460	0.82	2200	2280	3.6	12500	13200	5.45	18000	17800	1.12	1390	1690	19.5	1650	1670	1.20	1230	1250	1.61	3870	4000	3.30
Metals, Total																													
Aluminum	µg/L	3.0	2060	2200	6.57	1220	1510	21.25	81.8	66.3	20.9	165	200	19.18	188	55.9	**108.32**	27.6	166	**143.0**	86.9	90.5	4.06	169	165	2.40	2270	1850	20.39
Antimony	µg/L	0.10	0.38	0.39	2.60	0.33	0.34	2.99	0.31	0.31	0.0	0.13	0.12	8.00	0.2	<0.2		0.13	0.19	**37.5**	0.17	0.16	6.06	<0.1	<0.1		0.49	0.46	6.32
Arsenic	µg/L	0.10	1.47	1.77	18.52	0.6	0.63	4.88	0.34	0.32	6.1	0.53	0.56	5.50	0.61	0.55	10.34	0.25	0.28	11.3	0.42	0.39	7.41	0.5	0.48	4.08	2.68	2.4	11.02
Barium	µg/L	0.10	213	224	5.03	134	140	4.38	62.3	59.8	4.1	33.2	33.5	0.90	31.9	26.4	18.87	110	59.2	**60.0**	63.3	61.4	3.05	61.2	62.5	2.10	207	208	0.48
Beryllium	µg/L	0.10	0.122	0.14	13.74	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.127	0.136	6.84
Bismuth	µg/L	0.05	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.1	<0.1		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Boron	µg/L	10	31	31	0.00	30	31	3.28	18	18	0.0	76	77	1.31	158	162	2.50	27	169	**144.9**	219	220	0.46	296	293	1.02	30	30	0.00
Cadmium	µg/L	0.005	0.0689	0.0927	29.46	0.0225	0.0231	2.63	0.007	<0.005	**33.3**	0.128	0.128	0.00	0.0528	0.0418	23.26	0.0092	0.113	**169.9**	0.0437	0.036	19.32	0.0188	0.0191	1.58	0.187	0.213	13.00
Calcium	µg/L	50	72700	70400	3.21	79900	79900	0.00	43400	44100	1.6	115000	121000	5.08	257000	261000	1.54	99400	84300	16.4	76200	73200	4.02	59800	55800	6.92	71000	73300	3.19
Cesium	µg/L	0.01	0.691	0.782	12.36	0.237	0.263	10.40	0.015	0.012	22.2	0.024	0.028	15.38	0.021	<0.02		<0.01	0.036	**113.0**	0.031	0.028	10.17	0.025	0.023	8.33	0.381	0.296	25.11
Chromium	µg/L	0.10	3.71	3.87	4.22	2.18	2.65	19.46	0.97	0.94	3.1	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		5.81	6.68	13.93
Cobalt	µg/L	0.10	1.83	2.14	15.62	0.36	0.41	12.99	0.12	<0.1	18.2	3.38	3.47	2.63	3.13	2.44	24.78	<0.1	3.44	**188.7**	1.12	1.11	0.90	0.31	0.3	3.28	2.17	2.18	0.46
Copper	µg/L	0.50	5.61	6.42	13.47	1.87	1.66	11.90	1.01	0.94	7.2	2.02	2.02	0	1.46	<1	**37.40**	<0.5	1.53	**101.5**	1.06	1.05	0.95	1.01	0.97	4.04	7.22	7.04	2.52
Iron	µg/L	10	2790	3440	20.87	608	747	20.52	84	56	**40.0**	297	324	8.70	670	454	**38.43**	106	92	14.1	64	54	16.95	82	83	1.21	5640	4560	21.18
Lead	µg/L	0.05	1.72	2.11	20.37	0.395	0.454	13.90	0.08	0.061	27.0	0.178	0.139	24.61	<0.1	<0.1		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		2.71	2.81	3.62
Lithium	µg/L	1.0	9.3	9.2	1.08	8.2	8.5	3.59	3.4	3.6	5.7	14.9	14.8	0.67	42.2	41.7	1.19	10	37.6	**116.0**	39.8	39	2.03	51.3	49.1	4.38	12.3	12	2.47
Magnesium	µg/L	5.0	15400	15300	0.65	15000	17600	15.95	9630	9790	1.6	51500	55300	7.12	135000	133000	1.49	24300	22800	6.4	21700	21400	1.39	17600	17000	3.47	24800	24700	0.40
Manganese	µg/L	0.10	44.9	58.6	26.47	7.61	10	27.14	1.89	1.46	25.7	848	853	0.59	1490	1110	29.23	16.9	50.8	**100.1**	17.5	17.2	1.73	2.02	1.99	1.50	136	143	5.02
Mercury	µg/L	0.005	<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		0.0203	0.0237	15.45
Molybdenum	µg/L	0.05	2.82	2.78	1.43	3.9	3.62	7.45	3.73	3.53	5.5	0.935	0.956	2.22	0.619	0.577	7.02	1.48	2.7	**58.4**	2.87	2.84	1.05	2.88	2.91	1.04	1.89	1.43	27.71
Nickel	µg/L	0.5	5.14	5.44	5.67	1.46	1.54	5.33	<0.5	<0.5		15.8	14.9	5.86	22	20.9	5.13	0.63	16.4	**185.2**	9.65	9.57	0.83	4.68	4.66	0.43	7.71	7.33	5.05
Phosphorus	µg/L	50.0	133	180	**30.03**	52	<50		<50	<50		73	66	10.07	<100	<100		<50	<50		<50	<50		<50	<50		272	296	8.45
Potassium	µg/L	50.0	2810	2790	0.71	2830	2890	2.10	2290	2260	1.3	14300	14600	2.08	15600	15400	1.29	4120	3530	15.4	3660	3600	1.65	3020	2990	1.00	4340	4420	1.83
Rubidium	µg/L	0.2	7.28	7.4	1.63	3.62	4.32	17.63	1.78	1.71	4.0	2.64	2.62	0.76	4.6	4.33	6.05	0.66	1.78	**91.8**	1.85	1.65	11.43	1.33	1.35	1.49	3.74	3.26	13.71
Selenium	µg/L	0.05	1.88	1.87	0.53	1.33	1.38	3.69	0.813	0.764	6.2	0.446	0.389	13.65	0.289	0.212	**30.74**	0.757	0.617	20.4	0.402	0.372	7.75	0.154	0.164	6.29	1.57	1.45	7.95
Silicon	µg/L	100	7840	7570	3.50	7330	7590	3.49	3770	3700	1.9	2240	2220	0.90	940	800	16.09	4790	3890	20.7	3960	3850	2.82	3540	3500	1.14	4940	4370	12.24
Silver	µg/L	0.01	0.031	0.041	27.78	0.01	0.012	18.18	<0.01	<0.01		<0.01	<0.01		<0.02	<0.02		<0.01	<0.01	0.0	<0.01	<0.01		<0.01	<0.01		0.045	0.036	22.22
Sodium	µg/L	50.0	29100	28800	1.04	33400	34200	2.37	11200	11200	0.0	83000	86600	4.25	186000	183000	1.63	19200	66900	**110.8**	82200	81300	1.10	113000	106000	6.39	8350	8420	0.83
Strontium	µg/L	0.2	180	185	2.74	166	165	0.60	96.6	97.2	0.6	329	329	0.00	650	649	0.15	229	425	**59.9**	445	435	2.27	464	466	0.43	339	351	3.48
Sulfur	µg/L	500	37000	36000	2.74	47400	47300	0.21	14000	14900	6.2	224000	230000	2.64	505000	496000	1.80	34500	64800	**61.0**	56600	54300	4.15	61000	61200	0.33	34200	34600	1.16
Tellurium	µg/L	0.2	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.4	<0.4		<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Thallium	µg/L	0.01	0.052	0.059	12.61	0.024	0.026	8.00	<0.01	<0.01		0.012	0.014	15.38	<0.02	<0.02		<0.01	0.015	**40.0**	0.01	<0.01		<0.01	<0.01		0.062	0.052	17.54
Thorium	µg/L	0.10	0.58	0.77	28.15	0.17	0.22	25.64	<0.1	<0.1		<0.1	<0.1		0.32	<0.2	**46.15**	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.8	0.7	13.33
Tin	µg/L	0.10	0.13	0.15	14.29	<0.1	<0.1		0.13	0.13	0.0	0.15	<0.1		<0.2	<0.2		<0.1	0.25	**85.7**	0.1	0.11	9.52	<0.1	<0.1		0.15	0.11	**30.77**
Titanium	µg/L	0.30	37	37.9	2.40	32.9	36.5	10.37	2.25	1.64	**31.4**	6.48	7.26	11.35	1.63	<0.6	**92.38**	<0.3	<0.3		0.3	<0.3		<0.3	<0.3		49.5	37.4	27.85
Tungsten	µg/L	0.10	<0.1	<0.1		<0.1	<0.1		0.22	0.21	4.7	<0.1	<0.1		<0.2	<0.2		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Uranium	µg/L	0.01	1.8	1.62	10.53	1.89	1.93	2.09	0.906	0.901	0.6	1.04	1.12	7.41	2.47	2.4	2.87	1.37	1.28	6.8	1.01	1.01	0.00	0.879	0.897	2.03	1.74	1.79	2.83
Vanadium	µg/L	0.50	6.93	7.71	10.66	4.3	5	15.05	1.26	1.14	10.0	0.65	0.75	14.29	<1	<1		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		8.35	7.09	16.32
Zinc	µg/L	3.0	19.4	23.6	19.53	15.2	13.6	11.11	4.7	4.6	2.2	44.4	43	3.20	19.7	16.1	20.11	<3	17.8	**142.3**	7.8	8.1	3.77	3.3	<3	9.52	26.1	24.7	5.51
Zirconium	µg/L	0.06	0.67	1.1	**48.59**	1.28	1.31	2.32	<0.2	<0.2		<0.2	0.22	9.52	<0.4	0.59	**38.38**	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Metals, Dissolved																													
Aluminum	µg/L	1.0	20.4	25	20.26	8.8	8.8	0.00	16.1	16.3	1.2	17.9	16.8	6.34	9.8	12	20.18	2.2	133	**193.5**	74.1	68.3	8.15	152	150	1.32	37.8	30.7	20.73
Antimony	µg/L	0.10	0.28	0.29	3.51	0.28	0.31	10.17	0.31	0.3	3.3	0.11	0.1	9.52	<0.2	<0.2		0.12	0.18	**40.0**	0.14	0.14	0.00	<0.1	<0.1		0.18	0.19	5.41
Arsenic	µg/L	0.10	0.27	0.24	11.76	0.28	0.29	3.51	0.25	0.27	7.7	0.45	0.52	14.43	0.53	0.47	12.00	0.23	0.3	26.4	0.37	0.37	0.00	0.44	0.48	8.70	0.29	0.28	3.51
Barium	µg/L	0.10	81.8	83.9	2.53	91.2	95	4.08	56.3	58.5	3.8	31.1	30.7	1.29	24.7	25.6	3.58	113	60.9	**59.9**	61.6	62.2	0.97	62.3	60.8	2.44	105	102	2.90
Beryllium	µg/L	0.10	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Bismuth	µg/L	0.05	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.1	<0.1		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Boron	µg/L	10.0	26	26	0.00	26	26	0.00	19	18	5.4	76	75	1.32	149	147	1.35	25	166	**147.6**	205	200	2.47	270	274	1.47	26	26	0.00
Cadmium	µg/L	0.005	0.0079	0.0127	**46.60**	0.0064	0.0057	11.57	<0.005	<0.005		0.131	0.111	16.53	0.0351	0.0316	10.49	0.0085	0.106	**170.3**	0.033	0.0288	13.59	0.0157	0.0142	10.03	0.018	0.0176	2.25
Calcium	µg/L	50.0	72300	75400	4.20	73400	75900	3.35	42900	43600	1.6	117000	120000	2.53	242000	246000	1.64	104000	82300	23.3	72000	70500	2.11	56900	56600	0.53	61400	61600	0.33
Cesium	µg/L	0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.02	<0.02		<0.01	0.028	**94.7**	0.027	0.026	3.77	0.022	0.024	8.70	<0.01	<0.01	
Chromium	µg/L	0.10	<0.5	<0.5		<0.5	<0.5		0.78	0.79	1.3	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	0.0	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	
Cobalt	µg/L	0.10	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		3.34	3.18	4.91	2.46	2.41	2.05	<0.1	3.43	**188.7**	1.05	1.01	3.88	0.28	0.27	3.64	0.12	0.11	8.70
Copper	µg/L	0.20	3.15	0.46	**149.03**	0.65	0.54	18.49	0.73	0.56	26.4	1.94	1.92	1.04	0.75	0.68	9.79	0.4	1.12	**94.7**	0.9	0.88	2.25	1.26	0.84	**40.00**	0.69	0.66	4.44
Iron	µg/L	10.0	<10	<10		<10	<10		<10	<10		52	61	15.93	89	98	9.63	18	<10	**57.1**	13	13	0.00	39	32	19.72	40	30	28.57
Lead	µg/L	0.05	0.121	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.1	<0.1		<0.05	<0.05	0.0	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Lithium	µg/L	1.0	6.5	6.4	1.55	6.5	6.9	5.97	3.6	3.6	0.0	15.2	15	1.32	39.8	39.3	1.26	10	37.4	**115.6**	38.8	36.7	5.56	49.9	51.2	2.57	11.2	11	1.80
Magnesium	µg/L	5.0	14000	14200	1.42	16100	15800	1.88	9600	9630	0.3	51900	53300	2.66	139000	140000	0.72	23600	23100	2.1	20800	21300	2.38	16500	16900	2.40	23500	23300	0.85
Manganese	µg/L	0.10	2.4	2.46	2.47	0.92	1.05	13.20	0.28	0.25	11.3	865	853	1.40	1070	1090	1.85	15.1	51.7	**109.6**	16.4	16.2	1.23	1.7	1.54	9.88	13.2	13.1	0.76
Mercury	µg/L	0.005	<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005	0.0	<0.005	<0.005		<0.005	<0.005		<0.005	<0.005	
Molybdenum	µg/L	0.05	2.7	2.71	0.37	3.33	3.46	3.83	3.7	3.5	5.6	0.924	0.926	0.22	0.616	0.626	1.61	1.5	2.72	**57.8**	2.79	2.71	2.91	2.8	2.88	2.82	1.82	1.75	3.92
Nickel	µg/L	0.50	0.81	0.75	7.69	<0.5	0.52		<0.5	<0.5		14.3	14.3	0.00	20.6	20.6	0.00	0.63	15.6	**184.5**	8.87	8.98	1.23	4.48	4.28	4.57	0.58	0.56	3.51
Phosphorus	µg/L	50.0	<50	<50		<50	<50		<50	<50		<50	<50		<100	<100		<50	<50	0.0	<50	<50		<50	<50		<50	<50	
Potassium	µg/L	50.0	2080	2120	1.90	2470	2490	0.81	2330	2280	2.2	14800	15300	3.32	15100	15600	3.26	4170	3550	16.1	3590	3590	0.00	3270	3350	2.42	4030	4010	0.50
Rubidium	µg/L	0.20	0.93	0.72	25.45	1	0.93	7.25	1.64	1.64	0.0	2.1	2.11	0.48	4.37	4.29	1.85	0.85	1.38	**47.5**	1.58	1.55	1.92	1.38	1.35	2.20	0.55	0.56	1.80
Selenium	µg/L	0.05	1.75	1.92	9.26	1.61	1.65	2.45	0.789	0.816	3.4	0.324	0.42	25.81	0.245	0.224	8.96	0.943	0.698	29.9	0.38	0.452	17.31	0.215	0.171	22.80	1.53	1.47	4.00
Silicon	µg/L	50.0	4360	4220	3.26	4820	4770	1.04	3570	3710	3.8	1970	1920	2.57	760	731	3.89	4670	3800	20.5	3820	3900	2.07	3360	3340	0.60	1340	1330	0.75
Silver	µg/L	0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.02	<0.02		<0.01	<0.01	0.0	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	
Sodium	µg/L	50.0	28600	29600	3.44	32400	34000	4.82	10600	10700	0.9	86700	89300	2.95	186000	185000	0.54	19200	67000	**110.9**	79000	79700	0.88	105000	109000	3.74	8160	8110	0.61

Parameter	Unit	RDL	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	L2-US	L2-US-R	RPD %	L2-US	L2-US-R	RPD%	LBP-Pond	LBP-Pond-R	RPD %	LBP-Pond	LBP-Pond-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-US	RBSBIAR-US-R	RPD %
			30-Jan-23			20-Feb-23			29-Mar-23			28-Apr-23			19-May-23			28-Jun-23			17-Jul-23			30-Aug-23			28-Sep-23		
Strontium	µg/L	0.2	174	171	1.74	162	172	5.99	95.6	96.7	1.1	328	330	0.61	645	650	0.77	227	437	**63.3**	436	426	2.32	454	458	0.88	310	306	1.30
Sulfur	µg/L	500	37800	38100	0.79	46000	46400	0.87	13700	14500	5.7	233000	240000	2.96	509000	518000	1.75	35100	63500	**57.6**	53600	54300	1.30	58600	58800	0.34	33300	33600	0.90
Tellurium	µg/L	0.20	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.4	<0.4		<0.2	<0.2	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Thallium	µg/L	0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		0.011	0.013	16.67	<0.02	<0.02		<0.01	0.013	26.1	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	
Thorium	µg/L	0.10	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.2	<0.2		<0.1	<0.1	0.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Tin	µg/L	0.10	<0.1	<0.1		<0.1	<0.1		0.1	<0.1		<0.1	<0.1		<0.2	<0.2		<0.1	0.22	**75.0**	0.11	<0.1		<0.1	<0.1		<0.1	<0.1	
Titanium	µg/L	0.30	0.34	0.52	**41.86**	<0.3	<0.3		<0.3	<0.3		0.52	0.68	26.67	<0.6	<0.6		<0.3	<0.3	0.0	<0.3	<0.3		<0.3	<0.3		1.03	0.74	**32.77**
Tungsten	µg/L	0.10	<0.1	<0.1		<0.1	<0.1		0.23	0.21	9.1	<0.1	<0.1		<0.2	<0.2		<0.1	<0.1	0.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Uranium	µg/L	0.01	1.55	1.57	1.28	1.55	1.6	3.17	0.86	0.884	2.8	1.05	1.12	6.45	2.4	2.38	0.84	1.33	1.22	8.6	0.98	0.983	0.31	0.832	0.823	1.09	1.38	1.36	1.46
Vanadium	µg/L	0.50	<0.5	<0.5		<0.5	<0.5		1.02	0.94	8.2	<0.5	<0.5		<1	<1		<0.5	<0.5	0.0	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	
Zinc	µg/L	1.0	3.4	1.7	**66.67**	8.3	6.8	19.87	2.6	2.8	7.4	41.7	40.5	2.92	13.7	14.4	4.98	<1	15.5	**175.8**	6.2	5.9	4.96	2.7	2.4	11.76	<1	<1	
Zirconium	µg/L	0.06	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		<0.4	<0.4		<0.2	<0.2	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Laboratory Work Order Number			FJ2300206	FJ2300206		FJ2300373	FJ2300373		FJ2300677	FJ2300677		FJ2300936	FJ2300936		FJ2301129	FJ2301129		FJ2301553	FJ2301553		FJ2301738	FJ2301738		FJ2302196	FJ2302196		FJ2302574	FJ2302574	

Notes:

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (ABS[(difference between two values)]/((sum of two values/2))*100

Blank indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results is less than detection limits or within 5 times the RDL.

RPD greater than 30%

Blank - not analyzed.

Table 6: River Road - In Situ Water Quality Sampling

Sample Site	Date	In-Situ Tests - 2023							
		pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/sec)	Turbidity	Comments
LBRR-DD [1]	29-Mar-23	7.76	98	800	80	1.0	1.0	clear	Flow discharging to Peace River.
LBRR-LC	29-Mar-23	7.83	1052	800	80	1.1	1.0	clear	
LBRR-UC	no measurements								
LBRR-12+600	no measurements								
LBRR-12+700	no measurements								
LBRR-12+810	no measurements								
LBRR-12+920	29-Mar-23	7.81	644	450	40	-0.1	0.25	turbid	surface flow over ice.
	28-Apr-23	8.30	1,650	450	180	9.1	0.50	clear	
	19-May-23	8.03	1472	800	180	14.4	0.50	clear	
	28-Jun-23	7.99	1468	450	240	17.3	0.50	clear	
	17-Jul-23	7.94	1482	-	-	16.2	0.25	clear	
	30-Aug-23	8.21	1696	240	800	13.4	0.10	clear	
	28-Sep-23	7.86	2800	800	180	11.7	0.10	turbid	
RR8 [1]	no measurements								
RR9 [1]	29-Mar-23	8.34	1296	800	80	0.9	1.0	slightly turbid	Flow discharging to Peace River.
	28-Sep-23	8.00	3890	800	120	12.2	0.075	slightly turbid	
LBRR-EDP	29-Mar-23	7.79	21.30	800	120	-0.20	0.75	turbid	Flow discharging to Peace River; ice in culvert.
	28-Apr-23	8.29	2570	450	120	5.4	0.25	slightly turbid	infiltrates to ground d/s ~ 50m.
	28-Sep-23	8.11	3380	800	180	11.8	0.075	turbid	

[1] **Discharge station**

Table 7: Summary of Water Quality Exceedances (BCAWQG-FST) Along River Road from Water Sampling Events in 2023

	Sampling Dates	Total Iron (Fe)	Total Arsenic (As)	Total Zinc (Zn)	Dissolved Aluminum (Al)	Chloride (Cl)
LBRR-DD [1]	29-Mar-23	✓				
LBRR-EDP	29-Mar-23	✓	✓	✓		
	28-Apr-23	✓	✓		✓	
	28-Sep-23	✓	✓		✓	✓
RR8 [1]	-					
RR9 [1]	29-Mar-23	✓				
	28-Sep-23	✓				✓
LBRR-UC	-					
LBRR-LC	29-Mar-23					

[1] **Discharge station**

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life water use and Short Term Maximum (FST) WQG. Exceedances denoted by a check mark.

Table 8: RBSBIAR - In Situ Water Quality Measurements

Sample Site	Date	In-Situ Tests - 2023							
		pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/sec)	Turbidity	Comments
RBSBIAR-US	28-Sep-23	8.35	575	250	120	11.9	2.5	turbid	
RBSBIAR-DS	29-Mar-23	7.68	1347	800	80	-0.1	0.20	slightly turbid	channelized flow thru ice.
	28-Apr-23	8.61	1177	450	180	10.4	0.25	clear	
	19-May-23	8.48	681	450	180	11.0	0.50	clear	pumping from area 20
	28-Jun-23	8.36	792	250	240	17.6	0.75	clear	
	17-Jul-23	8.33	770	180	250	15.0	0.50	clear	
	30-Aug-23	9.31	803	240	450	14.0	0.25	clear	algae in ditch; clear flow
	28-Sep-23	8.30	619	450	180	11.9	2.5	turbid	
	29-Oct-23	8.29	1051	450	120	0.7	0.06	clear	
RBSBIAR-EUS	29-Mar-23	7.00	-	450	40	-	0.05		min. surface flow over ice; test strip only
	28-Apr-23	7.87	775	450	180	11.1	0.0005	clear	trickle, not enough flow to sample
	19-May-23	7.81	678	450	180	12.6	0.1	clear	algae in pools; trickle flow
	28-Jun-23	8.10	718	250	180	21.3	0.1	clear	
	17-Jul-23	7.82	754	180	450	18.0	0.05	clear	
	30-Aug-23	9.00	-	240	450	-	0.025		ditch upstream filled in
	28-Sep-23	7.97	904	450	240	12.4	0.03	clear	
RBSBIAR-EDS	29-Mar-23	7.95	984	800	40	0.0	0.15		surface flow over ice

Table 9: Summary of Water Quality Exceedances (BCAWQG-FST) RBSBIAR from Water Sampling Events in 2023

	Sampling Dates	Total Iron (Fe)	Dissolved Iron (Fe)	Dissolved Aluminum (Al)[3]	Total Arsenic (As)	Total Zinc (Zn)[2]	Total Cobalt (Co)	Dissolved Cadmium (Cd)[2]
RBSBIAR-US (West ditch; upstream)	28/Sep/23	✓						
RBSBIAR-DS (West ditch; downstream)	29/Mar/23	✓	✓		✓	✓	✓	✓
	28/Apr/23							
	19/May/23							
	28/Jun/23							
	17/Jul/23							
	30/Aug/23			✓				
	28/Sep/23	✓		✓	✓			
RBSBIAR-EUS (East ditch; upstream)	19/May/23							
	28/Jun/23			✓				
	17/Jul/23							
RBSBIAR-EDS (East ditch; downstream)	29/Mar/23	✓			✓	✓		

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life (F) water use and Short Term Maximum (ST) WQG. Exceedances denoted by a check mark.

[1]Copper-dissolved guideline is dependant on pH, hardness and Dissolved Organic Carbon

[2]Hardness-dependent parameters (Zn, Cd) use capped hardness values in guideline calculations.

[3]Calculated guideline is pH dependent for dissolved Aluminum.

Table 10: L2 Powerhouse - In Situ Water Quality Sampling

Sample Site	Date	In-Situ Tests - 2023							
		pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/sec)	Turbidity	Comments
L2 US	30-Jan-23	8.55	610	450	80	7.2	5	slightly turbid	
	20-Feb-23	8.44	562	450	80	7.2	2.5	clear	
	29-Mar-23	7.74	350	250	80	5.8	2.0	clear-silty	mult. hoses discharging mix of silty or clear water; active construction in areas
	Sample location removed following March 2023 sample event								
L2 DS	Sample location removed following March 2023 sample event								

Table 11: Summary of Water Quality Exceedances (BCAWQG-FST) at the L2 Powerhouse Area From Water Sampling Events in 2023

	Sampling Dates	Total Iron (Fe)
L2 US	30-Jan-23	✓
	20-Feb-23	
	29-Mar-23	
L2 DS	-	

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life (F) water use and Short Term Maximum (ST) WQG. Exceedances denoted by a check mark.

[1]Calculated guideline is pH dependent for dissolved Aluminum.

[2]Hardness-dependent parameters use capped hardness values in guideline calculations.

[3]Ammonia guideline is based on temperatrue and pH

Table 12: LBDB - In Situ Water Quality Sampling

Sample Site		Date	In-Situ Tests - 2023						
			pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/s)	Turbidity
Laydown Drainage	LBDB-LD-US	no measurements							
	LB Pond	28-Apr-23	7.45	1285	450	80	7.30	n/a	clear edge; turbid centre
		19-May-23	7.10	2.48	800	180	13.7	n/a	clear edge; turbid centre
		28-Jun-23	7.32	3.56	450	240	23.1	n/a	turbid; standing water
		17-Jul-23	7.68	4.03	240	800	22.0	n/a	turbid; veg in pond
		30-Aug-23	9.32	4.81	120	800	16.9	n/a	stagnant, rust iron; natural sheen; heavily vegetated
		28-Sep-23	7.26	3800	800	240	13.0	n/a	slightly turbid
	LBDB-LD-MS	no measurements							
	LBDB-LD-DS	no measurements							
Upstream Armor Ditch	LBDB-EUS	no measurements							
	LBDB-WUS	no measurements							
Downstream Armor Ditch	LBDB-EDS	no measurements							
	LBDB-WDS	no measurements							

Table 13: Summary of Water Quality Exceedances (BCAWQG-FST) at the Left Bank Debris Boom From Water Sampling Events in 2023

	Sampling Dates	Total Iron (Fe)	Dissolved Iron (Fe)	Dissolved Aluminum (Al)[1]	Total Arsenic (As)	Total Manganese (Mn)[2]	Total Zinc (Zn)[2]
LB Pond	28-Apr-23						
	19-May-23						
	28-Jun-23						
	17-Jul-23						
	30-Aug-23						
	28-Sep-23	✓	✓	✓		✓	

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life water use and Short Term Maximum (FST) WQG. Exceedances denoted by a check mark.

[1]Calculated guideline is pH dependent for dissolved Aluminum.

[2]Hardness-dependent parameters (Mn, Zn) use capped hardness values in guideline calculations.

Table 14: Discharge and Downstream Locations - Minimum, Maximum and Mean Values

Discharge/Downstream Locations	Unit	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBRR-DD	RR9			RBSBIAR-DS			RBSBIAR-EDS
				1 Sample Event	2 Sample Events			6 Sample Events			1 Sample Event
				Minimum	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum
Hardness as CaCO3	µg/L	NG	NG	476000	513000	1700000	1106500	210000	929000	390500	465000
pH	pH Units	6.5 - 9.0	6.5-9.0	8.19	7.92	8.05	7.99	7.39	8.33	8.11	7.74
Acidity (Total as CaCO3)	µg/L	NG	NG	<2000	2100	6600	4350	<2000	6700	1950	2900
Alkalinity (Total as CaCO3)	mg/L	NG	NG	216	123	155	139	93	228000	107417	85800
Total Dissolved Solids (TDS)	µg/L	NG	NG	729000	966000	2620000	1793000	342000	1540000	680333	801000
Total Suspended Solids (TSS)	µg/L	NG	NG	15300	108000	268000	188000	4100	410000	190600	1340000
Anions and Nutrients											
Chloride (Cl-)	µg/L	600000	150,000	96600	219000	**971000**	595000	14700	60000	39583	38700
Sulphate (SO4)	µg/L	NG	Hardness-dependent	236000	226000	499000	362500	90300	964000	300217	423000
Metals, Total											
Aluminum - New FLT Guideline Aug 2023	µg/L	NG	pH, DOC, Hardness-dependent	546	2120	3770	2945	27.6	11800	2788	20700
Iron	µg/L	1000	NG	**1500**	**6340**	**11700**	**9020**	64.0	**20800**	**5576**	**62600**
Arsenic	µg/L	5.0 prior to Aug 2023	5.0 after Aug 2023	1.2	2.66	4.42	3.54	0.25	**11.3**	3.09	**29.2**
Cadmium	µg/L	NG	NG	0.148	0.376	0.449	0.4125	0.009	6.55	1.25	2.3
Cobalt	µg/L	110	4.0	1.58	6.72	7.98	7.4	0.31	**180**	39.1	30.7
Copper - Guideline prior to Aug 2019	µg/L	NG	NG	2.92	8.08	11.9	10.0	0.86	109	26.3	69.7
Zinc - Guideline prior to Aug 2023	µg/L	Hardness dependent	Hardness dependent	17.2	26.9	63.6	45.3	3.30	**1380**	306.8	**383**
Metals, Dissolved											
Aluminum - Guideline prior to Aug 2023	µg/L	pH-dependent	pH-dependent	17.5	65.80	79.3	72.6	2.20	**152**	79.4	31.0
Iron	µg/L	350	NG	11	<10	<20	<10	13.0	**2120**	442	21.0
Arsenic	µg/L	NG	NG	0.48	0.2	0.47	0.34	0.22	0.44	0.31	0.19
Cadmium	µg/L	Hardness dependent	Hardness dependent	0.0663	0.079	0.214	0.15	0.009	**5.59**	0.98	0.154
Cobalt	µg/L	NG	NG	0.91	3.95	4.79	4.37	0.28	173	36.2	3.48
Copper	µg/L	pH, DOC, hardness dependent	pH, DOC, hardness dependent	1.23	2.82	6.95	4.89	0.40	10.1	2.46	0.98
Zinc - NEW Guideline Aug 2023	µg/L	pH, DOC, hardness dependent	pH, DOC, hardness dependent	5.0	3.0	6.0	4.5	2.70	1060	217	5.9

*<Detection Limit values use half the value to calculate mean values.

PHOTOGRAPHS

Photo 1: River Road LBRR-UC location, September 28, 2023.

Photo 2: River Road LBRR-LC location, May 19, 2023.

Photo 3: River Road LBRR-12+920 location, May 19, 2023.

Photo 4: River Road LBRR-DD location, discharge area, May 19, 2023.

Photo 5: River Road LBRR-EDP end-of-pipe sample collection location looking upstream, May 19, 2023.

Photo 6: Road LBRR-EDP location looking downstream from the end-of-pipe location towards RR8 and RR9, May 19, 2023.

Photo 7: River Road RR8 inlet location, May 19, 2023.

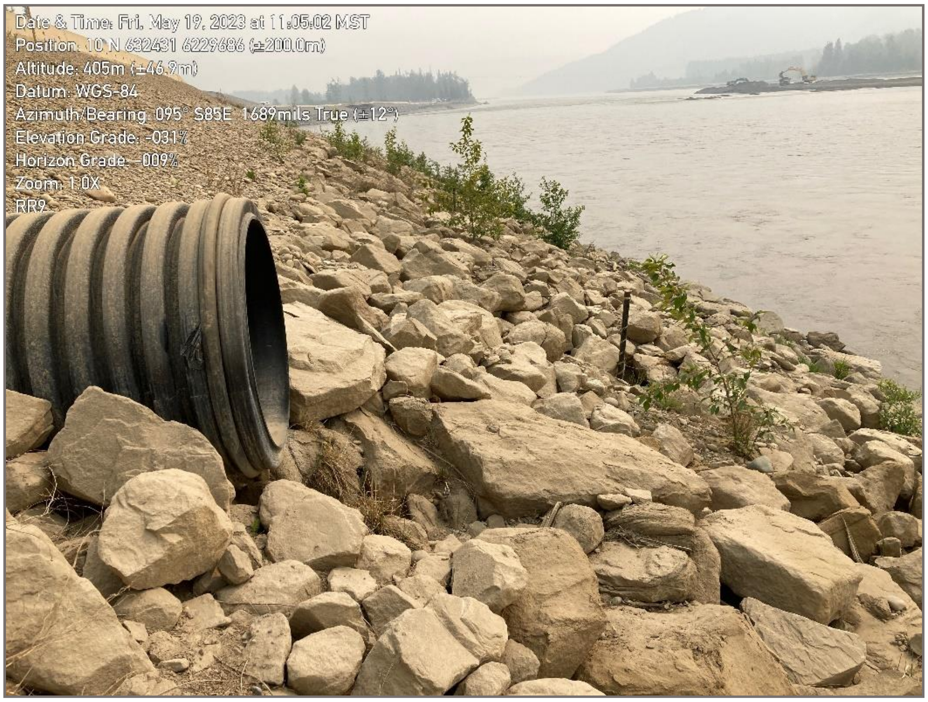


Photo 8: River Road RR9 outlet location, May 19, 2023. Samples are collected from outlet location.

Photo 9: RBSBIAR-US location, looking upstream, September 28, 2023.

Photo 10: RBSBIAR-US location, looking downstream, September 28, 2023.

Photo 11: RBSBIAR-DS location, looking upstream, September 28, 2023.

Photo 12: RBSBIAR-DS location, looking downstream, September 28, 2023.

Photo 13: RBSBIAR-EUS location, looking upstream, September 28, 2023.

Photo 14: RBSBIAR-EUS location, looking downstream, September 28, 2023.

Photo 15: RBSBIAR-EDS location, September 28, 2023.

Photo 16: RBSBIAR-EDS location, looking upstream, September 28, 2023.

Photo 17: L2-US location, March 29, 2023.

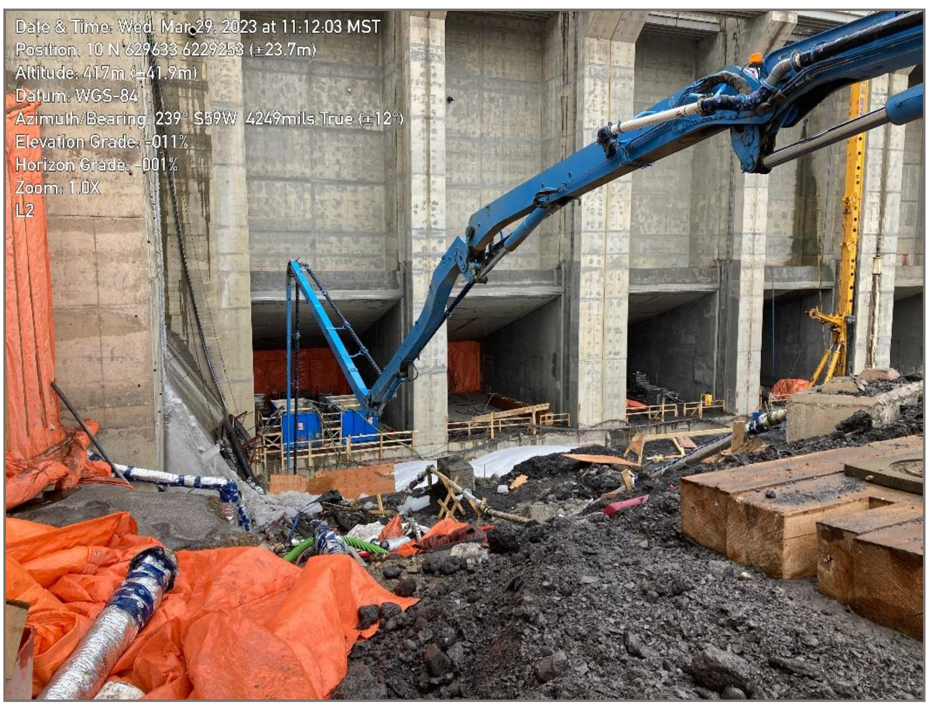


Photo 18: L2-DS sample location, March 29, 2023.

Photo 19: L2-US and L2-DS locations, marked with red arrows, March 29, 2023.

Photo 20: LBP Pond location, September 28, 2023.

Photo 21: LBDB-EUS location, looking upstream, September 28, 2023.

Photo 22: LBDB-EUS location, looking downstream, September 28, 2023.

Photo 23: LBDB-EDS location looking upstream, September 28, 2023.

Photo 24: LBDB-EDS location looking downstream, September 28, 2023.

Photo 25: LBDB-LD-US location, May 19, 2023.

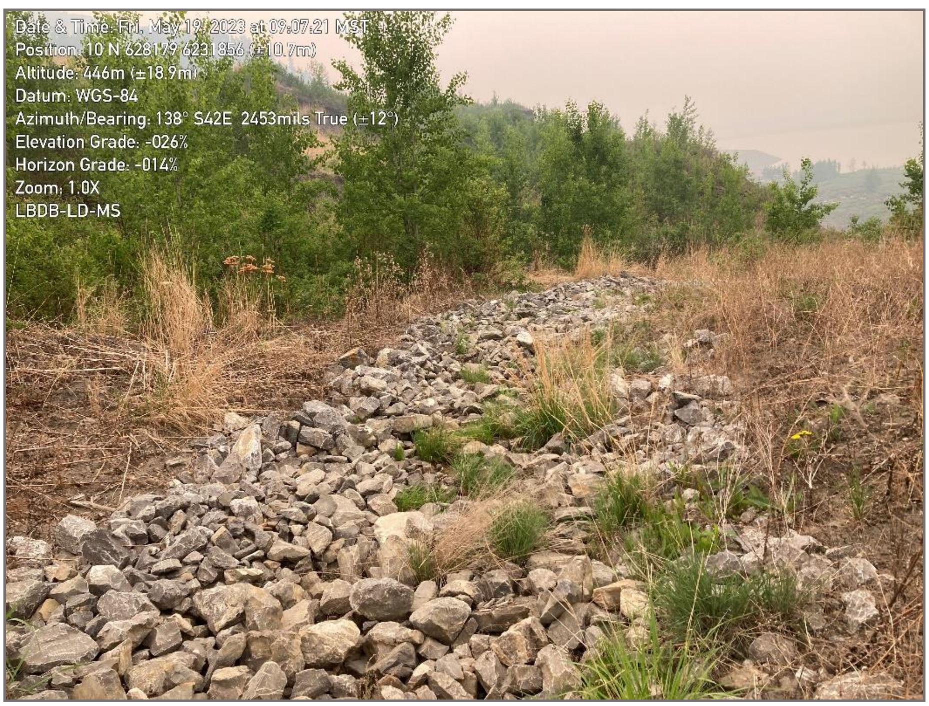


Photo 26: LBDB-LD-MS location, May 19, 2023.

Photo 27: LBDB-LD-DS location, September 28, 2023.

Photo 28: LBDB-WDS and LBDB-EDS location, May 19, 2023.

Photo 29: LBDB-WUS location looking downstream, September 28, 2023.

Photo 30: LBDB-WDS location looking upstream, September 28, 2023.

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

SURFACE WATER ANALYTICAL LABORATORY RESULT TABLES

B1 – 2023 Surface Water Laboratory Analytical Results from River Road Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B2 – 2023 Surface Water Laboratory Analytical Results from SBIAR Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B3 – 2023 Surface Water Laboratory Analytical Results from L2 Powerhouse Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B4 – 2023 Surface Water Laboratory Analytical Results from Left Bank Debris Boom Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

Appendix B1: LBRR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBRR-DD	LBRR-LC	LBRR-EDP	LBRR-EDP	LBRR-EDP	RR9	RR9
					29-Mar-23	29-Mar-23	29-Mar-23	28-Apr-23	28-Sep-23	29-Mar-23	28-Sep-23
Physical Parameters											
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	1000	3000	2200	3600	8500	2100	6600
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	216	212	208	185	255	155	123
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	1090	1030	937	2510	2980	1280	3760
Hardness as CaCO3, dissolved	µg/L	500	NG (Acceptable ranges exist when calculating exceedances for Cd, Cu, Pb, Mn, Zn)	NG (Acceptable ranges exist when calculating exceedances for Cd, Cu, Pb, Mn, Zn)	476000	458000	372000	1530000	1330000	513000	1700000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L	500			477000	450000	667000	1710000	1470000	536000	1740000
pH	pH Units	0.10	6.5 - 9	6.5-9.0	8.19	8.12	7.91	8.11	7.88	8.05	7.92
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	729000	722000	667000	2130000	2190000	966000	2620000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	15300	9100	1680000	690000	1150000	268000	108000
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	216000	212000	208000	185000	255000	155000	123000
Anions and Nutrients (Matrix: Water)											
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	7.0	7.4	98.6	43.9	91.9	97.8	157
Ammonia FST Guideline	µg/L		pH dependent (at Temp 4 °C or in situ T)		3950	4950	7420	4950	7420	4950	7420
Ammonia FLT Guideline	µg/L			pH dependent (at Temp 4 °C or in situ T)	759	952	1430	952	1430	952	1430
Chloride (Cl^-)	µg/L	500	600,000	150,000	96600	88700	143000	88800	**728000**	219000	**971000**
Nitrate (NO_3^- as N)	µg/L	5.0-100	NG	NG	4610	4700	267	318	539	335	832
Nitrite (NO_2^- as N)	µg/L	1.0-20	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	93.6	96.9	11.8	6.5	<20	11.2	21.6
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	236000	218000	163000	1350000	426000	226000	499000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	309000	309000	309000	429000	429000	309000	429000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	6.28	5630	5230	4.12	7.26	5.18	8.67
Metals, Total											
Aluminum	µg/L	3.00	NG		546	104	16800	7880	6810	3770	2120
NEW FLT GUIDELINE AUG 2023 (no FST Guideline)				pH, DOC, Hardness-dependent; valid hardness 10-430 mg/L, pH 6.0-8.7, DOC 0.8-12.3 mg/L					457	376	513
Antimony	µg/L	0.1-0.2	NG	NG	0.17	0.12	1.22	0.97	0.9	0.56	0.74
Arsenic	µg/L	0.10	5, discontinued in Aug 2023	5.0	1.2	0.7	**18.9**	**9.74**	7.11	4.42	2.66
Barium	µg/L	0.10	NG	NG	46.4	38.4	829	361	303	221	200
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.1	0.949	0.504	0.537	0.209	0.122
Bismuth	µg/L	0.05-0.10	NG	NG	<0.05	<0.05	0.226	<0.25	<0.1	<0.05	<0.1
Boron	µg/L	10.0	1200	1200	34	33	44	119	115	41	139
Cadmium	µg/L	0.005	NG	NG	0.148	0.0748	2.08	1.18	1.13	0.449	0.376
Calcium	µg/L	50	NG	NG	130000	122000	195000	485000	431000	148000	523000
Cesium	µg/L	0.01		NG	0.092	0.031	1.82	0.729	0.473	0.476	0.203
Chromium [4]	µg/L	0.1-0.7	NG	NG	1	<0.5	48.3	19.9	20.8	9.4	5.56
Cobalt	µg/L	0.10	110	4.0	1.58	0.75	23.6	10.4	13	7.98	6.72
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	2.92	1.64	53.1	22.2	26.4	11.9	8.08
Cu STM Guideline Calc.	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness > 400,000 is Capped Value of 400,000								
Cu LTA Guideline Calc.	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10							
Iron	µg/L	10	1000	NG	**1500**	219	**58000**	**24800**	**21100**	**11700**	**6340**
Lead [3]	µg/L	0.05-0.1	Calc. based on Hardness	Calc. based on Hardness	0.55	0.096	19	7.19	7.62	3.56	2.02
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Hardness ≤ 8000 is 3; Hardness 8000-360,000: calc. Hardness>360,000 is Capped Value of 360,000		417	417	417	417	417	417	417
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Hardness 8000-360,000: calc. Hardness > 360,000 is Capped Value of 360,000	20	20	20	20	20	20	20
Lithium	µg/L	1.0	NG	NG	16	11.3	33.8	85.2	69	22.8	86.4
Magnesium	µg/L	5.0	NG	NG	37100	35200	43800	122000	96200	40500	106000
Manganese [3]	µg/L	0.10	Calc. based on hardness	Calc. based on Hardness	63.4	67.8	1450	562	899	444	750
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Hardness 25,000 - 259,000 : calc.; Hardness > 259,000 is Capped Value of 259,000		3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Hardness 37,000 - 450,000: calc.; Hardness > 450,000 is Capped Value of 450,000	2585.0	2585.0	2241.8	2585.0	2585.0	2585.0	2585.0
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	0.174	<0.005	0.0534	0.0142	0.009
Molybdenum	µg/L	0.05	2000	≤ 1000	2.58	2.26	4.12	3.64	5.7	3.55	7.73
Nickel	µg/L	0.5	NG		19.9	10.7	80	133	56.2	31.5	39.6
Phosphorus	µg/L	50-100	NG	NG	94	<50	2390	1060	1280	456	288
Potassium	µg/L	50.0	NG	NG	6140	6010	8530	10600	15100	7610	28500
Rubidium	µg/L	0.2	NG	NG	1.82	1.03	21.2	10.7	9.05	6.34	9.39
Selenium	µg/L	0.05	NG	2.0	0.72	0.61	1.6	2.22	1.26	1.08	1.72
Silicon	µg/L	100		NG	4350	4030	26300	15100	12700	8070	5960
Silver [3]	µg/L	0.01-0.02	0.10 - 3.0	0.05 - 1.5	0.015	<0.01	0.319	0.129	0.114	0.061	0.045
Ag FST Guideline Calc			Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc				Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	31700	30700	26000	41600	90400	35600	96500
Strontium	µg/L	0.2	NG	NG	356	348	1110	1460	4150	1260	6830
Sulfur	µg/L	500	NG	NG	75900	72200	55600	522000	164000	71900	196000
Tellerium	µg/L	0.2-0.4	NG	NG	<0.2	<0.2	<0.4	<1	<0.4	<0.2	<0.4
Thallium	µg/L	0.01-0.055	NG	NG	0.025	0.012	0.373	0.167	0.14	0.087	0.096
Thorium	µg/L	0.1-0.2	NG	NG	0.17	<0.1	6.36	2.57	3.02	1.38	0.76
Tin	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	0.41	<0.5	0.32	0.17	<0.2
Titanium	µg/L	0.3-1.2	NG	NG	10.8	2.06	285	196	132	104	66.6
Tungsten	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	0.29	<0.5	<0.2	0.17	<0.2
Uranium	µg/L	0.01	NG	NG	2.06	2.33	4.39	5.94	7.1	3.18	7.24
Vanadium	µg/L	0.5-1.0	NG	NG	1.63	<0.5	59.1	27.7	22.7	13.1	7.33
Zinc [3]	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	17.2	5.1	**314**	151	125	63.6	26.9
Zn FST Guideline Calc.	µg/L		Hardness < 90,000 = 33.0 Hardness 90,000 - 500,000, Calc. Hardness > 500,000, Capped Value		322.5	309.0	244.5	340.5	340.5	340.5	340.5
Zn FLT Guideline Calc.	µg/L			Hardness < 90,000 = 7.5 Hardness 90,000 - 330,000, Calc. Hardness > 330,000, Capped Value	187.5	187.5	187.5	187.5	187.5	187.5	187.5
Zirconium	µg/L	0.06-0.12	NG	NG	<0.2	<0.2	<0.4	1.48	1.2	0.34	1.05
Metals, Dissolved											
Aluminum [5]	µg/L	1.0	100	50	17.5	15.4	70.6	**105**	**116**	65.8	79.3
Al FST Guideline Calc (based on pH), to Aug 2023	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH), to Aug 2023	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50	50
Antimony	µg/L	0.1-0.2	NG	NG	0.11	0.1	0.15	<0.5	0.32	0.16	0.5
Arsenic	µg/L	0.10	NG	NG	0.48	0.58	0.19	0.25	0.36	0.2	0.47
Barium	µg/L	0.10	NG	NG	27	35.3	57.6	87	81.6	64.3	110
Beryllium	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05-0.1	NG	NG	<0.05	<0.05	<0.05	<0.25	<0.1	<0.05	<0.1
Boron	µg/L	10.0	NG	NG	34	34	30	100	108	42	132
Cadmium [3]	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.066	0.056	0.080	0.249	0.131	0.0787	0.214
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.80	2.80	2.28	2.80	2.80	2.80	2.80
Cd FLT Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Calcium	µg/L	50.0	NG	NG	128000	124000	103000	421000	380000	140000	507000
Cesium	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01	<0.05	<0.02	<0.01	<0.02
Chromium	µg/L	0.10	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	µg/L	0.10	NG	NG	0.91	0.66	3.85	1.47	4.76	3.95	4.79
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	1.23	1.7	5.35	1.88	2.45	2.82	6.95
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		40.2	33.9	25.3	18.6	41.8	30.2	51.4
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	7.7	6.4	4.5	3.27	5.3	5.7	8.6
Iron	µg/L	10.0-20.0	350	NG	11	12	5	57	10	5	10
Lead	µg/L	0.05-0.1	NG	NG	<0.05	<0.05	0.14	<0.25	<0.1	<0.05	<0.1
Lithium	µg/L	1.0	NG	NG	15.5	11.9	18.1	71.3	67.9	22.7	93.4
Magnesium	µg/L	5.0	NG	NG	37900	36100	28000	116000	91900	39600	105000
Manganese	µg/L	0.10	NG	NG	37.3	66.3	178	89.8	302	196	588
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	2.37	2.26	2.16	1.54	6.44	2.51	7.29
Nickel	µg/L	0.50	NG	NG	16.5	10.2	18	92.8	30.1	18.6	32.1
Phosphorus	µg/L	50.0-100.0	NG	NG	<50	<50	<50	<250	<100	<50	<100
Potassium	µg/L	50.0	NG	NG	6110	6230	5870	9090	14400	7280	27600
Rubidium	µg/L	0.20	NG	NG	0.97	0.77	1.18	3.33	3.99	1.42	7.28

Appendix B1: LBRR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBRR-DD	LBRR-LC	LBRR-EDP	LBRR-EDP	LBRR-EDP	RR9	RR9
					29-Mar-23	29-Mar-23	29-Mar-23	28-Apr-23	28-Sep-23	29-Mar-23	28-Sep-23
Selenium	µg/L	0.05	NG	2.0	0.612	0.682	0.865	1.5	1.1	0.888	1.63
Silicon	µg/L	50.0	NG	NG	3710	3900	2460	3380	3080	2480	2600
Silver	µg/L	0.01-0.02	NG	NG	<0.01	<0.01	<0.01	<0.05	<0.02	<0.01	<0.02
Sodium	µg/L	50.0	NG	NG	31100	29700	23400	39200	88300	34900	93000
Strontium	µg/L	0.20	NG	NG	361	355	825	1300	3910	1210	6640
Sulfur	µg/L	500	NG	NG	76500	71400	52400	506000	158000	72500	186000
Tellerium	µg/L	0.2-0.4	NG	NG	<0.2	<0.2	<0.2	<1	<0.4	<0.2	<0.4
Thallium	µg/L	0.01	NG	NG	<0.01	<0.01	0.011	<0.05	0.031	0.011	0.056
Thorium	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.5	<0.2	<0.1	<0.2
Tin	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.5	<0.2	<0.1	<0.2
Titanium	µg/L	0.3-0.6	NG	NG	<0.3	<0.3	<0.3	<1.5	<0.6	<0.3	<0.6
Tungsten	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.5	<0.2	<0.1	<0.2
Uranium	µg/L	0.01	NG	NG	1.99	2.26	1.89	4.78	5.32	2.76	6.21
Vanadium	µg/L	0.5-1.0	NG	NG	<0.5	<0.5	<0.5	<2.5	<1	<0.5	<1
Zinc	µg/L	1.00	NG	NG	5	4.6	9	17.2	3	6	3
Zn FST Guideline Calc. - NEW GUIDELINE AUG 2023	µg/L		Hardness and DOC-dependent, Capped Value; valid for Hardness 13.8-250.5 mg CaCO3/L, DOC 0.3-17.3 mg/L						47.2		57.3
Zn FLT Guideline Calc. - NEW GUIDELINE AUG 2023	µg/L			Hardness and DOC-dependent, Capped Value; valid for Hardness 23.4-399 mg $CaCO_3$/L, pH 6.5-8.13, DOC 0.3-22.9 mg/L)					165.7		217.2
Zirconium	µg/L	0.06-0.12	NG	NG	<0.2	<0.2	<0.2	<1	<0.4	<0.2	<0.4
Laboratory Work Order Number					FJ2300677	FJ2300677	FJ2300677	FJ2300936	FJ2302574	FJ2300677	FJ2302574

Notes:

Screening completed on BCAWQG-FST [1] and FLT [2] guideline values.

[1] BC Ministry of Environment, Water Protection & Sustainability Branch (2019). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (F) water use and Short Term Maximum (ST) guidelines.

[2] BC Ministry of Environment, Water Protection & Sustainability Branch (2018). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (F) water use and Long Term Average (LT) guidelines.

[3] Guideline is hardness dependant. Where results are above laboratory reportable detection limits, guideline limits have been evaluated based on individual sample hardness. Sample-specific guideline values are listed in parentheses after the laboratory result, where applicable.

[4] Guideline is for Chromium (IV) cation. Analytical results are for unspeciated Chromium. Where analytical results exceed the guideline, speciated analysis may be warranted.

[5] Guideline is pH dependant.

NG - No Guideline

Detection limit can vary as described in the COA. Detection limit can be raised when dilutation is required due to high Dissolved Solids/Electrical Conductivity (DLDS), e.g. nitrite.

BOLD and shaded dark gray: Exceeds BCAWQG-FST (Freshwater Short Term) guideline.

Shaded Light Gray: Exceeds BCAWQG-FLT (Freshwater Long Term) guideline.

RED - Measured value is below detection limit (DL); value shown is 50% of DL

Blank - Not analyzed

Appendix B2: SBIAR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-US	RBSBIAR-EDS	RBSBIAR-EUS	RBSBIAR-EUS	RBSBIAR-EUS
					29-Mar-23	28-Apr-23	19-May-23	28-Jun-23	17-Jul-23	30-Aug-23	28-Sep-23	28-Sep-23	29-Mar-23	19-May-23	28-Jun-23	17-Jul-23
Physical Parameters																
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	6700	1000	2400	1000	1000	1000	1000	1000	2900	10000	1000	3800
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	93.3	217	214	189	228	222	194	185	85.8	91	194	252
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	1830	1140	660	681	821	820	550	512	979	857	775	801
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	929000	312000	271000	357000	265000	210000	270000	250000	465000	331000	300000	369000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L				924000	308000	275000	348000	280000	222000	312000	279000	701000	324000	298000	381000
pH	pH Units	0.10	6.5 - 9	6.5-9.0	7.39	8.33	8.06	8.05	8.32	8.32	8.25	8.26	7.74	7.45	8.20	8.10
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	1540000	758000	432000	430000	461000	551000	342000	302000	801000	657000	493000	533000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	343000	4100	11100	5300	1500	1500	410000	209000	1340000	92100	3100	3500
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	2600	<1000	<1000	5000	2400	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	93300	215000	214000	189000	223000	219000	194000	185000	85800	91000	194000	252000
Anions and Nutrients																
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	310	644	124	9.4	140	16.4	26.7	14.2	142	13	222	14.6
Ammonia FST Guideline	µg/L		pH dependent (at Temp 4 °C or in situ T)		15300	3150	4950	6220	3150	3150	3150	3150	10300	13600	3950	4950
Ammonia FLT Guideline				pH dependent (at Temp 4 °C or in situ T)	1970	606	952	1200	606	606	606	606	1980	1970	759	952
Chloride (Cl^-)	µg/L	500	600000	150,000	60000	38200	30800	59600	34400	30600	14700	12700	38700	55600	42300	59800
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	258	882	1150	640	191	309	59.8	69.7	842	763	150	541
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	10.2	18.7	11.1	4.8	50.4	21.2	2.3	3.4	39	8.8	19.4	<5
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	964000	323000	110000	90300	156000	159000	109000	91300	423000	326000	164000	86000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	429000	429000	309000	309000	309000	309000	309000	309000	429000	429000	309000	309000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	5.15	1.91	1.84	1.39	1.65	1.23	4.69	3.87	3.24	4.09	2.36	2.62
Metals, Total																
Aluminum	µg/L	3.00	NG		11800	95	223	27.6	86.9	169	4550	2270	20700	37.6	167	51.1
NEW August 2023 FLT Guideline (no FST)	µg/L			pH, DOC, Hardness-dependent; valid hardness 10-430 mg/L, pH 6.0-8.7, DOC 0.8-12.3 mg/L						174	390	348				
Antimony	µg/L	0.10	NG	NG	0.92	0.28	0.26	0.13	0.17	<0.1	0.6	0.49	1.04	0.18	0.18	0.13
Arsenic	µg/L	0.10	5, discontinued Aug 2023	5.0	**11.3**	0.35	0.48	0.25	0.42	0.5	5.7	2.68	**29.2**	0.37	0.28	0.36
Barium	µg/L	0.10	NG	NG	340	35.8	91.2	110	63.3	61.2	303	207	1140	132	59.4	142
Beryllium	µg/L	0.10	NG	NG	2.07	<0.1	<0.1	<0.1	<0.1	<0.1	0.442	0.127	1.24	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05	NG	NG	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	0.064	<0.05	0.416	<0.05	<0.05	<0.05
Boron	µg/L	10.0	1200	1200	103	206	72	27	219	296	43	30	44	19	166	32
Cadmium	µg/L	0.005	NG	NG	6.55	0.192	0.0517	0.0092	0.0437	0.0188	0.682	0.187	2.3	0.0139	0.12	0.0135
Calcium	µg/L	50	NG	NG	210000	81800	77000	99400	76200	59800	83000	71000	202000	92000	81600	111000
Cesium	µg/L	0.01	NG	NG	1.16	0.04	0.06	<0.01	0.031	0.025	0.834	0.381	3.51	<0.01	0.03	<0.01
Chromium [4]	µg/L	0.1-1.0	NG	NG	12	<0.5	<0.5	<0.5	<0.5	<0.5	8.93	5.81	38.7	<0.5	<0.5	<0.5
Cobalt	µg/L	0.10	110	4.0	**180**	5.34	0.73	<0.1	1.12	0.31	8.9	2.17	30.7	0.17	3.61	0.12
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	109	0.86	1.17	<0.5	1.06	1.01	19.6	7.22	69.7	0.64	1.44	<0.5
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000													
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10												
Iron	µg/L	10	1000	NG	**20800**	103	378	106	64	82	**12300**	**5640**	**62600**	157	68	162
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	7.24	0.062	0.241	<0.05	<0.05	<0.05	5.03	2.71	26.2	<0.05	<0.05	<0.05
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		417.0	347.5	290.5	412.6	282.3	209.9	289.1	262.12	416.97	374.69	330.60	416.97
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	19.6	16.9	14.6	19.4	14.3	11.5	14.6	13.53	19.57	17.92	16.20	19.57
Lithium	µg/L	1.0	NG	NG	189	64.5	22.8	10	39.8	51.3	18.1	12.3	35.4	7.9	37.4	10.3
Magnesium	µg/L	5.0	NG	NG	97000	25100	20100	24300	21700	17600	25400	24800	47800	23000	22900	25300
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	2410	132	26.8	16.9	17.5	2.02	289	136	1310	52.9	51.8	33.9
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		3394.18	3394.18	3394.18	3394.18	3394.18	2854.2	3394.18	3295.0	3394.2	3394.2	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	1845.8	1845.8	1845.8	2175.8	1771	1529	1793	1705.0	2585.0	2061.4	1925.0	2228.6
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	0.0439	<0.005	<0.005	<0.005	<0.005	<0.005	0.0301	0.0203	0.0572	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	3.91	3.19	2.3	1.48	2.87	2.88	2.42	1.89	5.69	1.86	2.72	1.32
Nickel	µg/L	0.50	NG	NG	528	22.6	5.06	0.63	9.65	4.68	27.3	7.71	96.8	1.42	16.4	0.78
Phosphorus	µg/L	50.0	NG	NG	761	<50	<50	<50	<50	<50	516	272	2600	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	5220	3320	3030	4120	3660	3020	4870	4340	6770	3490	3530	4480
Rubidium	µg/L	0.2	NG	NG	12.7	2.58	1.84	0.66	1.85	1.33	8.05	3.74	34.3	0.62	1.98	0.84
Selenium	µg/L	0.05	NG	2.0	7.72	0.775	1.09	0.757	0.402	0.154	1.75	1.57	4.35	0.536	0.64	0.888
Silicon	µg/L	100.0	NG	NG	9140	3060	4450	4790	3960	3540	8000	4940	29300	3170	3890	5100
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	0.106	<0.01	<0.01	<0.01	<0.01	<0.01	0.087	0.045	0.543	<0.01	<0.01	<0.01
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	56200	152000	41600	19200	82200	113000	11600	8350	19000	15500	68000	20500
Strontium	µg/L	0.2	NG	NG	1150	703	320	229	445	464	404	339	497	203	446	246
Sulfur	µg/L	500.0	NG	NG	317000	122000	36000	34500	56600	61000	42300	34200	146000	33200	65600	30000
Tellerium	µg/L	0.2	NG	NG	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	0.169	0.023	0.02	<0.01	0.01	<0.01	0.121	0.062	0.569	0.014	0.014	<0.01
Thorium	µg/L	0.10	NG	NG	12.9	<0.1	<0.1	<0.1	<0.1	<0.1	2.52	0.8	11.4	<0.1	<0.1	<0.1
Tin	µg/L	0.10	NG	NG	0.26	0.21	1.27	<0.1	0.1	<0.1	0.22	0.15	0.6	<0.1	0.24	<0.1
Titanium	µg/L	0.3-4.5	NG	NG	57.6	1.28	5.79	<0.3	0.3	<0.3	65.3	49.5	140	1.1	<0.3	<1.2
Tungsten	µg/L	0.10	NG	NG	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	10.8	1.37	1.42	1.37	1.01	0.879	2.21	1.74	5.17	1.46	1.3	1.17
Vanadium	µg/L	0.50	NG	NG	15	<0.5	1.06	<0.5	<0.5	<0.5	14.3	8.35	67.6	<0.5	<0.5	<0.5
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	**1380**	13.8	4.8	1.5	7.8	3.3	129	26.1	**383**	<3	17.2	1.5
Zn FST Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		340.5	199.5	168.75	233.25	164.25	123	168	153	314.25	213.75	190.50	242.25
Zn FLT Guideline Calc.				Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	187.5	174	143.25	187.5	138.75	97.5	142.5	127.5	188	188	165	188
Zirconium	µg/L	0.06	NG	NG	0.47	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2
Metals, Dissolved																
Aluminum [5]	µg/L	1.0	100	50	97.7	48.1	10.8	2.2	74.1	**152**	**102**	37.8	31	57	**140**	2.5
Al FST Guideline Calc (based on pH), to Aug 2023	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH), to Aug 2023	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50	50	50	50	50	50	50
Antimony	µg/L	0.10	NG	NG	0.38	0.28	0.2	0.12	0.14	<0.1	0.19	0.18	0.16	0.12	0.19	0.11
Arsenic	µg/L	0.10	NG	NG	0.22	0.26	0.25	0.23	0.37	0.44	0.33	0.29	0.19	0.24	0.32	0.35
Barium	µg/L	0.10	NG	NG	37.9	37.5	80.3	113	61.6	62.3	69.5	105	29.9	131	61.1	144
Beryllium	µg/L	0.10	NG	NG	0.133	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth		0.05	NG	NG	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	100	205	70	25	205	270	36	26	21	19	167	28
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	**5.59**	0.199	0.0387	0.0085	0.033	0.0157	0.0384	0.018	0.154	0.0707	0.109	0.0072
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.801	1.899	1.642	2.182	1.605	1.263	1.636	1.512	2.801	2.018	1.824	2.257
Cd FLT Guideline Calc.				Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.457	0.457	0.441	0.457	0.433	0.365	0.439	0.415	0.457	0.457	0.457	0.457
Calcium	µg/L	50.0	NG	NG	204000	85000	73900	104000	72000	56900	68900	61400	137000	91900	82300	106000
Cesium		0.01	NG	NG	0.025	0.036	0.017	<0.01	0.027	0.022	<0.01	<0.01	<0.01	<0.01	0.031	<0.01
Chromium	µg/L	0.10	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	µg/L	0.10	NG	NG	173	5.36	0.54	<0.1	1.05	0.28	1.12	0.12	3.48	1.18	3.49	0.1
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	10.1	0.70	0.38	0.40	0.90	1.26	1.4	0.69	0.98	2.44	1.15	0.37
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		14.3	10.8	12	4.77	8.18	11.1	28.9	23.2	11.7	10.8		
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	2.3	1.92	2.1	0.84	1.45	2.1	5.4	4.3	2.0	1.9		
Iron	µg/L	10.0	350	NG	**2120**	<10	<10	18	13	39	18	40	21	148	12	60
Lead	µg/L	0.05	NG	NG	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	µg/L	1.0	NG	NG	200	71.3	21.5	10	38.8	49.9	14.6	11.2	12.1	8.5	37.5	9.7
Magnesium	µg/L	5.0	NG	NG	102000	24300	21000	23600	20800	16500	23700	23500	29900	24700	23000	25400
Manganese	µg/L	0.10	NG	NG	2340	136	14.8	15.1	16.4	1.7	27.7	13.2	211	55.4	51.7	30.7
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	2.41	3.44	2.59	1.5	2.79	2.8	1.92	1.82	2.28	1.85	2.69	1.27
Nickel	µg/L	0.50	NG	NG	511	22.9	4.6	0.63	8.87	4.48	5.62	0.58	13.6	5.17	16	0.64
Phosphorus	µg/L	50.0	NG	NG	<100	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	4210	3580	2920	4170	3590	3270	4080	4030	2780	3740	3630	4420
Rubidium	µg/L	0.20	NG	NG	2.39	2.33	1.33	0.85	1.58	1.38	1.02	0.55	0.94	0.63	1.43	0.79
Selenium	µg/L	0.05	NG	2.0	7.23	0.869	1.15	0.943	0.38	0.215	1.47	1.53	3.01	0.623	0.662	0.965
Silicon	µg/L	50.0	NG	NG	2940	3160	3940	4670	3820	3360	1430	1340	1410	3040	3870	5100
Silver	µg/L	0.01	NG	NG	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	NG	NG	55700	153000	42100	19200	79000	105000	11500	8160	16400	16300	67700	20400
Strontium	µg/L	0.20	NG	NG	1140	719	329	227	436	454	344	310	291	207	452	239
Sulfur	µg/L	500	NG	NG	332000	128000	34800	35100	53600	58600	39200	33300	139000	35100	65200	29900
Tellurium	µg/L	0.20	NG	NG	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	0.022	0.024	0.015	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.014	<0.01
Thorium	µg/L	0.10	NG	NG	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.10	NG	NG	<0.2	0.21	1.26	<0.1	0.11	<0.1	<0.1	<0.1	0.32	<0.1	0.24	<0.1
Titanium	µg/L	0.30	NG	NG	<0.6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.03	0.32	<0.3	<0.3	<0.3
Tungsten	µg/L	0.10	NG	NG	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	4.66	1.45	1.4	1.33	0.98	0.832	1.39	1.38	2.25	1.59	1.24	1.16
Vanadium	µg/L	0.50	NG	NG	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	1.00	NG	NG	1060	13.4	2.7	0.5	6.2	2.7	3.4	0.5	5.9	11.9	15.6	0.5
Zn FST Guideline Calc. - NEW GUIDELINE AUG 2023	µg/L		Hardness and DOC-dependent, Capped Value; valid for Hardness 13.8-250.5 mg CaCO3/L, DOC 0.3-17.3 mg/L							76	130	116				
Zn FLT Guideline Calc. - NEW GUIDELINE AUG 2023	µg/L			Hardness and DOC-dependent, Capped Value; valid for Hardness 23.4-399 mg $CaCO_3$/L, pH 6.5-8.13, DOC 0.3-22.9 mg/L)						10	23	19				
Zirconium	µg/L	0.06	NG	NG	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Laboratory Work Order Number					FJ2300677	FJ2300936	FJ2301129	FJ2301553	FJ2301738	FJ2302196	FJ2302574	FJ2302574	FJ2300677	FJ2301129	FJ2301553	FJ2301738

Notes:

Screening completed on BC AWQG-FWAL FST 1 and FLT 2 guideline values.

[1] BC Ministry of Environment, Water Protection & Sustainability Branch (2019), British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (FWAL) water use and Short Term Maximum (FST) guidelines.

[2] BC Ministry of Environment, Water Protection & Sustainability Branch (2018). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (FWAL) water use and Long Term Average (FLT) guidelines.

[3] Guideline is hardness dependant. Where results are above laboratory reportable detection limits, guideline limits have been evaluated based on individual sample hardness. Sample-specific guideline values are listed in parentheses after the laboratory result, where applicable.

[4] Guideline is for Chromium (IV) cation. Analytical results are for unspeciated Chromium. Where analytical results exceed the guideline, speciated analysis may be warranted.

[5] Guideline is pH dependant.

[6] Guideline is Dissolved Organic Carbon (DOC) dependent. BML Model assumed 10% DOC and Humic acid 10% of DOC value, due to no DOC in lab analysis.

NG - No Guideline

Detection limit can vary as described in the COA. Detection limit can be raised when dilutation is requited due to high Dissolved Solids/Electrical Conductivity (DLDS), e.g. nitrite.

BOLD and shaded dark gray: Exceeds BCAWQG-FFST (Short-term Maximum) guideline.

Shaded Light Gray: Exceeds BCAWQG-FLT (Long-term Average) guideline.

RED - Measured value is below detection limit (DL); value shown is 50% of DL

Blank - Not analyzed

TETRA TECH

Appendix B3 L2 Powerhouse Area Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	L2-US 30-Jan-23	L2-US 20-Feb-23	L2-US 29-Mar-23
Physical Parameters							
Acidity (Total as $CaCO_3$)	µg/L	1000; 2000	NG	NG	28500	4900	1000
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	179	193	136
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	540	547	340
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	238000	250000	147000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L				245000	261000	148000
pH	pH Units	0.10	6.5 - 9.0	6.5-9.0	8.16	8.26	8.07
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	501000	376000	226000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	84400	5500	3500
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	179000	193000	136000
Anions and Nutrients							
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0); GL capped at pH 9.0	pH dependent (6.5-9.0); GL capped at pH 9.0	43.5	2.5	9.5
Ammonia FST Guideline	µg/L		pH dependent (**at Temp 4 °C** or in situ T)		3950	3150	4950
Ammonia FLT Guideline				pH dependent (**at Temp 4 °C** or in situ T)	759	606	952
Chloride (Cl^-)	µg/L	500	600000	150,000	10200	12600	3460
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	352	331	164
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	1.1	1.3	3.9
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	106000	117000	42900
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000; Hardness 181,000-250,000 = 429,000; Hardness > 250,000 site-specific	309000	309000	309000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	3.00	2.44	2.20
Metals, Total							
Aluminum	µg/L	3.00	NG	NG	2060	1220	81.8
NEW FLT GUIDELINE AUG 2023 (no FST Guideline)				pH, DOC, Hardness-dependent; valid hardness 10-430 mg/L, pH 6.0-8.7, DOC 0.8-12.3 mg/L			
Antimony	µg/L	0.10	NG	NG	0.38	0.33	0.31
Arsenic	µg/L	0.10	5.0	5.0	1.47	0.6	0.34
Barium	µg/L	0.10	NG	NG	213	134	62.3
Beryllium	µg/L	0.10	NG	NG	0.122	<0.1	<0.1
Bismuth	µg/L	0.05	NG	NG	<0.05	<0.05	<0.05
Boron	µg/L	10.0	1200	1200	31	30	18
Cadmium	µg/L	0.005	NG	NG	0.0689	0.0225	0.007
Calcium	µg/L	50	NG	NG	72700	79900	43400
Cesium	µg/L	0.01	NG	NG	0.691	0.237	0.015
Chromium [4]	µg/L	0.1-1.0	NG	NG	3.71	2.18	0.97
Cobalt	µg/L	0.10	110	4.0	1.83	0.36	0.12
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	5.61	1.87	1.01
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000				
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10			
Iron	µg/L	10	1000	NG	**2790**	608	84
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	1.72	0.395	0.08
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		246.2	262.1	133.3
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	12.9	13.5	8.5
Lithium	µg/L	1.0	NG	NG	9.3	8.2	3.4
Magnesium	µg/L	5.0	NG	NG	15400	15000	9630
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	44.9	7.61	1.89
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		3162.76	3295	2159.94
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	1652.2	1705	1251.8
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	2.82	3.9	3.73
Nickel	µg/L	0.50	NG		5.14	1.46	<0.5
Phosphorus	µg/L	50.0	NG	NG	133	52	<50
Potassium	µg/L	50.0	NG	NG	2810	2830	2290
Rubidium	µg/L	0.2	NG	NG	7.28	3.62	1.78
Selenium	µg/L	0.05	NG	2.0	1.88	1.33	0.813
Silicon	µg/L	100.0	NG	NG	7840	7330	3770
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	0.031	0.01	<0.01
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	29100	33400	11200
Strontium	µg/L	0.2	NG	NG	180	166	96.6
Sulfur	µg/L	500.0	NG	NG	37000	47400	14000
Tellerium	µg/L	0.2	NG	NG	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	0.052	0.024	<0.01
Thorium	µg/L	0.10	NG	NG	0.58	0.17	<0.1
Tin	µg/L	0.10	NG	NG	0.13	<0.1	0.13
Titanium	µg/L	0.3-4.5	NG	NG	37	32.9	2.25
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.1	0.22
Uranium	µg/L	0.01	NG	NG	1.8	1.89	0.906
Vanadium	µg/L	0.50	NG	NG	6.93	4.3	1.26
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	19.4	15.2	4.7
Zn FST Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		144.0	153.0	75.8
Zn FLT Guideline Calc.	µg/L			Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	118.5	127.5	50.25
Zircronium	µg/L	0.06	NG	NG	0.67	1.28	<0.2
Metals, Dissolved							
Aluminum [5]	µg/L	1.0	100	50	20.4	8.8	16.1
Al FST Guideline Calc (based on pH)	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100
Al FLT Guideline Calc (based on median pH)	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50
Antimony	µg/L	0.10	NG	NG	0.28	0.28	0.31
Arsenic	µg/L	0.10	NG	NG	0.27	0.28	0.25
Barium	µg/L	0.10	NG	NG	81.8	91.2	56.3
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1
Bismuth		0.05	NG	NG	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	26	26	19
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.0079	0.0064	0.0025
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		1.44	1.51	0.87
Cd FLT Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.40	0.42	0.28
Calcium	µg/L	50.0	NG	NG	72300	73400	42900
Cesium	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01
Chromium	µg/L	0.10	NG	NG	<0.5	<0.5	0.78
Cobalt	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	3.15	0.65	0.73
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		14.9	17.2	10.5
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	2.62	3.30	1.90
Iron	µg/L	10.0	350	NG	5	5	5
Lead	µg/L	0.05	NG	NG	0.121	<0.05	<0.05
Lithium	µg/L	1.0	NG	NG	6.5	6.5	3.6
Magnesium	µg/L	5.0	NG	NG	14000	16100	9600
Manganese	µg/L	0.10	NG	NG	2.4	0.92	0.28
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	2.7	3.33	3.7
Nickel	µg/L	0.50	NG	NG	0.81	<0.5	<0.5
Phosphorus	µg/L	50.0	NG	NG	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	2080	2470	2330
Rubidium	µg/L	0.20	NG	NG	0.93	1	1.64

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	L2-US	L2-US	L2-US
					30-Jan-23	20-Feb-23	29-Mar-23
Selenium	µg/L	0.05	NG	2.0	1.75	1.61	0.789
Silicon	µg/L	50.0	NG	NG	4360	4820	3570
Silver	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	NG	NG	28600	32400	10600
Strontium	µg/L	0.20	NG	NG	174	162	95.6
Sulfur	µg/L	500	NG	NG	37800	46000	13700
Tellurium	µg/L	0.20	NG	NG	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01
Thorium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1
Tin	µg/L	0.10	NG	NG	<0.1	<0.1	0.1
Titanium	µg/L	0.30	NG	NG	0.34	<0.3	<0.3
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.1	0.23
Uranium	µg/L	0.01	NG	NG	1.55	1.55	0.86
Vanadium	µg/L	0.50	NG	NG	<0.5	<0.5	1.02
Zinc	µg/L	1.00	NG	NG	3.4	8.3	2.6
Zn FST Guideline Value (Acute) - New Guideline Aug 2023	µg/L		Hardness and DOC-dependent, Capped Value; valid for Hardness 13.8-250.5 mg CaCO3/L, DOC 0.3-17.3 mg/L				
Zn FLT Guideline Value (Chronic) - New Guideline Aug 2023	µg/L			Hardness and DOC-dependent, Capped Value; valid for Hardness 23.4-399 mg $CaCO_3$/L, pH 6.5-8.13, DOC 0.3-22.9 mg/L)			
Zircronium	µg/L	0.06	NG	NG	<0.2	<0.2	<0.2
Laboratory Work Order Number					FJ2300206	FJ2300373	FJ2300677

Appendix B4 LBDB Area Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND
					28-Apr-23	19-May-23	28-Jun-23	17-Jul-23	30-Aug-23	28-Sep-23
Physical Parameters										
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	<2000	10300	<2000	8300	7300	31200
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	97.3	240	258	216	234	394
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	1270	2630	3550	4310	4760	3770
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	506000	1180000	2000000	2290000	2330000	1740000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L				499000	1200000	1940000	2320000	2450000	1760000
pH	pH Units	0.10	6.5 - 9	6.5-9.0	8.03	8.19	8.31	7.98	8.35	7.56
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	796000	2200000	3390000	4290000	4750000	3310000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	45700	4100	26900	34900	32300	61600
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<1000	5000	<1000	6000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	97300	240000	253000	216000	228000	394000
Anions and Nutrients										
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	10	12.3	14.5	16.3	26.8	283
Ammonia FST Guideline	µg/L		pH dependent (**at Temp 4 °C** or in situ T)		6220	3950	3150	6220	2520	11900
Ammonia FLT Guideline	µg/L			pH dependent (**at Temp 4 °C** or in situ T)	1200	759	606	1200	484	1970
Chloride (Cl^-)	µg/L	500	600000	150,000	8560	<10000	3150	<10000	13000	13200
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	89.9	<100	<25	<100	<100	<100
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	<5	<20	<5	<20	<20	<20
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	604000	1370000	2280000	2710000	3050000	2190000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	429000	429000	429000	429000	429000	429000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	12.5	18	23.6	30	36.9	29.8
Metals, Total										
Aluminum	µg/L	3.00	NG	NG	165	188	84.1	31	61.8	196
NEW FLT GUIDELINE AUG 2023 (no FST Guideline)				pH, DOC, Hardness-dependent; valid hardness 10-430 mg/L, pH 6.0-8.7, DOC 0.8-12.3 mg/L					1196	1189
Antimony	µg/L	0.10	NG	NG	0.13	0.2	<0.5	<0.5	<0.5	<0.5
Arsenic	µg/L	0.10	5, discontinued Aug 2023	5.0	0.53	0.61	0.78	0.6	0.93	0.95
Barium	µg/L	0.10	NG	NG	33.2	31.9	32.6	26.5	23.7	26.8
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05	NG	NG	<0.05	<0.1	<0.25	<0.25	<0.25	<0.25
Boron	µg/L	10.0	1200	1200	76	158	280	346	351	228
Cadmium	µg/L	0.005	NG	NG	0.128	0.0528	<0.025	0.026	<0.025	0.0622
Calcium	µg/L	50	NG	NG	115000	257000	412000	454000	419000	342000
Cesium	µg/L	0.01	NG	NG	0.024	0.021	<0.05	<0.05	<0.05	<0.05
Chromium [4]	µg/L	0.1-1.0	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5
Cobalt	µg/L	0.10	110	4.0	3.38	3.13	1.33	0.25	1.06	3.53
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	2.02	1.46	<2.5	<2.5	<2.5	<2.5
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000							
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10						
Iron	µg/L	10	1000	NG	297	670	868	437	756	**14100**
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	0.178	<0.1	<0.25	<0.25	<0.25	<0.25
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		417.0	417.0	417.0	417.0	417.0	417.0
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	19.6	19.6	19.6	19.6	19.6	19.6
Lithium	µg/L	1.0	NG	NG	14.9	42.2	74.7	82.3	72.4	34.2
Magnesium	µg/L	5.0	NG	NG	51500	135000	222000	289000	340000	220000
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	848	1490	1070	561	1990	**11400**
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		3394.2	3394.2	3394.2	3394.2	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	2585	2585	2585	2585	2585	2585
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	0.935	0.619	0.565	0.352	0.602	0.501
Nickel	µg/L	0.50	NG		15.8	22	9.91	8.43	6.38	7.94
Phosphorus	µg/L	50.0	NG	NG	73	<100	<250	<250	<250	<250
Potassium	µg/L	50.0	NG	NG	14300	15600	9640	14500	24900	17500
Rubidium	µg/L	0.2	NG	NG	2.64	4.6	4.63	5.23	7.24	5.86
Selenium	µg/L	0.05	NG	2.0	0.446	0.289	0.323	0.468	0.29	0.296
Silicon	µg/L	100.0	NG	NG	2240	940	<500	<500	<500	1340
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	83000	186000	297000	376000	481000	344000
Strontium	µg/L	0.2	NG	NG	329	650	1020	1140	1170	940
Sulfur	µg/L	500.0	NG	NG	224000	505000	895000	985000	1180000	793000
Tellerium	µg/L	0.2	NG	NG	<0.2	<0.4	<1	<1	<1	<1
Thallium	µg/L	0.01	NG	NG	0.012	<0.02	<0.05	<0.05	<0.05	<0.05
Thorium	µg/L	0.10	NG	NG	<0.1	0.32	<0.5	<0.5	<0.5	<0.5
Tin	µg/L	0.10	NG	NG	0.15	<0.2	<0.5	<0.5	<0.5	<0.5
Titanium	µg/L	0.3-4.5	NG	NG	6.48	1.63	<1.5	<1.5	<1.5	<1.5
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.2	<0.5	<0.5	<0.5	<0.5
Uranium	µg/L	0.01	NG	NG	1.04	2.47	3.96	3.8	3.27	2.29
Vanadium	µg/L	0.50	NG	NG	0.65	<1	<2.5	<2.5	<2.5	<2.5
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	44.4	19.7	7.5	7.5	7.5	7.5
Zn FST Guideline Calc., prior to Aug 2023	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		340.5	340.5	340.5	340.5	340.5	340.5
Zn FLT Guideline Calc., prior to Aug 2023	µg/L			Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	187.5	187.5	187.5	187.5	187.5	187.5
Zircronium	µg/L	0.06	NG	NG	<0.2	<0.4	<1	<1	<1	<1
Metals, Dissolved										
Aluminum [5]	µg/L	1.0	100	50	17.9	9.8	7.4	7.7	11.7	**114**
Al FST Guideline Calc (based on pH), prior to Aug 2023	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH), prior to Aug 2023	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50
Antimony	µg/L	0.10	NG	NG	0.11	<0.2	<0.5	<0.5	<0.5	<0.5
Arsenic	µg/L	0.10	NG	NG	0.45	0.53	0.68	0.79	0.81	0.63
Barium	µg/L	0.10	NG	NG	31.1	24.7	46.5	25	22	24
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth		0.05	NG	NG	<0.05	<0.1	<0.25	<0.25	<0.25	<0.25
Boron	µg/L	10.0	NG	NG	76	149	315	328	339	220
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.131	0.0351	0.0125	0.0125	0.0125	0.0125
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.80	2.80	2.80	2.80	2.80	2.80
Cd FLT Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.46	0.46	0.46	0.46	0.46	0.46
Calcium	µg/L	50.0	NG	NG	117000	242000	414000	450000	412000	337000

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND
					28-Apr-23	19-May-23	28-Jun-23	17-Jul-23	30-Aug-23	28-Sep-23
Cesium	µg/L	0.01	NG	NG	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05
Chromium	µg/L	0.10	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	µg/L	0.10	NG	NG	3.34	2.46	1.18	<0.5	1	3.62
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	1.94	0.75	3.34	0.5	0.5	0.5
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		53.6	128.2	104	85.5	163.1	73.6
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	9.36	21.3	18.6	14.9	34.4	7.3
Iron	µg/L	10.0	350	NG	52	89	62	25	340	**10100**
Lead	µg/L	0.05	NG	NG	<0.05	<0.1	<0.25	<0.25	<0.25	<0.25
Lithium	µg/L	1.0	NG	NG	15.2	39.8	76.1	79.5	72.9	38.5
Magnesium	µg/L	5.0	NG	NG	51900	139000	234000	284000	317000	218000
Manganese	µg/L	0.10	NG	NG	865	1070	1090	439	1810	11600
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	0.924	0.616	0.424	0.368	0.642	0.479
Nickel	µg/L	0.50	NG	NG	14.3	20.6	9.96	7.9	5.87	7.04
Phosphorus	µg/L	50.0	NG	NG	<50	<100	<250	<250	<250	<250
Potassium	µg/L	50.0	NG	NG	14800	15100	10300	14200	24600	16900
Rubidium	µg/L	0.20	NG	NG	2.1	4.37	4.06	5.24	7.49	5.82
Selenium	µg/L	0.05	NG	2.0	0.324	0.245	0.256	0.308	0.331	0.344
Silicon	µg/L	50.0	NG	NG	1970	760	390	<250	<250	1220
Silver	µg/L	0.01	NG	NG	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05
Sodium	µg/L	50.0	NG	NG	86700	186000	310000	366000	454000	324000
Strontium	µg/L	0.20	NG	NG	328	645	1050	1150	1120	859
Sulfur	µg/L	500	NG	NG	233000	509000	886000	973000	1120000	729000
Tellurium	µg/L	0.20	NG	NG	<0.2	<0.4	<1	<1	<1	<1
Thallium	µg/L	0.01	NG	NG	0.011	<0.02	<0.05	<0.05	<0.05	<0.05
Thorium	µg/L	0.10	NG	NG	<0.1	<0.2	<0.5	<0.5	<0.5	<0.5
Tin	µg/L	0.10	NG	NG	<0.1	<0.2	<0.5	<0.5	<0.5	<0.5
Titanium	µg/L	0.30	NG	NG	0.52	<0.6	<1.5	<1.5	<1.5	<1.5
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.2	<0.5	<0.5	<0.5	<0.5
Uranium	µg/L	0.01	NG	NG	1.05	2.4	3.92	3.64	3.2	2
Vanadium	µg/L	0.50	NG	NG	<0.5	<1	<2.5	<2.5	<2.5	<2.5
Zinc	µg/L	1.00	NG	NG	41.7	13.7	2.5	2.5	2.5	6
Zn FST Guideline Value (Acute) - New Guideline Aug 2023	µg/L		Hardness and DOC-dependent, Capped Value; valid for Hardness 13.8-250.5 mg CaCO3/L, DOC 0.3-17.3 mg/L						70	57
Zn FLT Guideline Value (Chronic) - New Guideline Aug 2023	µg/L			Hardness and DOC-dependent, Capped Value; valid for Hardness 23.4-399 mg $CaCO_3$/L, pH 6.5-8.13, DOC 0.3-22.9 mg/L)					367	487
Zircronium	µg/L	0.06	NG	NG	<0.2	<0.4	<1	<1	<1	<1
Laboratory Work Order Number					FJ2300936	FJ2301129	FJ2301553	FJ2301738	FJ2302196	FJ2302574