APPENDIX 17 2023 AQUATIC ECOSYSTEM MONITORING PROGRAM (AEMP) REPORT

Aquatic Effects Monitoring Program 2023 Annual Report

Meliadine Mine

Prepared for:

Agnico Eagle Mines Limited
Meliadine Division
Rankin Inlet, Nunavut X0C 0G0

Final

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Azimuth Consulting Group Inc.
218-2902 West Broadway
Vancouver, B.C., V6K 2G8

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The 2023 Aquatic Effects Monitoring Program (AEMP) Annual Report was authored by Medhi Aqdam and Sean Engelking with technical contributions and internal review by Eric Franz (Azimuth Consulting Group Inc). We would like to thank Anne-Laurence Paquet, Jade Robitaille, Lisa Mah, and Sara Savoie for reviewing the draft.

PLAIN LANGUAGE SUMMARY

This document summarizes results from the 2023 Aquatic Effects Monitoring Program (AEMP) for Agnico Eagle's Meliadine Gold Mine near Rankin Inlet, Nunavut. The AEMP is an annual requirement of the Type A Water Licence (2AM-MEL-1631). The purpose of the AEMP is to verify that the Mine is operating as planned and not causing changes in water quality that have the potential to adversely impact aquatic life or traditional uses of Meliadine Lake.

The scope of the 2023 AEMP included the following components:

- Snow core chemistry sampling
- Effluent quality monitoring, including acute and sublethal toxicity testing
- Surface water quality monitoring in Meliadine Lake
- Phytoplankton community and chlorophyll-a sampling in Meliadine Lake
- Surface water quality monitoring in the Peninsula Lakes (Lake A8, Lake B7, and Lake D7).

Data collected in the 2023 AEMP were used to answer the key questions in **Table ES-1**.

Table ES-1. Key Questions for the Meliadine Lake and Peninsula Lakes Studies

Component	Key Questions
Meliadine Lake	
Water Quality	Are concentrations of key parameters in effluent less than limits specified in the Water Licence?
	Has water quality in the exposure areas changed over time, relative to reference/baseline areas?
	Is water quality consistent with predictions in the Final Environmental Impact Statement (FEIS) and below guidelines to protect aquatic life and human health?
Phytoplankton Community	Is the phytoplankton community affected by potential mine-related changes in water quality in Meliadine Lake?
Peninsula Lakes	
Water Quality	Is water quality consistent with predictions in the FEIS and below guidelines to protect aquatic life and human health?
	Has water quality in the exposure areas changed over time, relative to baseline conditions?

Meliadine Lake Study

Based on precipitation data collected on Site, 2023 and 2022 were the driest and second driest years since 1981. The relatively small snowpack in 2022/2023 meant less runoff was collected on Site during freshet. Freshet was also early in 2023 due to an unusually warm April and May and Agnico Eagle started discharging treated surface contact water to Meliadine Lake in early June. By mid-July, the lower operating level in CP1 was reached and discharge to Meliadine Lake was halted. Discharge resumed in mid-August and continued until the end of September. In total, approximately 530,000 m^3 of water was discharged into Meliadine Lake in 2023. For context, approximately twice the volume of water was discharged to Meliadine Lake in 2020 (1.03 Mm) after record rainfall in the summer of 2019.

Effluent Quality

Effluent samples were collected weekly for chemistry testing and monthly for acute toxicity testing while the Mine was discharging to Meliadine Lake. There were no exceedances of limits in the Water Licence in 2023 and there were no effects to Rainbow Trout or *Daphnia magna* in any of the acute toxicity tests. Two rounds of sublethal toxicity testing were completed with *Lemna minor* (duckweed), and there were no effects on frond growth or biomass in either test.

Meliadine Lake Water Quality

The water quality monitoring program in Meliadine Lake is designed to assess the effects of effluent discharge to Meliadine Lake. The monitoring program includes one winter sampling event (early April) and open water sampling in July, August, and September. The winter sampling event is primarily used to verify nothing unusual is occurring under the ice. Agnico Eagle discharges water during the open water season, so the focus of the Meliadine Lake water quality assessment is on water quality data collected in July, August, and September.

There were no mining-related exceedances of the AEMP Action Levels in 2023. A small number of samples exceeded the aquatic life water quality guideline for copper, but the exceedances occurred in the mid-field and reference areas. Copper is naturally elevated compared to the aquatic life guideline, but concentrations have been stable going back to the baseline period.

Water quality in Meliadine Lake has changed in recent years. In general, the magnitude of changes in water quality is more pronounced in the East Basin (MEL-01) compared to the mid-field (MEL-02) and far-field reference areas (MEL-03, MEL-04 and MEL-05). Parameters that have increased throughout Meliadine Lake include major ions (chloride, sodium, sulphate), organic carbon, and a few metals (arsenic, molybdenum, strontium, and uranium). For the parameters with effects-based thresholds, such as arsenic and uranium, current concentrations are well below guidelines meant to protect fish and other aquatic organisms and well below Health Canada's guidelines for safe drinking water.

Discharge of effluent was predicted to cause changes in water quality in the East Basin. The spatial extent of effluent-related effects on water quality outside of the East Basin is less certain. The long-term data from other areas in Meliadine Lake suggests that general warming patterns and more variable and extreme precipitation may also be contributing to incremental increases in the concentrations of some parameters (e.g., organic carbon and arsenic).

Phytoplankton Community

Effluent contains nutrients and minerals that can stimulate algal growth and contribute to changes in primary productivity. As in previous years, one phytoplankton sampling event was completed in August to determine if effluent is causing nutrient enrichment and changes in productivity in the East Basin. Changes in productivity are evaluated using the following lines of evidence: phytoplankton biomass (a direct measure of primary productivity), chlorophyll-a (an indirect measure of productivity), the composition of the phytoplankton community, and nutrient productivity relationships.

Phytoplankton biomass was slightly higher in the East Basin in 2023 compared to 2022 but lower than in 2015 to 2018 and below peak biomass observed in 2019 and 2021. Nine years of monitoring continue to support the conclusion that the East Basin of Meliadine Lake is naturally more productive than other areas farther downstream. Unlike phytoplankton biomass, which hasn't shown any consistent upward or downward trend, chlorophyll-a has steadily increased in the East Basin and downstream at MEL-02. It's unclear why chlorophyll-a follows a different trend than biomass, but neither phytoplankton biomass nor chlorophyll-a were strongly correlated with phosphorus or nitrogen concentrations.

Multivariate statistical analyses indicate the phytoplankton community in the East Basin was different in terms of the biomass of different taxonomic groups compared to the phytoplankton community downstream at the mid-field area and the reference areas. The FEIS (Agnico Eagle, 2014) predicted that effluent released to the East Basin could cause a shift in the structure of the phytoplankton community, but the magnitude of the change would be minor compared to baseline conditions. Importantly, no changes were predicted to primary productivity. These predictions accurately describe current conditions for the phytoplankton community in the East Basin.

Peninsula Lakes Study

Snowpack Chemistry

The snowpack sampling program was completed in early April 2023. The purpose of this sampling program is to qualitatively determine the extent and magnitude of off-site migration of metals and other parameters of interest during the winter. The snowpack chemistry results from 2023 indicate mining activities are not a source of metals or other parameters of interest to the snowpack north of the Mine or near Waste Rock Storage Facility 3 compared to the chemistry results at the background station. Off-site migration of dust is detected in the snowpack north of Lake A8. However, dust management practices that were implemented to control off-site migration of dust in 2021 have resulted in lower concentrations for all parameters of interest in snowpack samples collected from the Lake A8 monitoring station in 2021, 2022, and 2023.

Peninsula Lakes Water Quality

Water quality monitoring was completed at three replicate stations in each of the Peninsula Lakes in July and August. Lake A8 and Lake B7 are located next to major infrastructure; Lake A8 is located south of Tiriganiaq Pit 1 and 2 and Lake B7 is located west of the Tailings Storage Facility (TSF). Lake D7 is located west of Lake B7. Water quality data from Lake D7 provides information on the spatial extent of potential mining-related effects from dust, emissions, and alterations to the landscape and hydrology caused by construction of the Mine.

Water quality has changed in both Lake A8 and Lake B7 coinciding with construction and operations. The Changes in water quality are evident when comparing the concentrations of sulphate and arsenic in Lakes A8 and B7 with concentrations in Lake D7. No exceedances of AEMP Action Levels were reported for Lake A8 in 2023, but arsenic concentrations exceeded the AEMP Action Level (18.8 µg/L) in all three samples from Lake B7 in August. Follow-up monitoring was completed in October, and concentrations had decreased by roughly 50 %, from 20 µg/L to 10 µg/L. Arsenic concentrations likely decreased between August and October due to co-precipitation with iron. These data suggest that sediments are likely a sink for arsenic in the fall, but potentially a source of arsenic in the spring when ice comes off the lakes.

There is no evidence that mining activities have caused changes in water quality in Lake D7. Some parameters have increased compared to baseline, but the underlying cause is likely interannual climate variability.

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USE & LIMITATIONS OF THIS REPORT

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

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

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ACRONYMS & GLOSSARY OF TERMS

Acronym / Term	Definition
AEMP	Aquatic Effects Monitoring Program is the primary instrument for determining if the mine is causing changes in the aquatic environment.
AEMP Benchmark	The AEMP Benchmarks are screening guidelines that are protective of aquatic life and human drinking water quality for the project.
AEMP Action Level	The AEMP Action Level is an early warning trigger equal to 75% of the AEMP Benchmark.
ANOVA	Analysis of Variance
AWAR	All-weather Access Road connecting the mine site to Rankin Inlet.
Biomass	Biomass is the amount or weight of phytoplankton in per unit of water (µg/L).
Blanks (for quality control)	TB = Travel blanks are analyzed to assess cross contamination occurring during the transport of samples. These samples comprise analyte-free deionized water prepared in the lab by ALS, and travel to the site and back to the lab without being opened. DB = Deionized blanks (or field blanks) are analyzed to verify the “analyte-free” status of the deionized water to help interpret the equipment blank results. These samples are comprised of deionized water poured directly into the sampling containers. EB= Equipment blanks are analyzed to assess cross contamination in the sampling equipment that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free deionized water passed through the sampling equipment.
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
CIRNAC	Crown Indigenous Relations and Northern Affairs Canada
CP	Containment pond / collection pond / control pond: Pond constructed for the collection and temporary storage of surface contact water that is eventually treated and discharged to Meliadine Lake.
DL	Detection limit
DO	Dissolved oxygen
DOC	Dissolved organic carbon: a measure of the amount of organic matter present in water that passes through a 0.45 µm filter.

Acronym / Term	Definition
DQO	Data quality objective: are statements that define the degree of confidence in conclusions from data produced from a sampling program.
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring is a science-based monitoring program developed by Environment and Climate Change Canada. EEM describes monitoring that mining companies must undertake to detect and measure changes in aquatic ecosystems (i.e., receiving environments).
EWTP	Effluent Water Treatment Plant treats surface contact water from Collection Pond 1 (CP1) to lower TSS prior to discharge to Meliadine Lake.
FEIS	Final Environmental Impact Statement
FEQG	Federal Environmental Quality Guidelines are water quality guidelines developed by Environment and Climate Change Canada.
IQ	Inuit Qaujimaningit and Inuit Qaujimajatuqangit: -> Inuit Qaujimaningit encompasses Inuit traditional knowledge (and variations thereof or Inuit Qaujimajatuqangit), local and community-based knowledge, as well as Inuit epistemology as it relates to Inuit Societal Values and Inuit Knowledge. -> Inuit Qaujimajatuqangit are the guiding principles of Inuit social values (NIRB 2018).
KivIA	Kivalliq Inuit Association
MDMER	Metal and Diamond Mining Effluent Regulations
MF	Mid-field area in Meliadine Lake (MEL-02)
NF	Near-field in Meliadine Lake (MEL-01)
nMDS	Non-Metric Multidimensional Scaling: a multivariate statistical method used to condense information with multiple variables into a two-dimensional representation of the data. Used here to visually assess differences in benthic invertebrate community structure over space.
NIRB	Nunavut Impact Review Board: The government agency responsible for reviewing and assessing the potential ecosystemic and socio-economic effects of the Meliadine Gold mine Project presented in the Final Environmental Impact Statement.
Normal Range	The normal range refers to the range of baseline/reference conditions within the study area lakes. For the water quality monitoring program, the normal range is use to identify parameters that may have increased in concentration due to activities at the mine.

Acronym / Term	Definition
NWB	Nunavut Water Board: The government agency responsible for regulating water use and management in the Nunavut Settlement Area. Terms and Conditions regarding water use for the Meliadine Gold Project are outlined in Water Licence No: 2AM-MEL1631.
Overburden	Overburden is soil and till that need to be removed prior to developing the open pits.
Parameters	The term used to describe what gets measured in samples of surface water, sediment, and fish tissue collected in the various monitoring programs. Calcium, magnesium, iron, and aluminum are examples of parameters.
Phytoplankton	Phytoplankton are a diverse group of aquatic plant species (algae) that form the base of the food web in Meliadine Lake. Like other plants, they use sunlight, nutrients, and carbon sources to grow.
QA/QC	Quality Assurance are the practices employed (e.g., use of experienced field staff, standard operating procedures (SOPs), field data sheets, and certified laboratories) to collect scientifically defensible samples meeting pre-defined data quality objectives (DQOs). Quality control (QC) refers to samples that are used to evaluate whether field sampling methods and laboratory analytical procedures are producing data that meet DQOs.
REF	Reference areas in Meliadine Lake (MEL-03, MEL-04, and MEL-05)
Safe drinking water	In the context of the AEMP, water is considered safe for drinking if measured concentrations of parameters are below guidelines published by Health Canada.
Significance threshold	Significance thresholds are narrative statements that represent attributes of the aquatic environment that must be preserved as the Project develops.
Species richness	Species richness refers to the number of different (distinct) species in a sample. Use to describe the diversity of the phytoplankton and benthic invertebrate communities in Meliadine Lake.
SSWQO	Site-specific water quality objectives are guidelines developed specifically for the lakes around Meliadine that take into consideration background water quality in the region. SSWQOs were developed for fluoride, arsenic, and iron as part of the AEMP (Golder, 2014).
Surface contact water	Runoff from rain and snow melt that is collected on site. This water is collected, treated, and discharged to Meliadine Lake.
Tailings	Residual particulate waste left over after ore is processed to extract gold
TDS	Total Dissolved Solids: the total concentration of dissolved substances in water, including inorganic salts and small organic matter (e.g., calcium, magnesium, potassium, carbonates, chlorides).
TKN	Total Kjeldahl nitrogen is the sum of organic nitrogen and total ammonia (NH_3)

Acronym / Term	Definition
TN	Total nitrogen is the sum of organic and inorganic nitrogen in water. Total nitrogen = TKN + nitrate + nitrite
TOC	Total Organic Carbon: a measure of the amount of organic matter present
TP	Total phosphorus is the sum of all forms of phosphorus in aquatic systems: inorganic phosphorus, particulate organic phosphorus, and dissolved (soluble) organic phosphorus.
TSF	Tailings Storage Facility is the engineered structure used to store and contain tailings produced during the milling of ore
TSI	Trophic Status Index: a classification system used to "rate" the biological productivity in lakes and other waterbodies.
TSS	Total Suspended Solids: the total concentration of suspended solids that are undissolved in water, including silt, clay, metals, and other organic and inorganic materials.
Waste rock	Waste rock is fragment rock with no economic value that is initially removed during development of the open pit and underground mine workings
Water Licence	The Amended Type A Water Licence (2AM-MEL1631) authorizes Agnico Eagle to use waters and deposit waste in support of mining operations at Meliadine
WRSF	Waste rock and overburden storage facilities

1 INTRODUCTION

This report presents the findings from the 2023 Aquatic Effects Monitoring Program for the Meliadine Gold Mine (the Mine). The purpose of the AEMP is to assess if activities at the Mine are causing changes in water quality and impacts to aquatic life beyond those changes that were predicted in the Final Environmental Impact Statement (FEIS; Agnico Eagle, 2014). The AEMP is required under the Type A Amended Water Licence (NWB, 2021) and has been completed annually in Meliadine Lake and the small lakes located near the Mine (collectively referred to as the 'Peninsula Lakes') since 2015. The AEMP has four main objectives:

- Determine the short- and long-term effects of the Mine on the aquatic receiving environment;
- Evaluate the accuracy of predictions made in the FEIS, including the final significance statements regarding impacts to the aquatic ecosystem;
- Assess the efficacy of planned mitigation incorporated into the Mine design; and
- Collect data to make informed decisions regarding the need for mitigation within the Management Response Framework

1.1 Background

The Meliadine Gold Mine (Mine) is in the Kivalliq District of Nunavut near the western shore of Hudson Bay, in Northern Canada (**Figure 1-1**). The Project was approved by the Nunavut Impact Review Board (NIRB) on February 26, 2015, subject to terms and conditions in Project Certificate No. 006 (NIRB, 2022) and the Type A Water Licence (2AM-MEL1631) granted by the Nunavut Water Board (NWB; April 1, 2016). An amended Type A Water Licence was issued on June 23, 2021 (referred to hereafter as the Water Licence).

Commercial gold production started in 2019 with mining of the Tiriganiaq deposit. As per the Water Licence, underground and open pit methods have been used to develop the Tiriganiaq deposit. In January 2024, Agnico Eagle submitted a water licence amendment application to the Nunavut Water Board (NWB) for the completion of mining of all deposits permitted under the Project Certificate No. 006 (NIRB, 2022), which include Wesmeg, Wesmeg North, Pump, F Zone, and Discovery deposits. The current extent of the Mine and major infrastructure on Site is shown in **Figure 1-2**. A timeline of major construction activities from 2015 to 2023 is provided in **Table 1-3**.

1.2 Study Design

The AEMP includes separate studies for Meliadine Lake and the Peninsula Lakes. An overview of the Meliadine Lake and Peninsula Lakes studies is provided below.

Meliadine Lake Study

Meliadine Lake is the final discharge point for effluent (treated surface contact water) collected at the Mine and the primary focus of the AEMP. The Meliadine Lake study was designed to detect mining-related changes and define the spatial and temporal extent of those changes. The study design includes two exposure areas (near-field [NF], mid-field [MF]) and three reference areas. The NF area (MEL-01) is located in the East Basin around the diffuser. Changes in water quality and effects to the biological communities caused by discharge of effluent to Meliadine Lake would be expected to occur at MEL-01 first. The MF area (MEL-02) is located approximately 6 km downstream from MEL-01 past the narrows that separates the east and northwest basins. Monitoring data from MEL-02 helps define the spatial extent of potential changes observed at MEL-01. Three reference areas are included in the study design to provide insights into regional trends that would be expected to influence all sampling areas. Reference Area 1 (MEL-03) is in a bay in the northwest basin of Meliadine Lake. Reference Area 2 (MEL-04) is in the northwest area of the lake near the outlet to Peter Lake. Reference Area 3 (MEL-05) is in the southwest basin near the outlet to the Meliadine River.

The current scope of the Meliadine Lake study includes monitoring water, sediment, phytoplankton, benthic invertebrates, fish health, and fish tissue chemistry. To improve efficiency and reduce redundancy, the scope of biological monitoring under the AEMP was harmonized with the Environmental Effects Monitoring (EEM) program required under the Metal and Diamond Mining Effluent Regulations. Biological monitoring studies (benthic invertebrates and fish) are conducted every 3-years. The next biological monitoring study under EEM is scheduled for August 2024.

Peninsula Lakes Study

The water quality component of the Peninsula Lakes AEMP is designed to detect changes in water quality related primarily to the deposition of aerial emissions and alteration of watersheds (i.e., changes to natural drainage paths or hydrologic balance) (Agnico Eagle, 2014). Water quality monitoring is completed at three headwater lakes near the Mine: Lake A8, Lake B7 and Lake D7 (**Figure 1-2**) in July and August. If changes in water quality are detected, follow-up investigations may be conducted to determine the significance of changes in water quality and potential impacts to aquatic life. Importantly, changes in water quality in the Peninsula Lakes area were not predicted to cause changes in water quality downstream in Meliadine Lake.

1.3 Overview of the 2023 AEMP

The scope of the 2023 AEMP was completed as per the *AEMP Design Plan* (Azimuth, 2022) and included the following components:

- Effluent quality monitoring, including monthly acute toxicity tests with Rainbow Trout and Daphnia magna, and quarterly sublethal toxicity testing with *Lemna minor*;
- Snow sampling to monitor off-site dust migration[1];
- Surface water quality monitoring at fixed locations throughout Meliadine Lake;
- Surface water quality monitoring at fixed locations in the Peninsula Lakes; and
- Phytoplankton and chlorophyll-a monitoring in Meliadine Lake (August)

An overview of the sampling design is provided in **Table 1-1**. Key questions for the water quality and phytoplankton community programs are presented in **Table 1-2**.

Table 1-1. Scope of the 2023 AEMP

Lake/Area	Water Quality Monitoring Program Limnology Profiles and Water Chemistry					Phytoplankton Community Study
	Apr	Jul	Aug	Sep	Oct	Aug
Meliadine Lake Study						
MEL-01	✓	✓	✓	✓		✓
MEL-02	✓	✓	✓	✓		✓
MEL-03	✓*	✓	✓	✓		✓
MEL-04			✓			✓
MEL-05			✓			✓
Peninsula Lakes Study						
A8		✓	✓			
B7		✓	✓		✓*	
D7		✓	✓			

Notes:
* Extra sampling was completed in 2023 beyond what is required in the AEMP Design Plan.

[1] The snow core chemistry monitoring program is not a formal component of the AEMP. Annual snow core chemistry data were incorporated into the AEMP in 2020.

Table 1-2. Key Questions for the Meliadine Lake and Peninsula Lakes Studies

Component	Key Questions
Meliadine Lake	
Water Quality	Are concentrations of key parameters in effluent less than limits specified in the Water Licence?
	Has water quality in the exposure areas changed over time, relative to reference/baseline areas?
	Is water quality consistent with predictions in the FEIS and below guidelines to protect aquatic life and human health?
Phytoplankton Community	Is the phytoplankton community affected by potential mine-related changes in water quality in Meliadine Lake?
Peninsula Lakes	
Water Quality	Is water quality consistent with predictions in the FEIS and below guidelines to protect aquatic life and human health?
	Has water quality changed over time relative to baseline conditions?

1.4 Report Structure

The 2023 AEMP report is organized into the following sections and their associated appendices.

- **Section 2** Source Characterization – this chapter presents the results off the effluent quality monitoring program and results from the snow core sampling program in 2023. Supplemental figures and tables are provided in **Appendix B**.
- **Section 3** Meliadine Lake Water Quality – this chapter discusses changes in water quality in Meliadine Lake. Supplemental figures and tables are provided in **Appendix C**.
- **Section 4** Peninsula Lakes Water Quality – this chapter discusses changes in water quality in Lake A8, Lake B7, and Lake D7. Supplemental figures and tables are provided in **Appendix D**.
- **Section 5** Phytoplankton Community – this chapter presents the results of the 2023 phytoplankton community monitoring program and long-term trends in primary productivity in Meliadine Lake. Supplemental figures and tables are provided in **Appendix E**.
- **Section 6** Response Framework and Action Level Assessment
- Quality assurance and quality control methods and results are provided in **Appendix A**

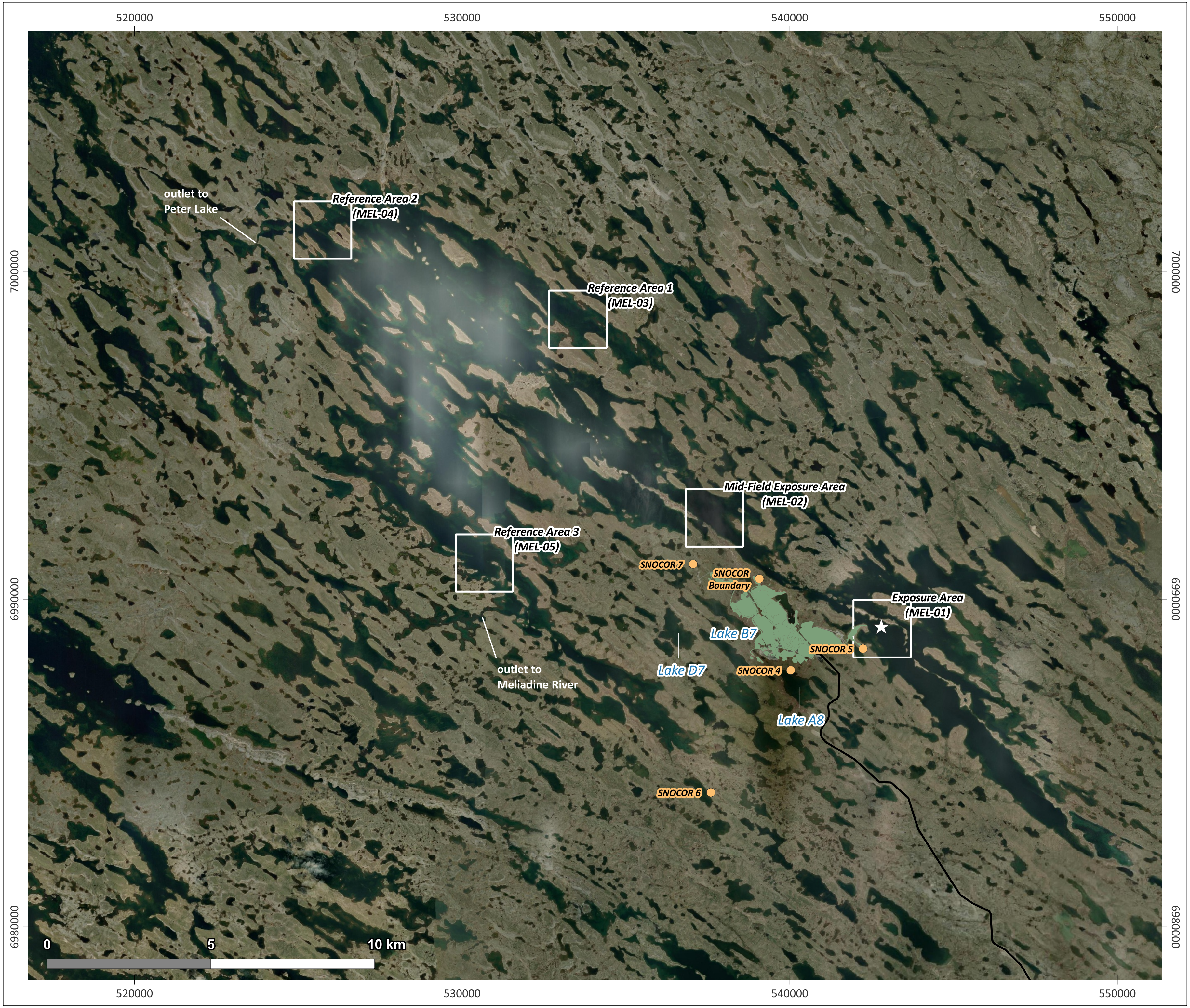


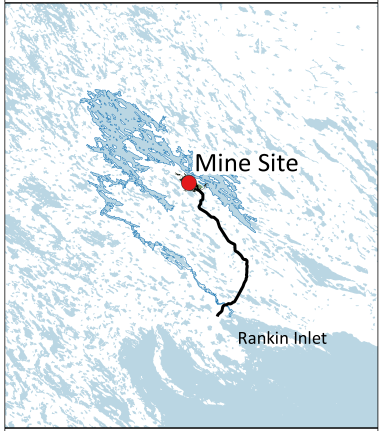
Figure 1-1
Study Area for the Aquatic Effects Monitoring Program

Aquatic Effects Monitoring Program
2023 Annual Report

AZIMUTH

Date:	March 10, 2023
Datum:	NAD 83 UTM Zone 15N
Scale:	1:150,000
Software:	QGIS version 3.22.11-Białowieża
Produced by:	E. Franz

REFERENCES:
1. Basemap imagery from ESRI
2. Mine Plan provided by Agnico Eagle
3. Roads and waterbodies from NRC



Legend

- CP1 Diffuser
- All weather access road
- Meliadine Mine (2022)
- Snowpack Monitoring Station

Figure 1-2. Meliadine Mine (2023)

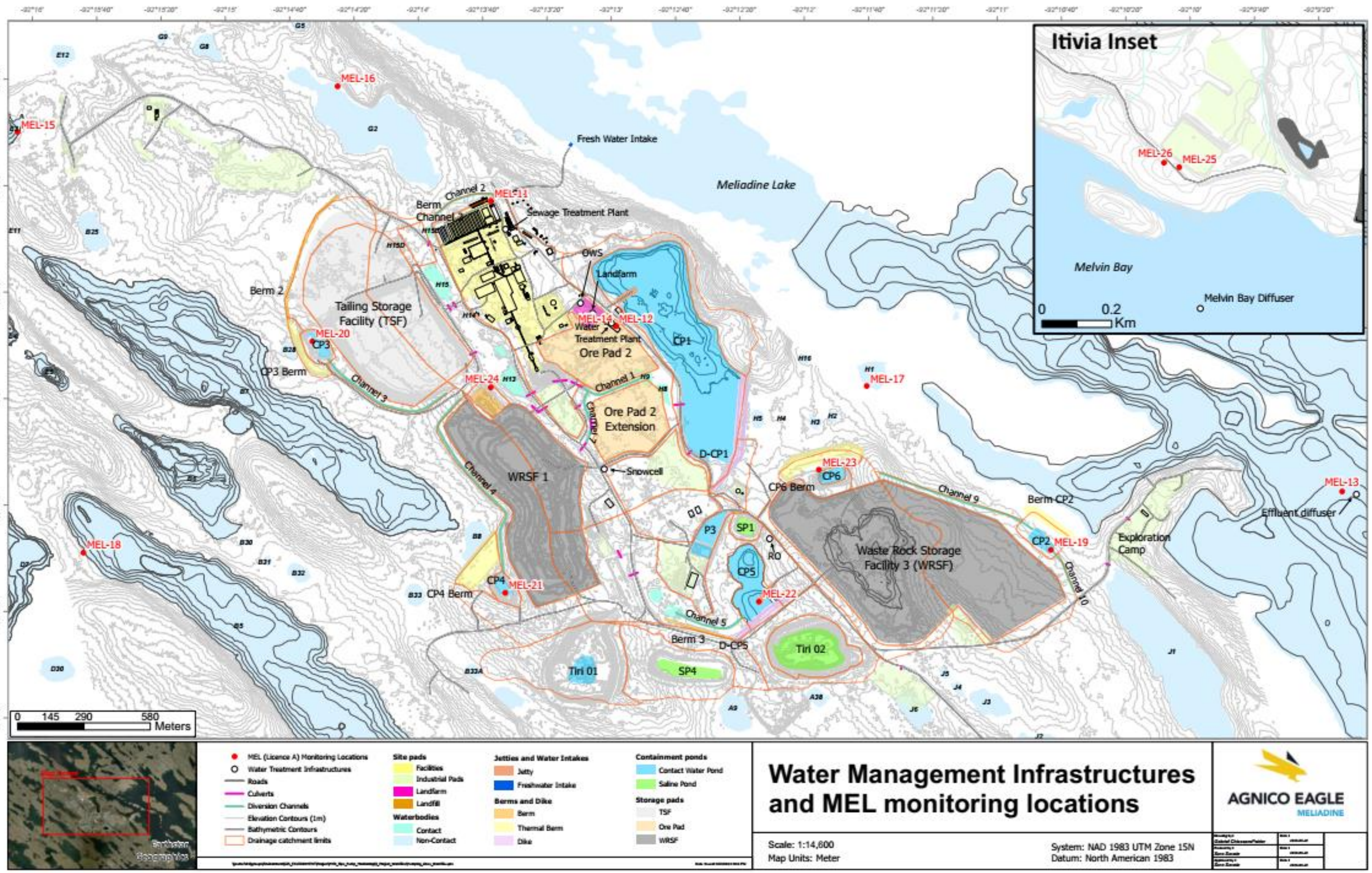


Table 1-3. Summary of Major Development Activities Since the Start of Construction in 2015

Year	Mine Development Activities and Sequence[a]
2015	• Started construction of industrial pad • Developed ramp to Tiriganiaq underground mine • Constructed portion of rock pad for stockpiles to store ore from Tiriganiaq underground ramp development
2016	• Continued construction of industrial pad • Constructed and operated the temporary landfill • Started temporary storage of waste rock in the future WRSF2 footprint for construction purposes • **Continuous dewatering of Lake H17 between August 21 and October 1 via a temporary diffuser located between MEL-01 and MEL-02 study areas (Golder, 2017)**
2017	• Constructed and utilized Type A landfarm • Constructed and began operation of Type A landfill • Erected and closed all main buildings except crusher, paste plant, and crushed ore storage • Erected incinerator • Erected and operated effluent water treatment plant (EWTP) • Installed fuel tanks 3 ML and 250 kL at Portal1 • Erected fuel tank 13.5 ML in Rankin Inlet • **Discharge from CP1 planned for September to October 2017 did not occur due to exceedance of the maximum average concentration (MAC) for TDS of 1,400 mg/L** • **Sewage effluent from the exploration camp STP transported to main camp STP for treatment beginning in November (Golder, 2019)**
2018	• Started construction of Ore Storage Pad 2 (OP2) • Erected and closed crusher, paste plant, and crushed ore storage buildings • Erected fuel tank 20 ML in Rankin Inlet • Erected fuel tanks 6 ML and 250 kL at industrial pad • Started process commissioning at end of Q4 • **Discharge of treated surface contact water from CP1 from June 21 to September 3**
2019	• Completed industrial pad • Completed construction of OP2 • Started to place filtered tailings in Cell 1 of TSF at end of Q1 • Started full capacity ore processing early Q2 • Created temporary waste rock storage area within footprint of Tiriganiaq Pit 2 from construction of Saline Pond 2 (SP2) • Began placement of waste materials from Saline Pond 4 (SP4) in WRSF1 • **Discharge of treated surface contact water from CP1 from July 9 to October 5**
2020	• Place waste rock from temporary storage within footprint of Tiriganiaq Pit 2 to construct haul roads for open pits and to WRSFs • Create temporary waste rock storage area between footprints of Tiriganiaq Pits 1 and 2 from construction of SP4 • Start to mine Tiriganiaq Pit 2 • Begin placement of waste materials from Tiriganiaq Pit 2 within WRSF3 • **Discharge of treated surface contact water from CP1 from June 5 to October 4**
2021	• Start to mine Tiriganiaq Pit 1 • Begin placement of waste rock and overburden from Tiriganiaq Pit 1 in WRSF1 • Continue placement of waste rock and overburden from Tiriganiaq Pit 2 in WRSF1 • Pause mining of Tiriganiaq Pit 2 • **Discharge of treated surface contact water from CP1 between July 13 and October 16**

Year	Mine Development Activities and Sequence[a]
2022	• Continue placement of Waste Rock and Overburden from Tiriganiaq Pit 1 in WRSF1 • Begin placement of overburden from Tiriganiaq Pit 1 in WRSF3 • Start Construction of OP2 Stage 2 • Construction of CP2 and associated CP2 Berm, Channels 9 and 10, east of WRSF3 • Continue mining of Tiriganiaq Pit 1 • **Discharge of treated surface contact water from CP1 from July 1 to August 2 and August 23 to September 25**
2023	• Continue placement of Waste Rock and Overburden from Tiriganiaq Pit 1 in WRSF1 • Continue placement of overburden from Tiriganiaq Pit 1 in WRSF3 • Continue mining of Tiriganiaq Pit 1 • Construction of the Channel 2 Berm • Rehabilitation of different infrastructures on site: Channel 3 reconstruction, Channel 5 maintenance, CP6 ramp extension, thermal fill placement at CP2, CP3, CP4 and between the TSF and Channel 3 • Construction of the Operations Landfill (Stage 4) Berm Raise • Construction of the waterline for discharge to sea (commenced in 2023) • **Discharge of treated surface contact water from CP1 from June 10 to July 18, August 21 to August 25, August 29 to September 6, September 11, September 16 to September 30**

Notes:

Key water management activities are **bolded**.

[a] This table was adapted from the Mine Waste Management Plan (Agnico Eagle 2020).

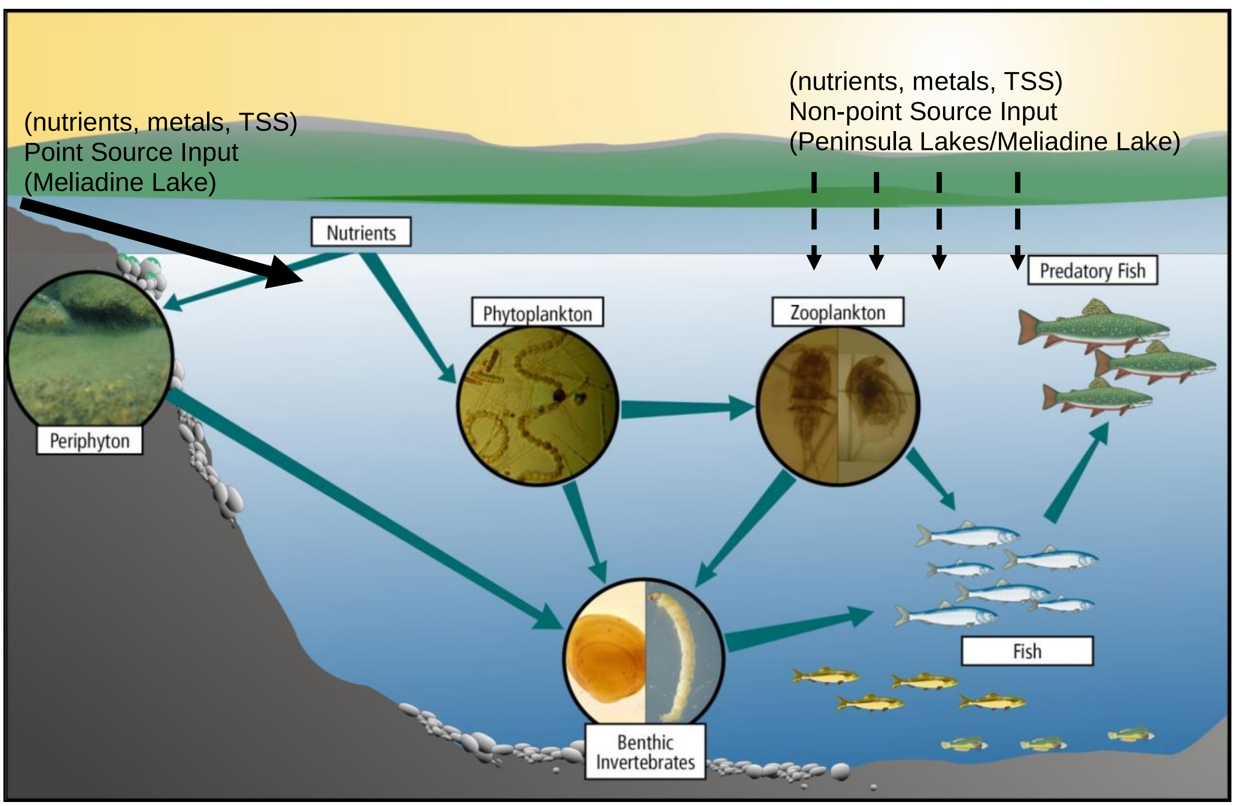
2 SOURCE CHARACTERIZATION

This section summarizes the current understanding of how mining operations may impact water quality in Meliadine Lake and the Peninsula Lakes. Mining operations have the potential to affect water quality in the aquatic receiving environment through discharge of treated effluent, accidental spills, altered hydrology due to construction activities, and aerial emissions and dust deposition (**Figure 2-1**). For Meliadine Lake, the main source of potential mining-related effects to water quality is the discharge of treated surface contact water. The compliance monitoring station (Final Discharge Point) is MEL-14, and water sampling is completed weekly for chemistry, monthly for acute toxicity testing, and quarterly for sublethal toxicity testing. Discharge volumes and chemistry results are used to calculate monthly and annual loadings. These results are used to help determine if spatial and temporal changes in water quality in Meliadine Lake are plausibly linked to the discharge of treated surface contact water.

Water quality in the Peninsula Lakes is potentially impacted by the cumulative effects of alterations to hydrology and flow, dust deposition, and aerial emissions. The effect of dust and aerial emissions are assessed using chemistry data from the snow core monitoring program that is completed in late winter.

Figure 2-1. Depiction of point source and non-point source inputs to the aquatic environment

Note: This figure was adapted from Version 1 of the *AEMP Design Plan* (Golder, 2016).



2.1 Findings from the 2023 Effluent Quality and Snow Chemistry Programs

- There were no exceedances of the effluent quality limits in the effluent samples from MEL-14. TDS concentrations were less than ½ of the maximum authorized concentration in grab sample (4,500 mg/L).
- Water discharged to Meliadine Lake was not acutely toxic to Rainbow Trout or the aquatic invertebrate *Daphnia magna*.
- There were no effects to *Lemna minor* frond yield or biomass in the two sublethal toxicity tests (June and August).
- Concentrations of metals and other parameters in the snow core samples collected from north and east of the Mine were within the range of background concentrations in 2023. As in previous years, some parameters were elevated in the snow core sample collected at the monitoring station north of Lake A8 (SNOCOR4) compared to background. Higher concentrations of metals and other parameters in this area are not surprising given the station is down wind from the TSF and Tiriganiaq Pits 1 and 2. Snow pack chemistry results at SNOCOR4 in 2023 were below the peak observed in April 2020, indicating that efforts to mitigate off-site migration of dust have been effective at reducing loadings of metals and other parameters downwind from the Mine.

2.2 Temperature and Precipitation Patterns in the Region

The AEMP is designed to assess if activities at the Mine are causing changes in water quality that may affect aquatic life. As part of the assessment, it is important to understand if there are other process/sources have the potential to contribute to temporal changes in water quality. Other than the Mine, there are no significant anthropogenic sources that have the potential to cause detectable changes in water quality in Meliadine Lake or the Peninsula Lakes. Water quality can, however, respond to changes associated with short-term weather patterns and long-term trends associated with climate variability. The effect of climate change on northern latitude lakes is well-documented, but the underlying processes are complex and difficult to quantify without highly complex models. The effect of climate change on water quality in Meliadine Lake is beyond the scope of the AEMP. However, precipitation and temperature data are qualitatively evaluated to help interpret the timing of some of the temporal trends in water quality observed in Meliadine Lake.

Some high-level observations about recent climate trends that have the potential to affect water quality in Meliadine Lake are provided below based on temperature and precipitation data provided by Agnico Eagle[2]. Tabulated monthly mean temperature and precipitation data are provided in **Table 2-1**. Total

[2] From 1981 through 2014, weather data came from the airport in Rankin Inlet. Starting in 2015, weather data was collected at the Mine.

annual precipitation (rain and snow combined) from 1981 to 2023 is shown in **Figure 2-2** and total rainfall is shown in **Figure 2-4**. Cumulative annual rainfall for 2013 to 2023 is shown in **Figure 2-4**.

- There has been a general warming trend since 2013 compared to historical climate data from 1981 to 2012. The annual temperature in 2023 was -7.8 °C, over 2.5 °C warmer than 1981 to 2012 and 2 °C warmer than the annual mean from 2013 to 2023.
- May 2023 stands out as a particularly warm month compared to historical and recent records. The average temperature in May 2023 was 0.2 °C, approximately 6 °C warmer than normal for May. Higher temperatures in May led to an earlier than normal freshet in the region. Based on aerial photos, the East Basin of Meliadine Lake was ice free by June 14.
- Precipitation patterns fluctuate from year-to-year, but the amount of precipitation has become more variable and extreme in recent years. 2023 and 2022 were the driest years since 1981 and 2016 was the third driest year going back to 1981 (**Figure 2-2**). From January through April 2023, less than 10 mm of precipitation (snow) fell on Site. June was a particularly wet month, but less rain fell in July and August, which contributed low runoff diverted to CP1.
- 2019 was the wettest year since 1981. Approximately 673 mm of rain and snow fell at the Mine, and of that total, 450 mm fell as rain from June 1 to September 30 (**Figure 2-4**). The rainfall total from July and August 2019 (300 mm) was nearly twice the amount of precipitation measured throughout 2023. The large amount of rain would have led to higher runoff from the tundra.
- The large amount of rain in 2019 caused strain on water management infrastructure, which ultimately led to Agnico Eagle applying for (and being granted) an Emergency Authorization to discharge treated water from CP1 to Meliadine Lake that had TDS concentrations greater than 1,400 mg/L. The drawdown of water from CP1 corresponds to the relatively large volume of water that was discharged to Meliadine Lake in June and July 2020 (**Figure 2-5**).

Quantifying the cumulative effect of regional climate variability on changes in water quality in Meliadine Lake is beyond the scope of the AEMP. Instead, the preceding summary is meant to demonstrate that variable (and extreme) precipitation patterns and an overall warming trend are occurring in the region. Warming patterns and changes in precipitation are implicated in changes in water quality for northern latitude lakes (Huser et al., 2020; Prowse et al., 2006).

Table 2-1. Average monthly temperature and precipitation data from 2013 to 2023 compared to data from 1981-2012

Year	Monthly Average Temperature (°C) from 2013 to 2023												Average (°C)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2013	-33.9	-30.4	-19.1	-16.8	-7.3	5.3	11.4	10.2	3.3	-4.2	-19.6	-29.4	-11.0
2014	-29.9	-29.1	-27.0	-17.2	-1.7	6.5	12.6	10.1	2.6	-3.6	-19.6	-22.8	-9.8
2015	-32.5	-34.4	-27.8	-16.6	-5.4	3.5	10.4	10.0	4.9	-6.1	-15.7	-23.6	-11.0
2016	-27.1	-31.9	-25.6	-20.2	-3.6	4.9	13.5	11.0	5.8	-3.7	-10.9	-25.2	-9.3
2017	-28.1	-28.4	-26.0	-17.7	-5.0	6.5	13.0	11.3	5.3	-5.8	-16.6	-25.7	-9.7
2018	-28.8	-35.2	-21.6	-17.3	-9.4	3.6	13.0	9.7	2.2	-6.9	-21.8	-24.6	-11.3
2019	-33.7	-33.3	-24.2	-16.0	-4.4	5.5	10.5	10.0	5.3	-2.1	-16.6	-24.5	-10.2
2020	-26.6	-30.2	-25.4	-16.6	-7.7	5.4	14.0	12.3	4.4	-3.4	-19.0	-23.9	-9.7
2021	-24.4	-28.1	-24.7	-14.7	-5.2	5.2	11.2	9.7	4.9	1.2	-12.8	-23.3	-8.3
2022	-30.1	-34.4	-24.3	-16.4	-3.2	8.0	15.1	11.8	5.4	-2.3	-19.2	-23.5	-9.3
2023	-26.6	-35.9	-25.1	-14.1	0.2	7.3	13.5	12.3[a]	6.4	-0.7	-14.0	-16.4[a]	-7.8
Monthly Average (2013-2023)	-29.2	-31.9	-24.8	-16.7	-4.7	5.6	12.6	10.7	4.6	-3.4	-16.9	-24.3	-9.8
Monthly Average (1981-2012)	-30.3	-29.8	-25.0	-15.7	-5.7	4.2	10.6	9.8	3.9	-4.5	-16.9	-25.4	-10.4

Year	Cumulative Monthly Precipitation (mm) from 2013 to 2023												Annual Total (mm)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2013	1.1	22.2	22.5	24.7	92.7	10.7	32.9	19.2	92.1	41.6	7.1	12.9	380
2014	23.6	9.3	8.5	2.5	14.0	21.9	21.9	99.2	71.5	108.8	29.3	36.7	447
2015	4.9	14.9	10.4	19.7	2.5	45.5	84.4	87.1	112.3	28.2	44.1	31.0	485
2016	9.9	20.0	7.9	6.0	0.8	24.1	33.4	13.8	88.6	31.2	34.5	4.4	275
2017	6.0	13.3	10.4	8.5	15.9	19.5	55.1	10.4	25.8	95.6	42.2	11.0	314
2018	10.8	14.5	18.1	12.1	52.1	38.9	21.6	72.3	26.0	33.7	26.6	11.5	338
2019	25.5	3.3	28.5	24.9	51.2	37.3	154.5	154.7	108.8	43.7	21.1	19.6	673
2020	14.5	24.6	15.8	21.6	31.5	5.9	10.7	35.8	73.6	30.8	58.8	136.6	460
2021	11.6	4.4	22.2	31.9	9.8	21.0	65.1	83.5	47.8	59.9	11.6	6.0	375
2022	6.5	2.1	2.9	12.3	6.3	33.8	41.4	31.6	58.6	41.3	18.9	13.8	269
2023	6.9	1.0	0.8	0.0	12.3	69.4	21.8	12.2[a]	16.0	2.8	21.7	5.9[b]	171
Monthly Average (2013-2023)	11.0	11.8	13.5	14.9	26.3	29.8	49.4	56.4	65.6	47.1	28.7	26.3	381
Monthly Average (1981-2012)	16.9	15.8	22.3	31.4	30.1	33.8	46.6	60.2	50.6	57.1	39.7	24.8	429

Notes:
Precipitation data from 1981 to 2015 is from the weather station in Rankin Inlet. Precipitation data from 2015 to 2023 is from the weather station at the Meliadine Mine.
[a] the weather station was out of service for 5 days in August 2023 and 5 days in December.
[b] cumulative precipitation data for December 2023 is based on weather station data from December 1 to 8. Anomalous precipitation readings from December 9 to 31 were omitted from the cumulative precipitation calculations.

Figure 2-2. Annual precipitation (mm) from 1981-2023

Notes: Precipitation data from 1981 to 2015 is from the weather station in Rankin Inlet. Precipitation data from 2015 to 2023 is from the weather station at the Meliadine Mine.
The white number corresponds to the annual rank (i.e., rainfall in 2023 was the lowest since 1981).

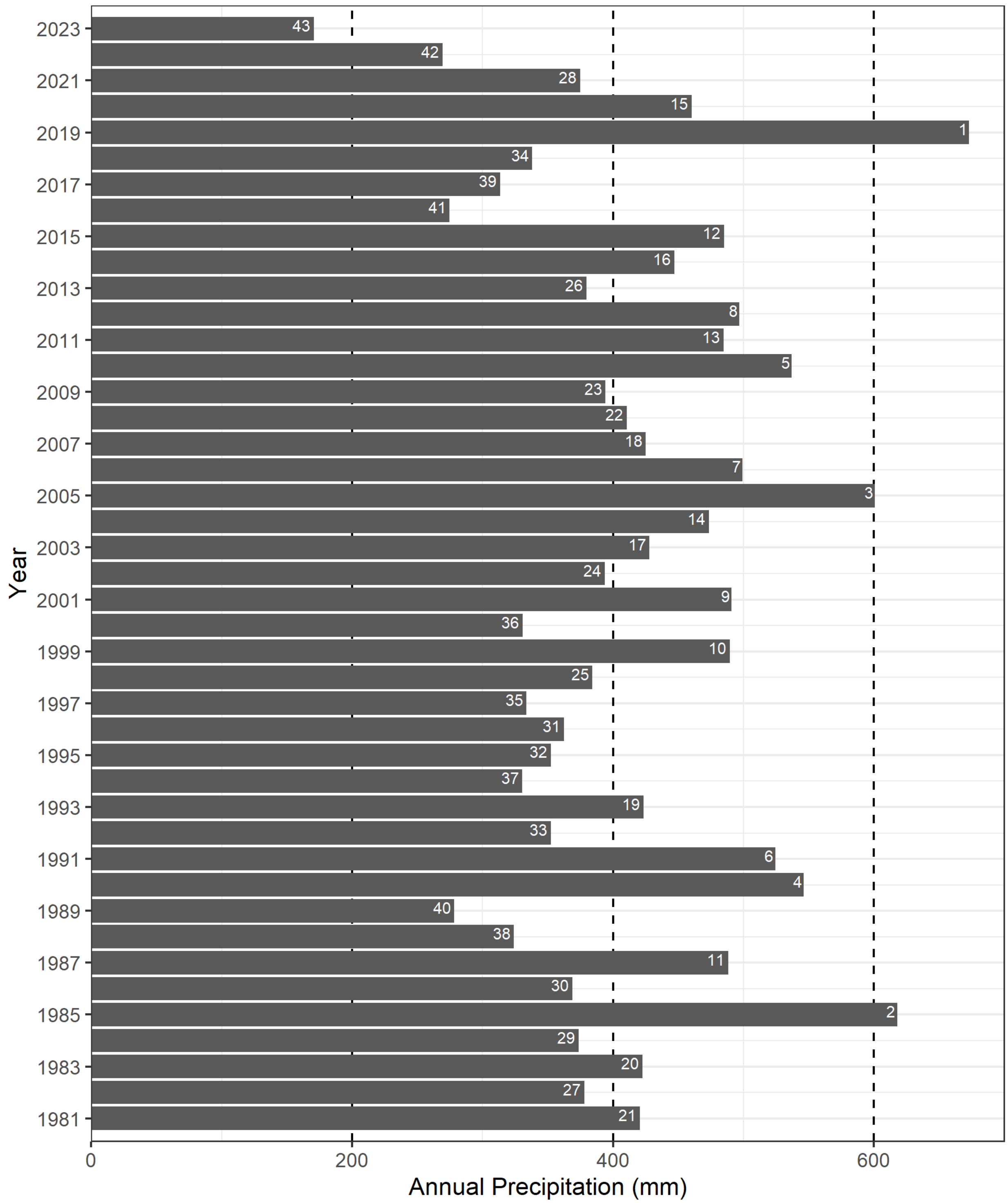


Figure 2-3. Annual rainfall (mm) from 1981-2023

Notes: Precipitation data from 1981 to 2015 is from the weather station in Rankin Inlet. Precipitation data from 2015 to 2023 is from the weather station at the Meliadine Mine.
Precipitation was classified as "rain" if the daily mean temperature was above 0 °C.
The white number corresponds to the annual rank (i.e., rainfall in 2023 was the lowest since 1981).

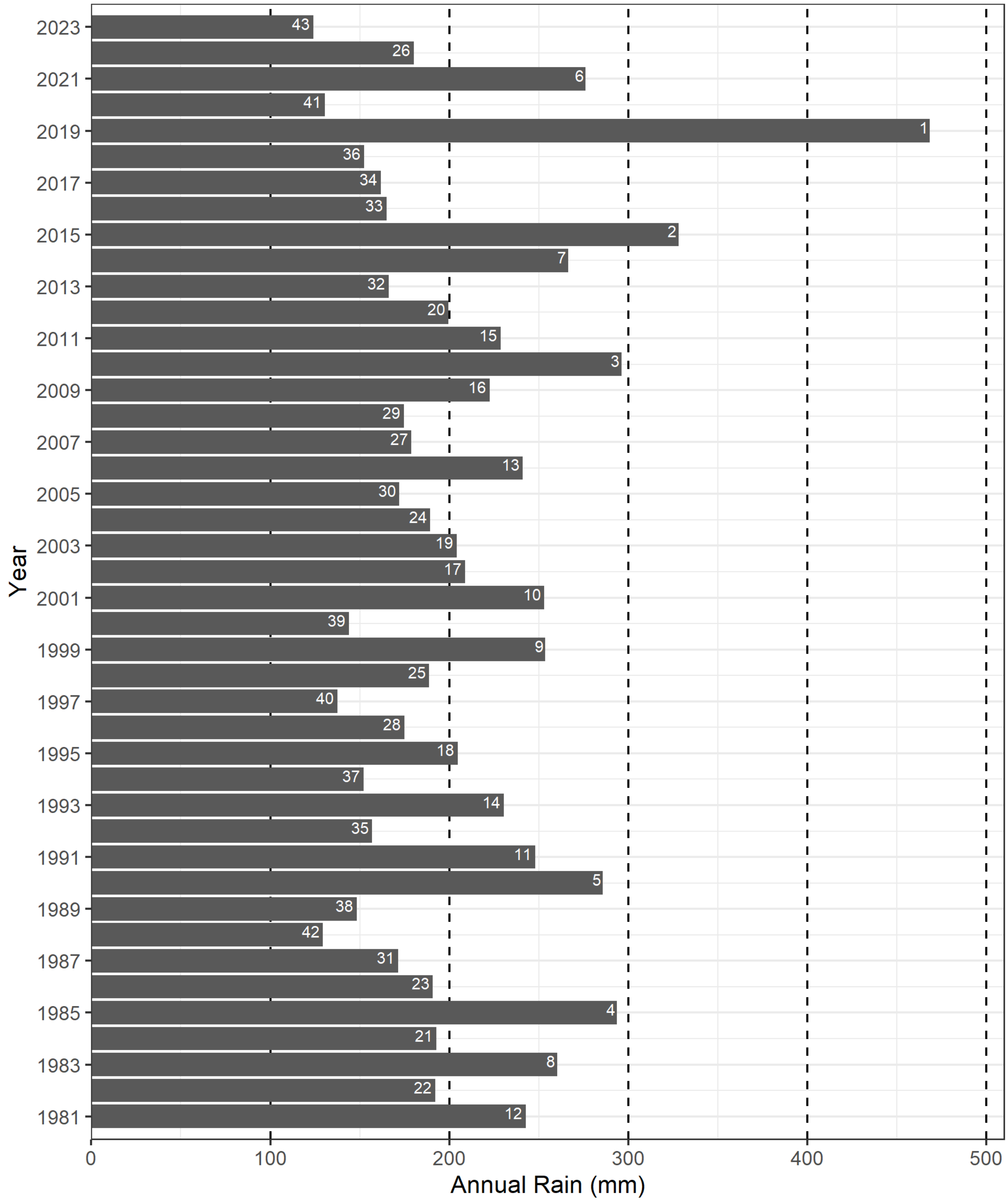
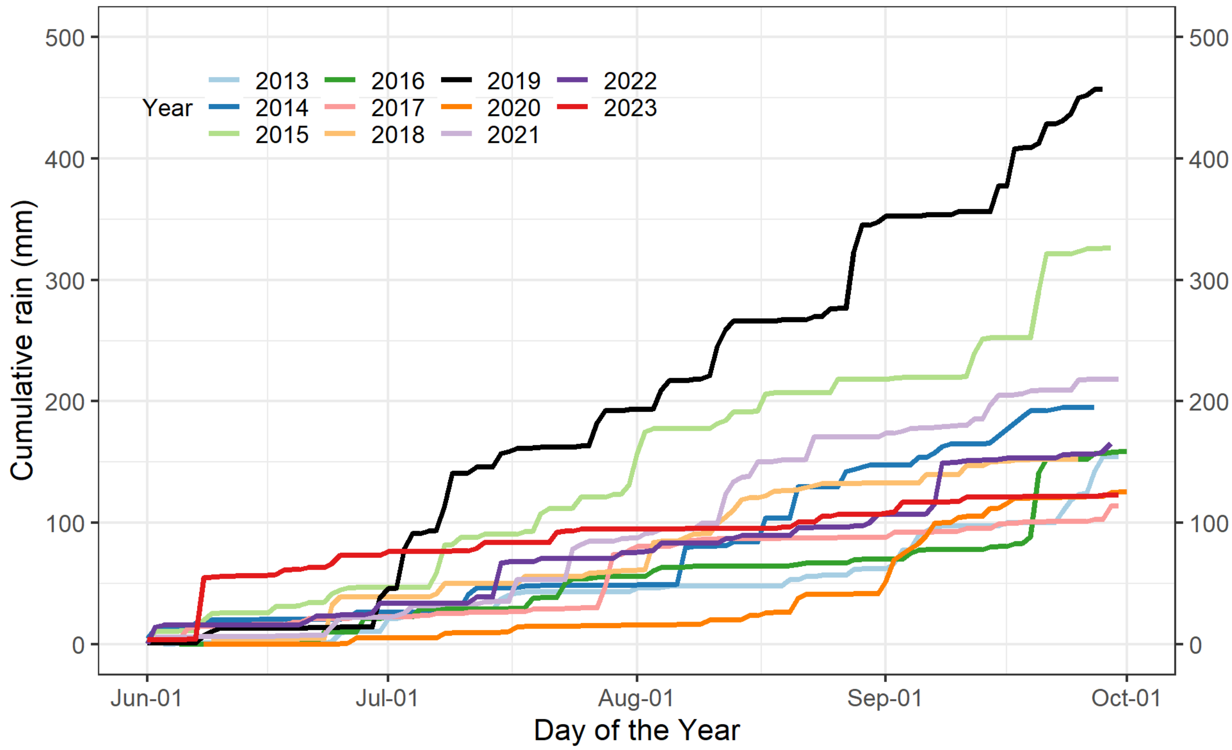


Figure 2-4. Cumulative annual precipitation as rain from 2013 to 2023

Notes: Precipitation data from 2013 to 2015 is from the weather station in Rankin Inlet. Precipitation data from 2015 to 2023 is from the weather station at the Meliadine Mine.
Precipitation was classified as “rain” in daily mean temperature was above 0 °C.



2.3 MEL-14 Effluent Monitoring Program

Meliadine Lake is the receiving environment for treated surface contact water collected at the Mine. Surface contact water refers to precipitation and runoff that occurs within the footprint of the Mine. The general strategy for managing surface contact water is to intercept water that comes in contact with infrastructure and direct it towards Collection Ponds (CPs) through a network of dikes, channels, and culverts. Six CPs are currently used to manage surface contact water collected on Site (**Table 2-2**). CP2 through CP6 are located near major infrastructure (**Figure 1-2**). Contact water from these CPs is ultimately directed toward CP1. Water in CP1 is treated at the EWTP before being discharged to Meliadine Lake. Other sources of water to CP1 include direct runoff from the CP1 catchment and treated wastewater from the Sewage Treatment Plant (STP). Water management for the CPs involves drawing down the water levels before freeze-up to create capacity to store runoff during freshet.

Table 2-2. Surface Contact Water Management Plan.

Source	Closest Collection Pond (CP)
Industrial Site Pad, Ore Storage Pad 2, Landfill	CP1
Waste rock storage facility 1 (WRSF1)	CP1, CP4, CP5
Waste rock storage facility 3 (WRSF3)	CP2 and CP6
Tiriganiaq Pit 1	Salinity based: CP4/CP5, SP1, or Tiriganiaq Pit 2
Tailings Storage Facility (TSF)	CP1 and CP3

2.3.1 Discharge from CP1 to Meliadine Lake

The volume of water (m^3) discharged from CP1 to Meliadine Lake since 2018 is shown in **Figure 2-5**. Monthly discharge volumes to Meliadine through the permanent diffuser from 2018 through 2023 are presented in **Table 2-3**.

Approximately 529,600 m^3 of treated contact water was discharged to Meliadine Lake in 2023. Freshet was early in 2023, and the Mine started discharging water to Meliadine Lake on June 10. From June 10 to June 26, approximately 191,000 m^3 of treated water was discharged to Meliadine Lake. The daily flow rate was reduced to between 4,000 and 5,000 m^3 from June 27 to July 16. The operating level in CP1 was reached on July 19 and discharge was suspended for approximately one month (until August 20). The rate of discharge increased in September to draw down the water level in CP1 before freeze-up as per the Water Management Plan.

Figure 2-5. Daily Discharge (m^3) from CP1 to Meliadine Lake, 2018-2023

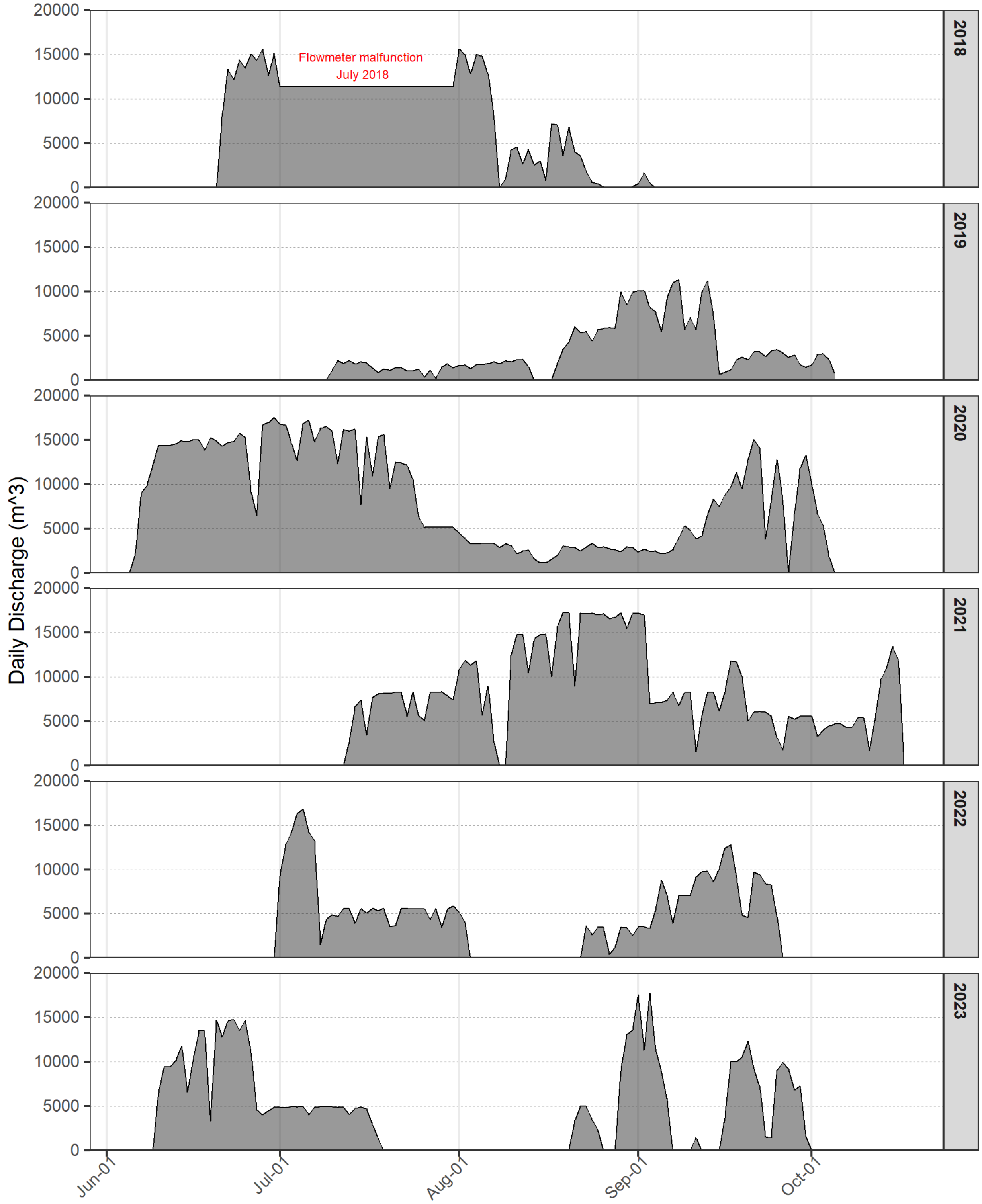


Table 2-3. Monthly discharge (m³) from CP1 to Meliadine Lake, 2018-2023

Month	2018		2019		2020		2021		2022		2023	
	Days	Discharge (m³)	Days	Discharge (m³)	Days	Discharge (m³)	Days	Discharge (m³)	Days	Discharge (m³)	Days	Discharge (m³)
June	10	134,272	0	0	26	352,954	0	0	0	0	21	209,024
July	na*	352,551	24	30,614	31	366,094	19	133,439	31	214,709	18	81,119
August	26	153,066	31	107,540	31	83,454	29	397,398	11	33,585	8	54,894
September	3	2,632	30	157,912	30	214,845	30	221,210	25	188,337	22	184,508
October	0	0	5	10,707	3	13,829	16	99,079	0	0	0	0
Totals	*70*	*642,521*	*89*	*306,773*	*121*	*1,031,179*	*94*	*851,126*	*67*	*436,631*	***67***	***529,545***

Notes:
* No daily discharge date for July 2018 because of a malfunction with the flow meter.

2.3.2 Effluent Chemistry at MEL-14

Effluent monitoring at the Final Discharge Point (MEL-14) is required under the MDMER and the Water Licence. The purpose of the effluent monitoring program is to ensure that water discharged to Meliadine Lake is safe for aquatic life. The conditions regarding disposal of contact water from CP1 to Meliadine Lake are outlined in Part F of the Water Licence:

- Effluent quality limits are not exceeded for parameters listed in **Table 2-4**, and
- Water from MEL-14 is not acutely lethal to Rainbow Trout as per the Environment Canada's Biological Test Method (EPS/1/RM/13).

Table 2-4 MEL-14 effluent limits in the Type A Amended Water Licence (2AM-MEL1631).

Parameter	Units	Maximum Average Concentration	Maximum Concentration in a Grab Sample
pH [a]	-	6.0 | 9.5	6.0 | 9.5
Total Dissolved Solids (calculated) [b]	mg/L	3,500	4,500
Total Suspended Solids [a]	mg/L	15	30
Total Phosphorus [c]	mg/L	2	4
Total Ammonia [c]	mg/L	14	18
Aluminum [c]	mg/L	2	3
Arsenic	mg/L	0.3	0.6
Copper [d]	mg/L	0.2	0.4
Nickel [a]	mg/L	0.5	1
Lead [a]	mg/L	0.1	0.2
Zinc [d]	mg/L	0.4	0.8
Total Cyanide	mg/L	0.5	1
Total Petroleum Hydrocarbons [c]	mg/L	5	5

Notes:
All concentrations are total values (i.e., unfiltered).
[a] Adopted from Metal and Diamond Mining Effluent Regulations (Government of Canada, 2022).
[b] The limit for TDS increased in 2020 as per the Amendment of the Water Licence (NWB, 2020).
[c] Not a parameter included in MDMER Schedule 4 (authorized limits of deleterious substances).
[d] Limit for the Water Licence is lower than authorized limits in MDMER.

Effluent samples were collected weekly from MEL-14 during discharge and submitted to the accredited laboratory Bureau Veritas (Nepean, ON) for analysis. Thirteen (13) weekly sampling events were completed in 2023: four in June, three in July, one in August, and five in September. Chemistry results for individual samples are provided in **Table 2-5**. The concentrations of key parameters are shown in **Figure 2-6** (TDS and constituent ions), **Figure 2-7** (nutrients), and **Figure 2-8** (metals). Summary statistics are provided in **Appendix B1**.

The key findings from the 2023 effluent chemistry data are summarized below:

- No exceedances of effluent limits were reported in 2023 (**Table 2-5**). The Water Management Plan has been effective at keeping TDS concentrations in surface contact water well below the maximum authorized concentration in a grab sample of 4,500 mg/L for calculated TDS.
- Total dissolved solids (TDS) concentrations were lowest in June (730 to 880 mg/L) and trended higher throughout the summer to a maximum of 2,270 mg/L in September (**Table 2-6**). The seasonal pattern of lower TDS during freshet and higher concentrations of TDS in the fall has been observed annually since 2020.
- Chloride is the dominant major ion in surface contact water collected at the Mine. In 2023, chloride comprised between 35 and 45 % of TDS (Table 2-6, **Figure 2-6**). Chloride remains below the 60% threshold that would trigger development of a site-specific water quality objective (SSWQO) under the Adaptive Management Plan for Water Management (Agnico Eagle, 2022).
- In previous years, sodium was consistently the second most abundant major ion in treated surface contact water from MEL-14. In 2023, sulphate concentrations were approximately equal to or slightly higher than sodium in some of the samples collected in the June, July, and August (**Figure 2-9**).

2.3.3 Toxicity Testing

Acute Toxicity Testing

Water samples were collected for acute toxicity testing with Rainbow Trout (96-hr survival) and *D. magna* (48-hr survival) on June 12, July 10, August 21, and September 11. Acute toxicity testing for *D. magna* is required under MDMER and the Type A Water Licence. Acute toxicity tests were conducted at AquaTox Testing & Consulting, in Puslinch (ON) according to standard test methods in the MDMER.

The 2023 test results are presented in **Table 2-5** along with the MEL-14 chemistry results. Water from MEL-14 was not acutely toxic to Rainbow Trout or *D. magna* in the four tests conducted in 2023. These findings add to the multi-year dataset that shows effluent discharged to Meliadine Lake does not pose a direct risk to fish or invertebrate survival.

Chronic (Sublethal) Toxicity Testing

Effluent samples were collected from MEL-14 on June 12 and August 21 for quarterly sublethal toxicity testing with *L. minor* (duckweed). There were no effects to *L. minor* biomass or growth endpoints relative to the laboratory control treatment. This is the second consecutive year of no sublethal effects for effluent discharged to Meliadine Lake.

2.3.4 Loadings to Meliadine Lake

Loadings from CP1 to Meliadine Lake are calculated monthly (during discharge months) as per Part 2, Division 2, Section 20 of the MDMER (Government of Canada, 2022). Monthly loadings are calculated according to the following equation:

$$ML = \frac{(C \times V)}{1{,}000}$$

Where:

ML = monthly loading in kg,

C = monthly mean concentration of parameters measured in MEL-14 samples in mg/L, and

V = is the total monthly volume of water discharged to Meliadine Lake from CP1 in m^3.

Annual loadings for selected parameters of interest for the Meliadine Lake are shown in **Figure 2-10**. Monthly and cumulative loadings since 2018, the first year of discharge from CP1 to Meliadine Lake, are provided in **Appendix B2**. A high-level overview of the loadings information is provided below, but the results for individual parameters of interest are discussed in greater detail within the Meliadine Lake water quality chapter and, in the case of nutrients, the phytoplankton community chapter.

Annual loadings in 2023 were broadly similar to 2022 for most parameters. Since the Emergency Authorization and amendment to the Type A Water Licence in 2020, annual loadings for most parameters have remained higher compared to early discharge period (2018-2019). Parameters with noticeably higher annual loadings to Meliadine Lake in recent years include sulphate, copper, molybdenum, and uranium. Importantly, annual loadings to Meliadine Lake for all parameters are less than the peak observed in 2020.

2.4 Snow Core Monitoring Program

Snow core samples were collected on April 16, 2023 at five dustfall monitoring locations. The monitoring stations are shown in **Figure 1-2**. Station SNOCOR6 is located approximately 4.5 km southeast of Tiriganiaq Pit 1. This location is used to characterize background chemistry in the snow pack. The other four stations are located around the perimeter of the Mine. SNOCOR7 is northwest of the emulsion plant, SNOCOR Boundary is located north of the main camp, SNOCOR4 is located north of the Lake A8, and SNOCOR5 is located east of WRSF3 and south of the Exploration Camp. Off-site dust migration is most likely to be detected at SNOCOR4 given its proximity to Tiriganiaq Pits 1 and 2 and the prevailing wind direction from the northwest.

The snow samples were collected according to the standard procedure developed by the Environment Department. Snow samples were analyzed for conventional parameters, organic carbon, and total and dissolved metals at Bureau Veritas Labs (Nepean, ON).

The potential for off-site dust migration to impact water quality was assessed by comparing the snow chemistry results from the four stations close to the Mine against the background results from SNOCOR6. Off-site dust migration was qualitatively rated according to the magnitude of the difference between samples: negligible (< 2-times background); low (5 to 10-times background); moderate (10 to 20-times background), and high (> 20-times background). The snow core chemistry results are provided in **Table 2-7**. The total and dissolved concentrations of a few selected metals from 2020-2023 are shown in **Figure 2-12** and **Figure 2-13**.

Snow Pack Chemistry Results

The key findings from the 2023 snow core chemistry monitoring program are described below.

- Snow core chemistry results from SNOCOR7, SNOCOR Boundary, and SNOCOR5 in 2023 were within 2-times background (SNOCOR6). These results corroborate the results from 2021 and 2022 that showed aerial emissions and dust are not contributing to higher concentrations of metals and other parameters in the snow pack to the north or east of the Mine.
- Similar to previous years, the concentrations of several parameters at SNOCOR4 were elevated compared to background. In 2023, the following parameters were measured at concentrations greater than 20-times background: cobalt, nickel, silicon, and titanium (all unfiltered samples). Several other parameters were measured at concentrations greater than 10-times background.
- Aluminum was the only parameter where the dissolved concentration was greater than 5-times background. These results illustrate that metals are primarily associated with particulates when the snow samples melt. This is important, because dissolved metals tend to be more mobile in aquatic systems and more bioavailable for aquatic life[3].
- The chemistry results from SNOCOR4 provide a plausible explanation for the changes in water quality in Lake A8 and Lake B7 in recent years. Temporal trends for the Peninsula Lakes are discussed in **Section 4**.

[3] U.S. EPA Factsheet: https://www.epa.gov/system/files/documents/2022-01/parameter-factsheet_metals_508.pdf

Table 2-5 MEL-14 effluent chemistry results in 2023

Parameter	Units	Water Licence Limits		June				July			August	September				
		Max Grab	Monthly Mean	2023-06-12	2023-06-21	2023-06-25	2023-06-28	2023-07-03	2023-07-10	2023-07-17	2023-08-21	2023-09-03	2023-09-11	2023-09-18	2023-09-25	2023-09-27
Field Parameters																
pH (field)	pH units	6 | 9.5	6 | 9.5	7.3	7.3	6.64	7.06	7.13	7.27	7.52	6.62	7.15	7.51	8.15	7.58	7.32
Sp. Conductivity (field)	µS/cm	-	-	1451	1608	1598	1666	1842	1937	2017	2566	3163	3252	3555	3787	3829
Temperature	C	-	-	11.7	11.7	11.6	15	17.1	12	18.1	12.8	4.1	7.7	9.7	12	7.0
Conventional Parameters																
Conductivity (lab)	µS/cm	-	-	1400	1600	1600	1700	1800	2000	2100	2500	3000	3300	3500	3600	NA
Hardness (T)	mg/L	-	-	285	331	317	361	358	357	381	417	551	604	581	844	873
pH (lab)	pH units	-	-	7.31	7.6	7.52	7.44	7.51	7.69	7.8	7.3	7.42	7.86	8.15	7.61	7.59
Total Dissolved Solids	mg/L	4,500	3,500	790	945	995	1050	1160	1230	1310	1440	1880	1810	1890	2140	2270
Total Dissolved Solids (Calculated)	mg/L	-	-	730	790	830	880	910	1000	1100	1300	1500	1700	1900	2100	2100
Total Suspended Solids	mg/L	30	15	2	3	3	2	3	2	3	3	9	4	3	3	5
Major Ions and Nutrients																
Alkalinity, Total	mg/L	-	-	34	47	50	54	68	68	76	57	68	80	81	88	85
Chloride	mg/L	-	-	280	310	330	340	320	410	480	580	650	720	780	960	910
Sodium	mg/L			129	160	152	170	161	178	195	244	333	348	316	458	462
Sulphate	mg/L	-	-	150	150	160	170	180	180	190	210	250	300	310	340	330
Calcium	mg/L			79.7	90.1	86.9	98.6	101	97.9	105	111	147	160	158	226	225
Magnesium	mg/L			20.9	25.7	24.3	28	25.6	27.3	28.7	34.1	44.6	50	45.2	68.1	75.4
Potassium	mg/L			12.1	14.2	13.8	15.1	15.1	16	16.7	20.9	26.7	26.9	24.6	35.1	35.4
Ammonia (as N)	mg/L	18	14	0.33	0.16	0.14	0.23	0.41	0.24	0.19	0.16	0.68	0.65	0.43	0.28	0.23
Nitrate (as N)	mg/L	-	-	8.02	5.73	4.9	6.04	5.89	5.97	5.77	2.8	5.77	7.66	10.1	11.6	12
Total Phosphorus	mg/L	4	2	0.051	0.027	*< 0.02*	0.038	0.033	0.055	0.045	*< 0.02*	0.028	0.034	0.024	0.035	0.04
Unionized Ammonia (calculated)	mg/L	-	-	0.0017	0.00063	*< 0.00061*	0.00089	0.0022	0.0012	0.0022	*< 0.00061*	0.0014	0.0039	0.013	0.0028	0.00087
Metals (Unfiltered)																
Aluminum (T)	mg/L	3	2	0.335	0.423	0.333	0.228	0.252	0.232	0.288	0.249	0.866	0.34	0.339	0.45	0.511
Arsenic (T)	mg/L	0.6	0.3	0.00515	0.00498	0.00374	0.00383	0.00587	0.00398	0.00622	0.00467	0.00619	0.00536	0.00327	0.00582	0.00445
Cadmium (T)	mg/L	-		0.000013	0.000016	0.000014	0.000014	0.00002	0.000015	0.000017	*< 1e-05*	0.000011	0.000012	*< 2e-05*	*< 2e-05*	*< 2e-05*
Chromium (T)	mg/L	-		*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.002*	*< 0.002*	*< 0.002*
Cobalt (T)	mg/L	-		0.00111	0.00115	0.00107	0.00113	0.00109	0.00099	0.00097	0.00075	0.00104	0.00104	0.00083	0.0011	0.00109
Copper (T)	mg/L	0.4	0.2	0.00217	0.00231	0.00226	0.00233	0.00284	0.00254	0.00304	0.00245	0.00199	0.00234	0.0022	0.0024	0.0021

Table 2-5 MEL-14 effluent chemistry results in 2023

Parameter	Units	Water Licence Limits		June				July			August	September				
		Max Grab	Monthly Mean	2023-06-12	2023-06-21	2023-06-25	2023-06-28	2023-07-03	2023-07-10	2023-07-17	2023-08-21	2023-09-03	2023-09-11	2023-09-18	2023-09-25	2023-09-27
Iron (T)	mg/L	-		0.027	0.024	0.018	0.016	0.019	0.019	0.017	0.02	0.092	0.02	*< 0.02*	0.024	0.051
Lead (T)	mg/L	0.2	0.1	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 2e-04*	*< 4e-04*	*< 4e-04*	*< 4e-04*
Manganese (T)	mg/L	-		0.0279	0.0287	0.0381	0.0416	0.0555	0.0503	0.0336	0.0235	0.0725	0.0563	0.034	0.0737	0.0981
Mercury (T)	mg/L	-		*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*	*< 1e-05*
Molybdenum (T)	mg/L	-		0.0044	0.0047	0.0049	0.0056	0.0048	0.0045	0.0051	0.0059	0.0062	0.0057	0.0046	0.0061	0.0065
Nickel (T)	mg/L	1	0.5	0.0037	0.0037	0.005	0.0038	0.0042	0.0037	0.0035	0.004	0.0055	0.0062	0.005	0.0065	0.006
Selenium (T)	mg/L	-		0.00064	0.00076	0.00071	0.00077	0.00074	0.00068	0.00069	0.00046	0.0006	0.00069	0.0007	0.00092	0.00096
Thallium (T)	mg/L	-		0.000016	0.00002	0.000019	0.000023	0.000024	0.000016	0.000023	0.000017	*< 1e-05*	0.000022	0.000021	0.000022	*< 2e-05*
Uranium (T)	mg/L	-		0.00033	0.00044	0.00023	0.0002	0.0008	0.00045	0.00116	0.00048	0.00121	0.00317	0.00228	0.00385	0.00307
Zinc (T)	mg/L	0.8	0.4	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.01*	*< 0.01*	*< 0.01*
Cyanide and Radium-226																
Cyanide (Total)	mg/L	1	0.5	0.00332	0.00175	0.00071	*< 5e-04*	0.00056	0.0007	0.00095	0.00137	0.00104	0.00082	0.00083	0.00092	0.00104
Radium-226	Bq/L	-		*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	0.007	*< 0.005*	*< 0.005*	0.006	*< 0.005*	0.027	0.007
Toxicity Tests																
Rainbow trout survival	LC50	-		>100	-	-	-	-	>100	-	>100	-	>100	-	-	-
D. magna survival	LC50	-		>100	-	-	-	-	>100	-	>100	-	>100	-	-	-
L. minor biomass	IC25	-		>97	-	-	-	-	-	-	>97	-	-	-	-	-
L. minor frond number	IC25	-		>97	-	-	-	-	-	-	>97	-	-	-	-	-

Notes:
Italicized values are below the limit of detection
LC50 = the concentration that causes a 50% reduction in survival.
IC25 = the concentration that causes a 25% reduction in endpoints for the L. minor test.

Table 2-6. The fraction of total dissolved solids comprised of chloride in effluent samples from MEL-14 in 2023

Month and Day	Chloride	TDS (Measured)		TDS (Calculated)	
	mg/L	mg/L	% Cl	mg/L	% Cl
June-12	280	790	35%	730	38%
June-21	310	945	33%	790	39%
June-25	330	995	33%	830	40%
June-28	340	1,050	32%	880	39%
July-03	320	1,160	28%	910	35%
July-10	410	1,230	33%	1,000	41%
July-17	480	1,310	37%	1,100	44%
August-21	580	1,440	40%	1,300	45%
September-03	650	1,880	35%	1,500	43%
September-11	720	1,810	40%	1,700	42%
September-18	780	1,890	41%	1,900	41%
September-25	960	2,140	45%	2,100	46%
September-27	910	2,270	40%	2,100	43%

Figure 2-6. Total dissolved solids and constituent ions in end-of-pipe effluent at MEL-14, 2018-2023

Notes: Calculated TDS was added to the Amended Water Licence in 2020. The limit for TDS applies to calculated TDS. Prior to 2020, calculated TDS was not reported by the laboratory.

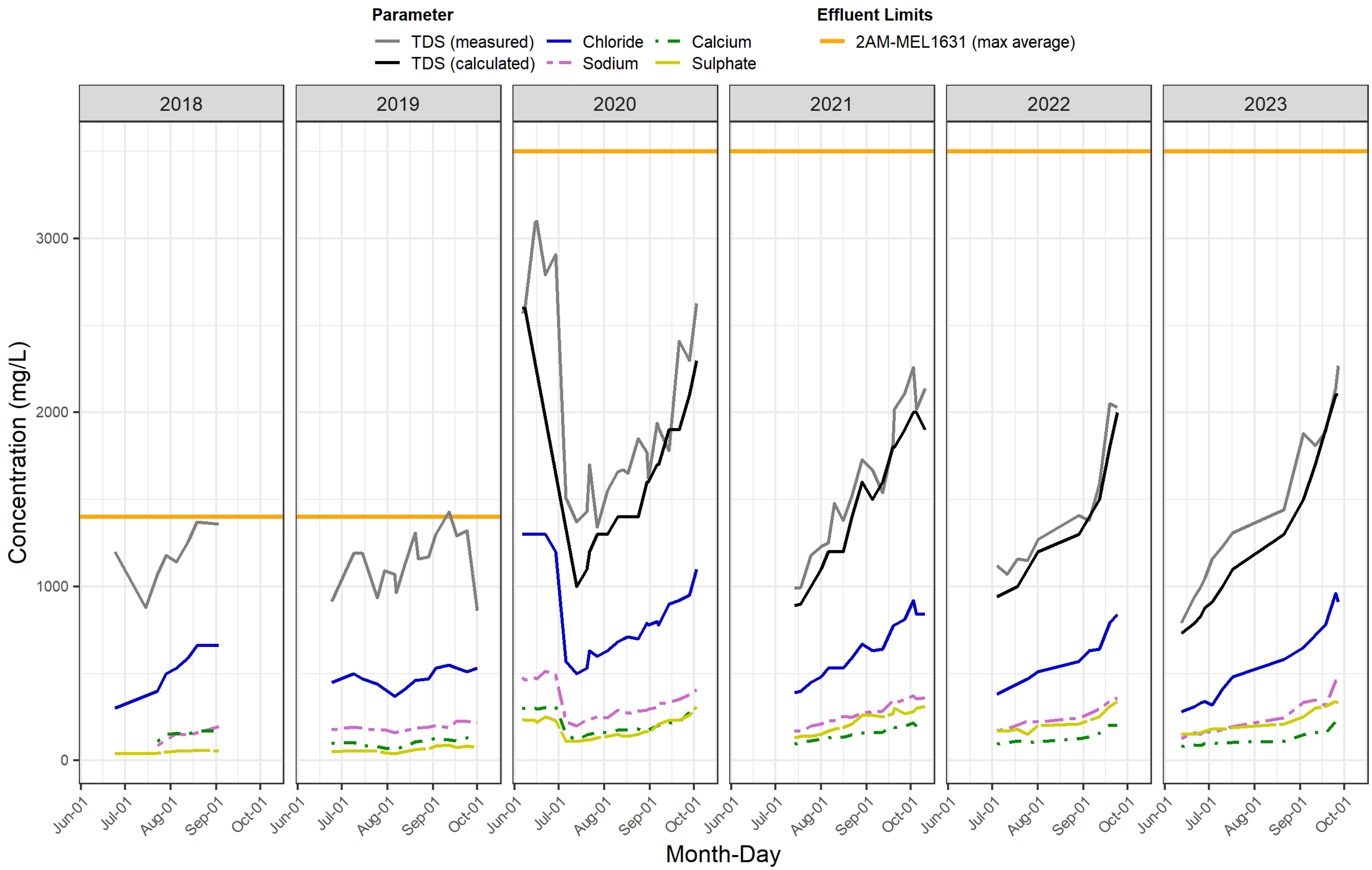


Figure 2-7. Concentrations of nutrients measured in end-of-pipe samples from MEL-14, 2018-2023

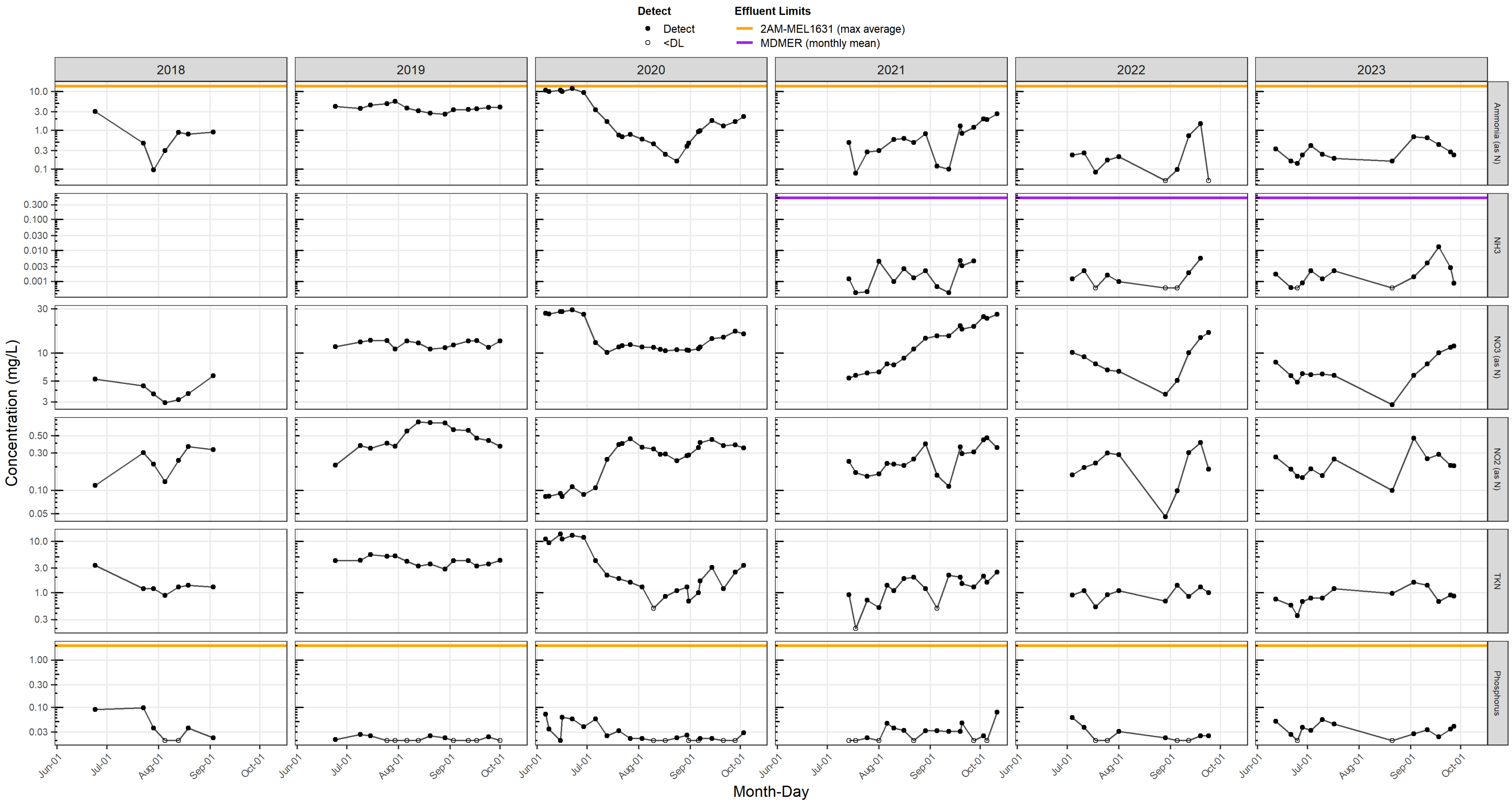


Figure 2-8. Concentrations of metals measured in end-of-pipe samples from MEL-14, 2018-2023

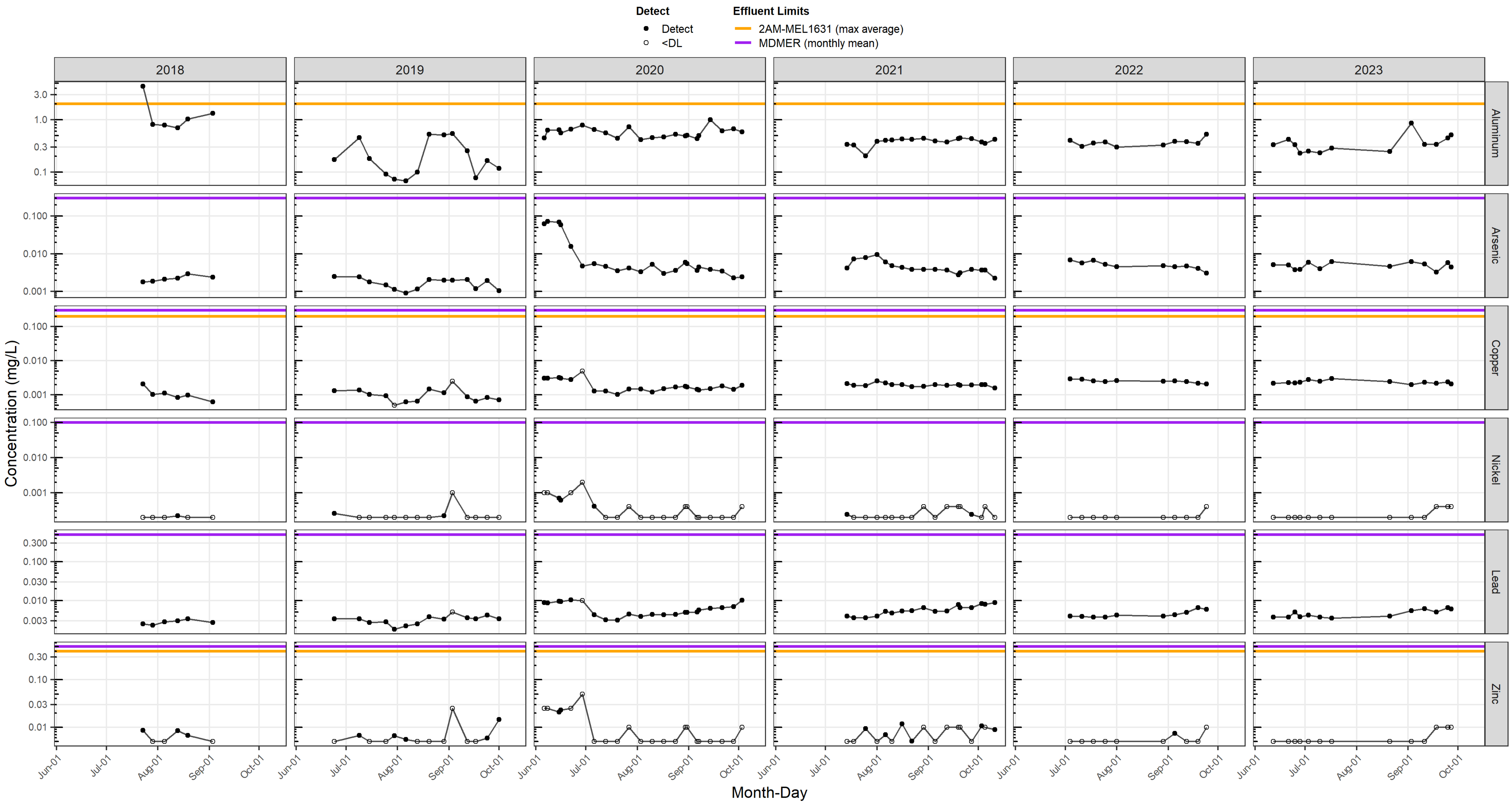


Figure 2-9. Percent composition of major ions in effluent from MEL-14

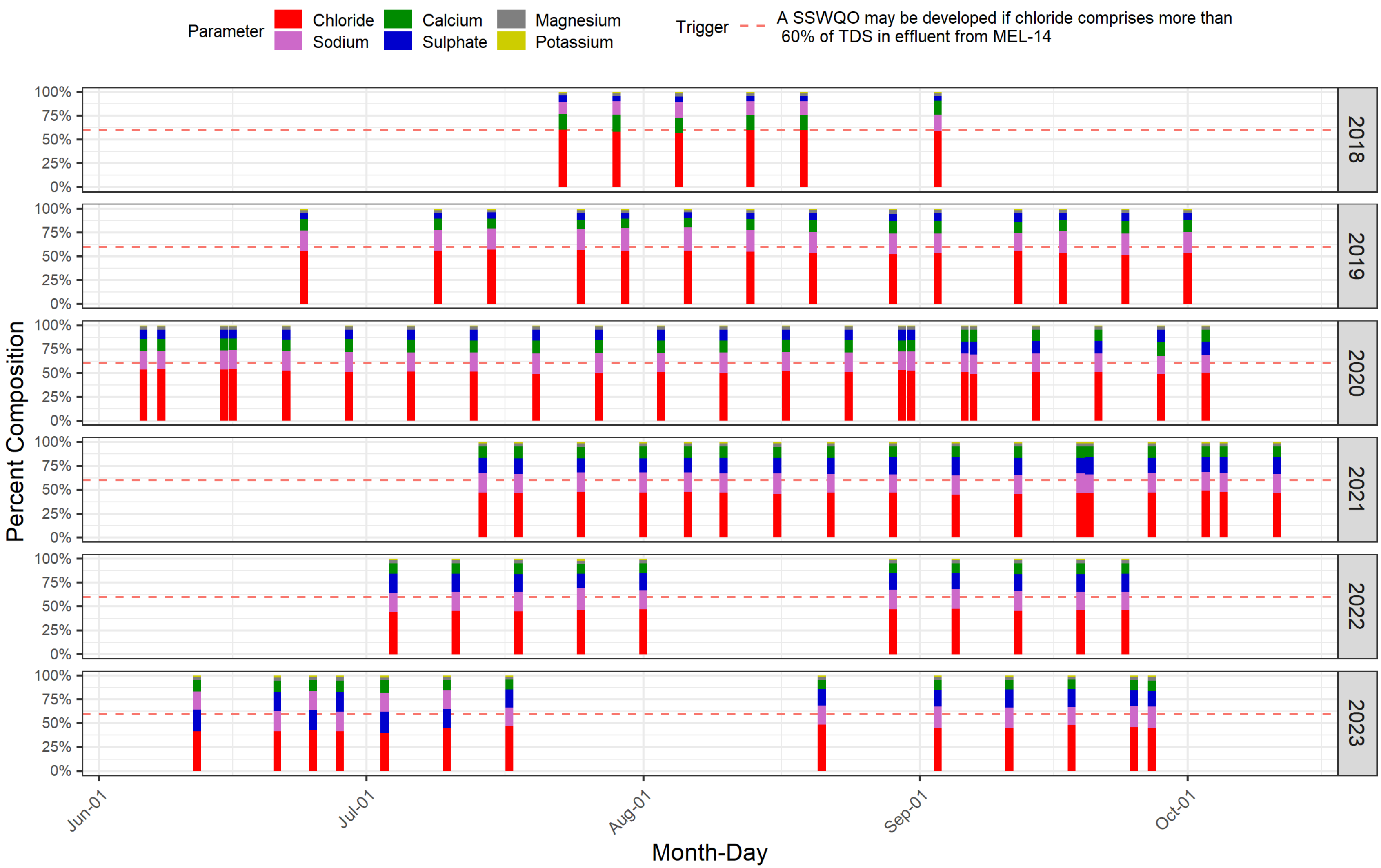


Figure 2-10. Annual loadings (kg) from CP1 to Meliadine Lake for selected parameters

Notes: The numbers above each bar indicate the percent contribution to the cumulative load (e.g., the annual load of chloride in 2023 accounts for 12% of the cumulative loading from 2018-2023).

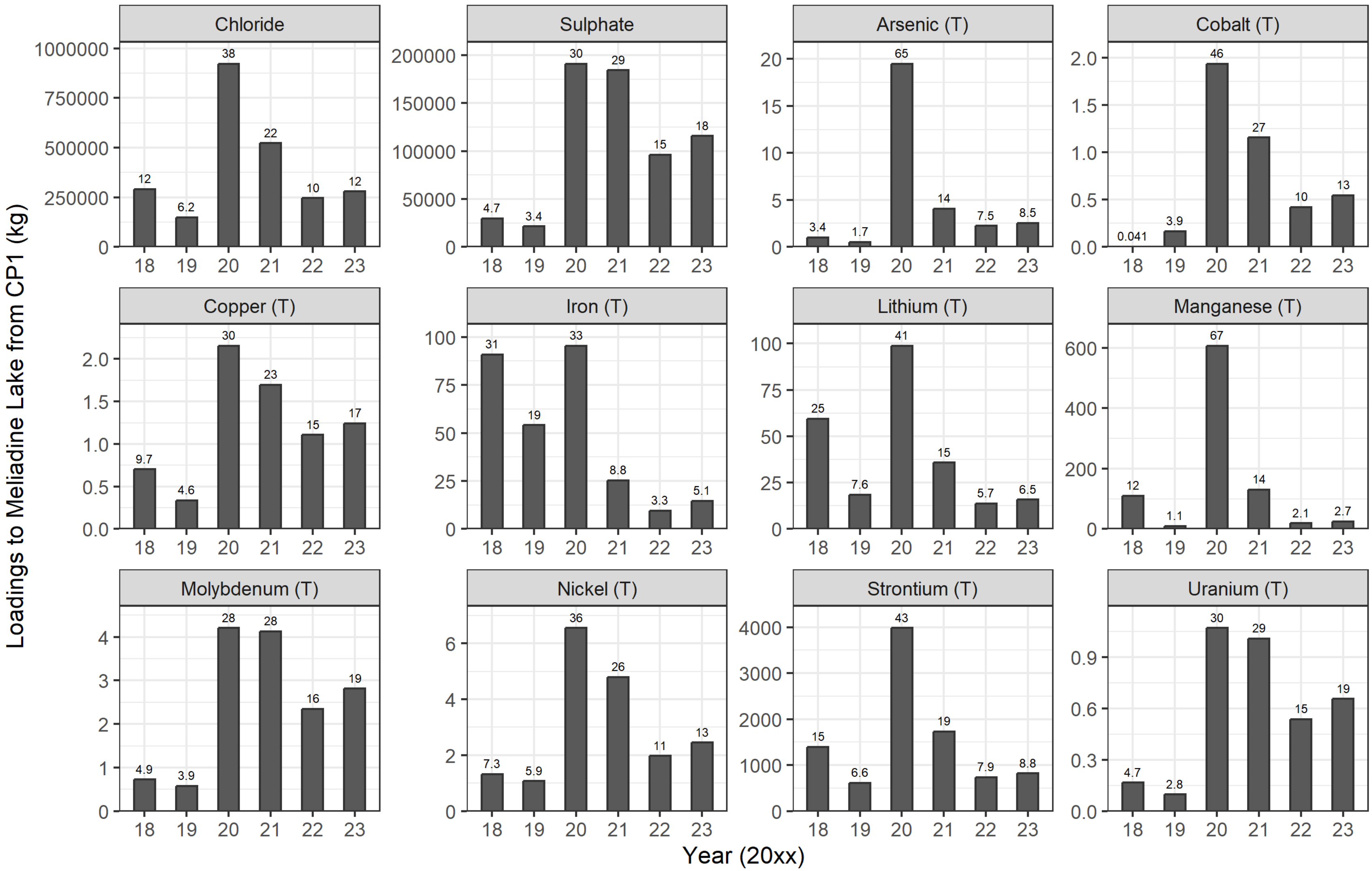


Figure 2-11. Sublethal toxicity test results for *Lemna minor* compared to measured concentrations of TDS in effluent from MEL-14

Notes: The vertical bars represent the 95th percent confidence interval for samples where effects to biomass or frond yield were observed at less than full strength effluent. The green outlined symbol indicates the results from 2023.

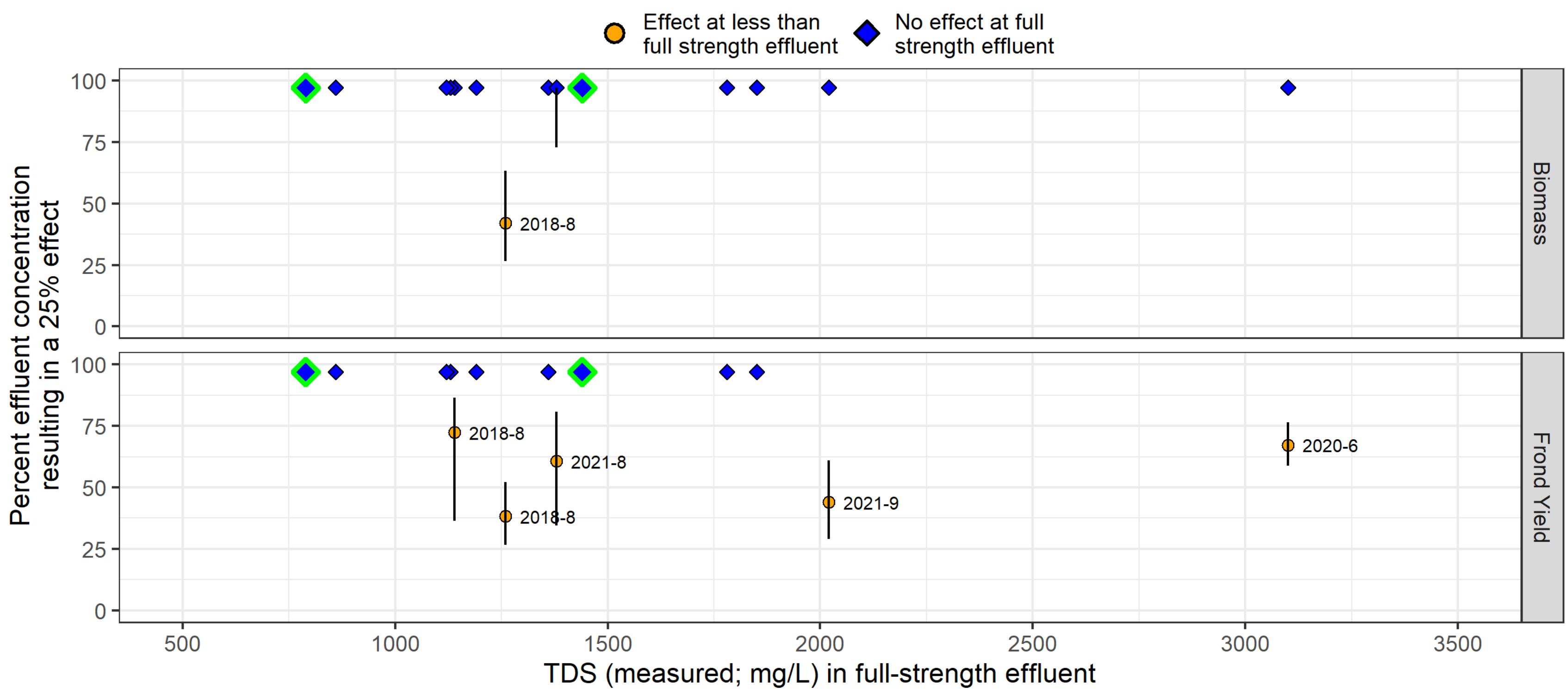


Table 2-7. Concentrations of parameters of interest in snow core samples in April 2023

Parameter	April 2023				
	Background	East of WRSF3	Emulsion Plant	North of Camp	North of Lake A8
	SNOCOR6	SNOCOR5	SNOCOR7	SNOCOR Boundary	SNOCOR4
Conventional Parameters (mg/L unless stated otherwise)					
Hardness (T)	7.33	1.73	6.07	2.3	77.8
Hardness (D)	3.96	1.12	3.36	1.2	***15***
Alkalinity, Bicarbonate	4.2	1.7	4.1	1.7	***18***
Alkalinity, Carbonate	*< 1*	*< 1*	*< 1*	*< 1*	*< 1*
pH (lab)	6.76	5.92	6.43	5.93	7.31
Alkalinity, Total	4.2	1.7	4.1	1.7	***18***
Conductivity (lab; µS/cm)	19	5.8	14	8.2	***65***
Total Dissolved Solids	*< 10*	*< 10*	10	10	***30***
Total Suspended Solids	47	14	45	26	930
Turbidity (NTU)	4.3	1.9	5	1.5	65
Organic Carbon (mg/L)					
Dissolved Organic Carbon	1.3	*< 0.4*	0.46	1.3	0.84
Total Organic Carbon	1.5	0.58	0.65	1.6	0.95
Major Ions (mg/L)					
Calcium (T)	1.94	0.405	1.66	0.516	18
Calcium (D)	1.28	0.332	1.17	0.325	***5.08***
Magnesium (T)	0.605	0.174	0.469	0.245	7.99
Magnesium (D)	0.184	0.071	0.108	0.095	***0.57***
Potassium (T)	0.264	0.062	0.181	0.2	2.74
Potassium (D)	0.128	*< 0.05*	0.064	0.145	***0.52***
Sodium (T)	1	0.283	0.427	0.689	***3.61***
Sodium (D)	1.01	0.289	0.419	0.652	***2.83***
Sulphate	*< 0.5*	*< 0.5*	*< 0.5*	*< 0.5*	***1.3***
Chloride	3.9	*< 1*	*< 1*	*< 1*	3.7
Total Metals (mg/L)					
Aluminum	0.749	0.227	0.856	0.322	12.6
Antimony	*< 0.0005*	*< 0.0005*	*< 0.0005*	*< 0.0005*	*< 0.0005*
Arsenic	0.0516	0.0042	0.0939	0.0137	0.302
Barium	0.0063	0.0018	0.0063	0.0032	0.104
Beryllium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	***0.00023***
Bismuth	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*
Boron	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*
Cadmium	0.000021	*< 0.00001*	0.000026	*< 0.00001*	0.00014
Chromium	0.0019	*< 0.001*	0.002	*< 0.001*	0.0318
Cobalt	0.00032	*< 0.0002*	0.00031	*< 0.0002*	0.0102
Copper	0.00242	*< 0.0005*	0.00309	0.00149	0.025
Iron	2.22	0.52	2.77	0.835	26.6
Lead	0.0126	0.00117	0.0145	0.00313	***0.0578***
Lithium	*< 0.002*	*< 0.002*	*< 0.002*	*< 0.002*	0.0155
Manganese	0.0555	0.0069	0.024	0.0146	0.391
Molybdenum	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*
Nickel	0.0015	*< 0.001*	0.0014	*< 0.001*	0.0335
Selenium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	0.00012
Silicon	0.75	0.24	0.87	0.32	17.1
Silver	*< 0.00002*	*< 0.00002*	*< 0.00002*	*< 0.00002*	0.000123
Strontium	0.0083	0.0023	0.0096	0.0027	0.0891
Sulphur	*< 3*	*< 3*	*< 3*	*< 3*	*< 3*
Thallium	*< 0.00001*	*< 0.00001*	*< 0.00001*	*< 0.00001*	0.00010
Tin	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*
Titanium	0.0114	*< 0.005*	0.016	0.0064	0.329
Uranium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	0.0008
Vanadium	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	***0.0225***
Zinc	0.0062	*< 0.005*	0.0065	*< 0.005*	0.0514
Zirconium	0.00013	*< 0.0001*	*< 0.0001*	*< 0.0001*	0.00214

Table 2-7. Concentrations of parameters of interest in snow core samples in April 2023

Parameter	April 2023				
	Background	East of WRSF3	Emulsion Plant	North of Camp	North of Lake A8
	SNOCOR6	SNOCOR5	SNOCOR7	SNOCOR Boundary	SNOCOR4
Dissolved Metals (mg/L)					
Aluminum	0.0137	0.0058	0.0259	0.0086	0.254
Antimony	*< 0.0005*	*< 0.0005*	*< 0.0005*	*< 0.0005*	*< 0.0005*
Arsenic	0.0127	0.00065	0.0141	0.0062	***0.0513***
Barium	*< 0.001*	*< 0.001*	*< 0.001*	0.0011	0.002
Beryllium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*
Bismuth	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*
Boron	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*
Cadmium	*< 0.00001*	*< 0.00001*	*< 0.00001*	*< 0.00001*	*< 0.00001*
Chromium	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*
Cobalt	*< 0.0002*	*< 0.0002*	*< 0.0002*	*< 0.0002*	*< 0.0002*
Copper	0.00058	*< 0.0002*	0.00028	0.00031	0.00038
Iron	0.0361	0.0093	0.0122	0.0287	0.02
Lead	0.00163	*< 0.0002*	0.00024	0.00035	*< 0.0002*
Lithium	*< 0.002*	*< 0.002*	*< 0.002*	*< 0.002*	*< 0.002*
Manganese	0.0134	0.004	0.008	0.0087	0.0026
Molybdenum	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*
Nickel	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*	*< 0.001*
Selenium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*
Silicon	*< 0.1*	*< 0.1*	*< 0.1*	*< 0.1*	***0.35***
Silver	*< 0.00002*	*< 0.00002*	*< 0.00002*	*< 0.00002*	*< 0.00002*
Strontium	0.005	0.0018	0.0054	0.0016	***0.0217***
Sulphur	*< 3*	*< 3*	*< 3*	*< 3*	*< 3*
Thallium	*< 0.00001*	*< 0.00001*	*< 0.00001*	*< 0.00001*	*< 0.00001*
Tin	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*
Titanium	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*
Uranium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*
Vanadium	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*
Zinc	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*	*< 0.005*
Zirconium	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*	*< 0.0001*

Notes
Italicized numbers are less than the DL
Bold italicized numbers are > 2-times background (SNOCOR6)
5 to 10-times background
10 to 20-times background
>20 times background

Figure 2-12. Metals concentrations in snow core samples, 2020-2023

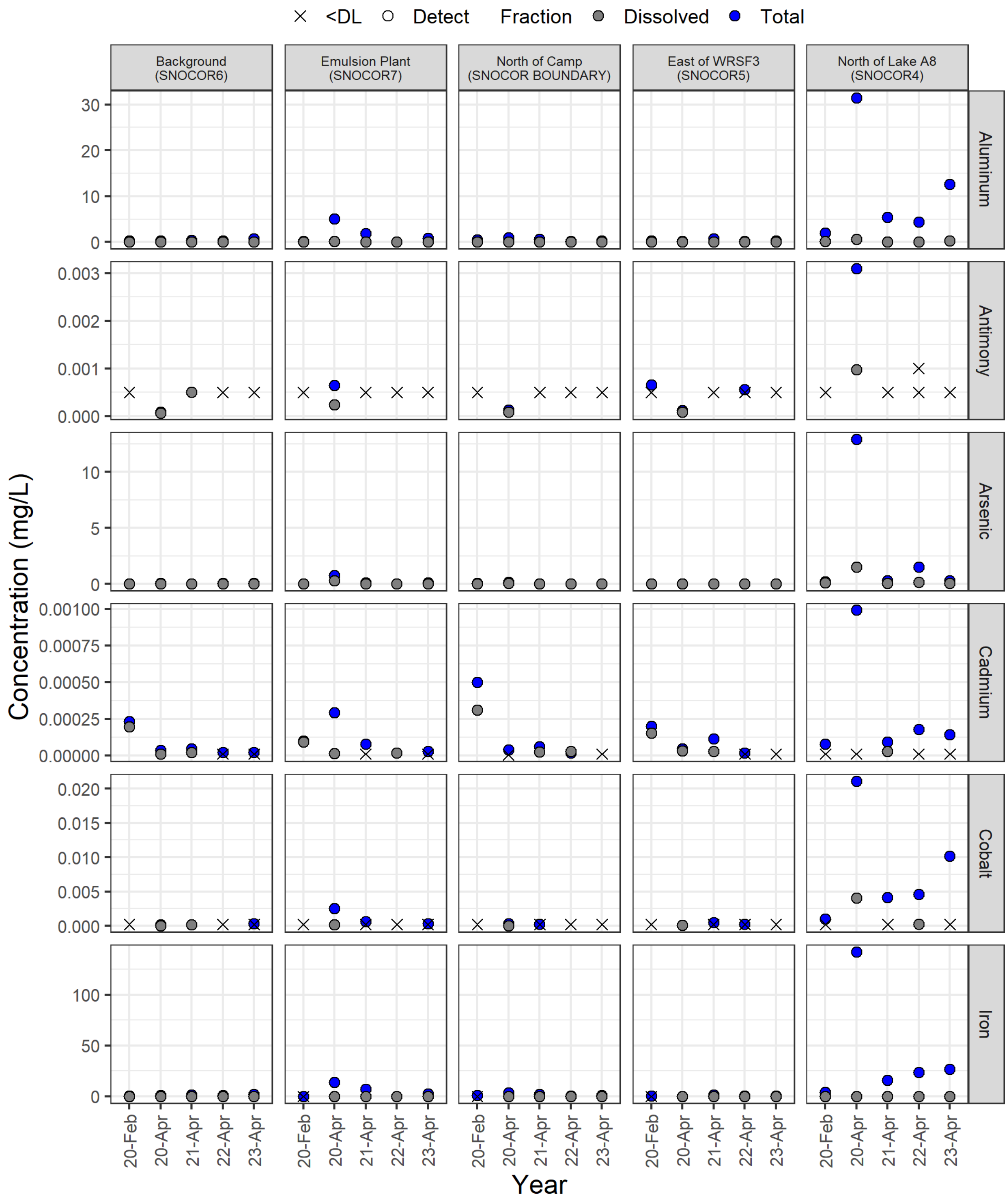
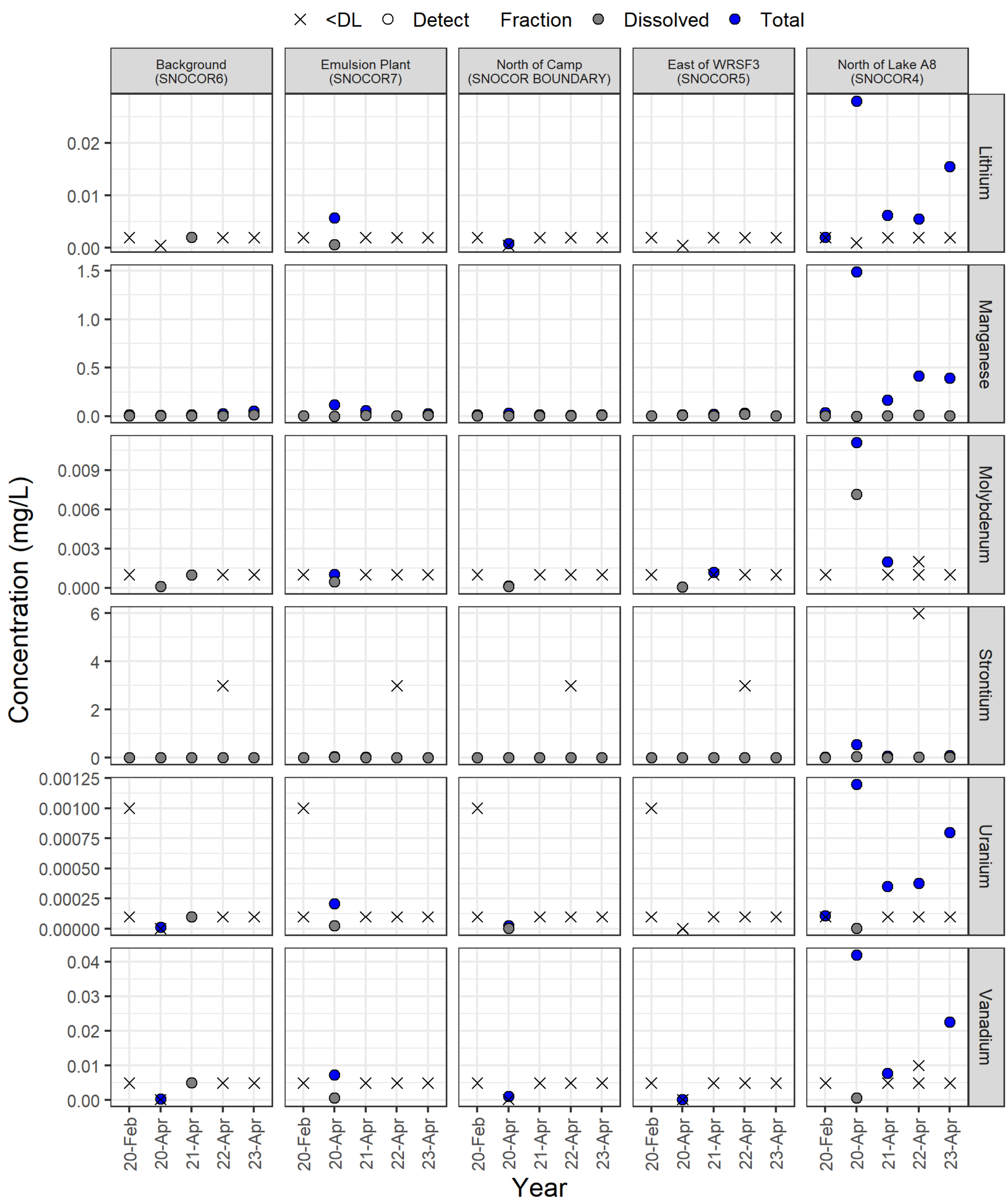


Figure 2-13. Metals concentrations in snow core samples, 2020-2023



3 MELIADINE LAKE WATER QUALITY

3.1 Introduction

This chapter presents the water quality results from Meliadine Lake in 2023. Sampling areas and stations within each area are shown in **Figure 3-1**. Water sampling was carried out according to the schedule in the *AEMP Design Plan* and recommendations in the 2022 AEMP report (Azimuth, 2023). Sampling dates, coordinates, and depths are provided in **Table 3-1**.

The Meliadine Lake water sampling program is designed to monitor changes in water quality during the open-water season when effluent is discharged to Meliadine Lake. Surface water samples were collected monthly in July, August, and September from the near-field area around the diffuser (NF; MEL-01), the mid-field area (MF; MEL-02) located to the northwest, past the narrows, and Reference Area 1 (REF1; MEL-03). Reference Areas 2 and 3 (MEL-04 and MEL-05) were sampled in August to bolster the dataset for looking at lake-wide changes in water quality. Under ice sampling was completed in April at MEL-01 and MEL-02 as in previous years. Reference Area 1 (MEL-03) was added to the winter sampling event in 2023 to provide an estimate of background water chemistry during the winter.

Objectives and Key Questions

The water quality monitoring program has four objectives:

- Determine if the Mine is causing changes to water quality in Meliadine Lake,
- Evaluate the accuracy of predicted changes in water quality,
- Assess whether mitigation measures are effective at reducing impacts to the aquatic environment, and
- Provide recommendations (as required) for follow-up monitoring or mitigation to lower the impact of mining-related activities on changes in water quality.

The following key questions are used to meet the objectives of the AEMP:

1. *Are concentrations of parameters in the effluent less than limits specified in the Water Licence?*

   This question was answered in **Section 2.3.2**. There were no exceedances of limits in the Water Licence in 2023.

2. *Has water quality in the exposure areas changed over time, relative to reference/baseline areas?*

   This question is explored using plots and statistical analyses in **Section 3.4.3**.

3. *Is water quality consistent with predictions outlined in the Final Environmental Impact Statement (FEIS) and less than AEMP Action Levels[4]?*

   This two-part question relies on information presented in **Section 3.4.3** (i.e., is water quality similar to, or different from baseline) and the water quality screening against the AEMP Action Levels (aka trigger values).

3.2 Findings from the 2023 Water Quality Program

- There were no exceedances of the AEMP Action Levels linking to mining activities in 2023 and the concentrations of most parameters are well below their respective AEMP Action Levels. As in previous years, dissolved copper naturally exceeded the aquatic life water quality guidelines in a few samples at the exposure and reference areas. Absolute concentrations of copper have remained stable in Meliadine Lake compared to the baseline period.
- Effluent has contributed to higher concentrations of some major ions, nutrients, and metals in the East Basin of Meliadine Lake over time. The effect of effluent on water quality in other areas of the Meliadine Lake is difficult to distinguish compared to the confounding effects of natural variability and interannual climate variability. On-going water quality monitoring should help decipher the effect of effluent discharge vs precipitation on water quality in Meliadine Lake.
- TDS and chloride concentrations in the East Basin of Meliadine remain well below predictions in the 2014 FEIS (Agnico Eagle, 2014) and the hydrodynamic model (Tetra Tech, 2020).
- The 2023 water quality results from Meliadine Lake do not require additional management actions as per the Low Action Level assessment and AEMP Response Framework. The study design for the 2024 AEMP in Meliadine Lake will follow the same scope and schedule as the 2023 AEMP.

[4] AEMP Action Levels refer to 75% of the AEMP Benchmark for a given parameter. The AEMP Benchmarks correspond to the lowest water quality guideline for protection of aquatic life and human health, or site-specific water quality objectives in the case of fluoride, arsenic, and iron. AEMP Action Levels and Benchmarks for the Meliadine Lake AEMP are listed in **Table C1-1**.

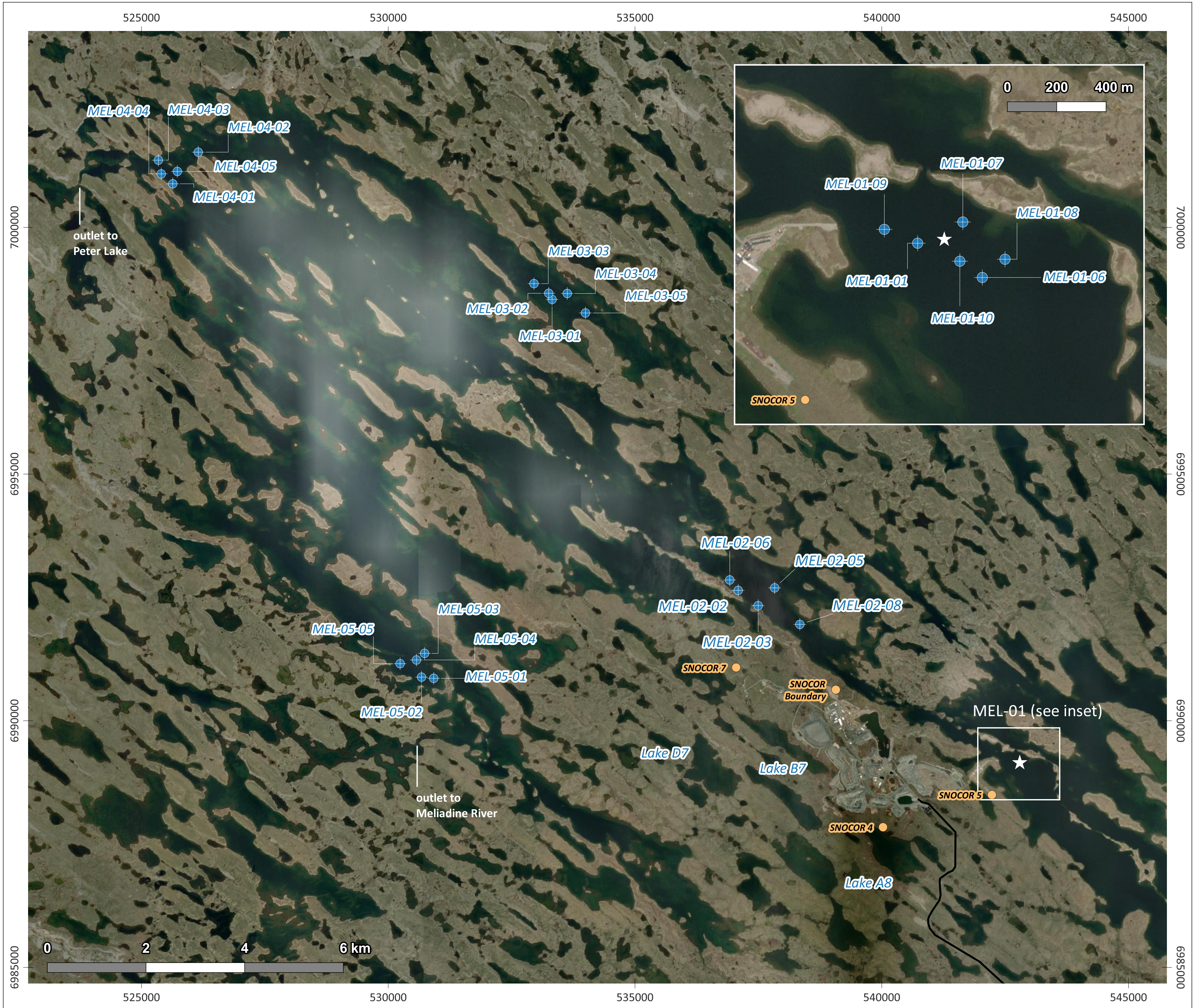


Figure 3-1
Meliadine Lake Water Quality Sampling Stations

Aquatic Effects Monitoring Program
2023 Annual Report

AZIMUTH

Date:	March 10, 2023
Datum:	NAD 83 UTM Zone 15N
Scale:	1:100,000 ; inset = 1:20,000
Software:	QGIS version 3.22.11-Białowieża
Produced by:	E. Franz

REFERENCES:
1. Basemap imagery from ESRI
2. Mine Plan provided by Agnico Eagle
3. Roads and waterbodies from NRC

Legend

- CP1 Diffuser
- All weather access road
- AEMP Water Quality Station
- Snowpack Monitoring Station

Table 3-1. Meliadine Lake water sampling events in 2023

Area	Station ID	Depth[a]	Easting	Northing	Distance to the Diffuser	April	July	August	September
MEL-01 Near-field	MEL-01-01	9.4	542690	6989132	109 m	**April 1** LP, WQ	**July 16** LP, WQ	**August 22** LP, WQ, Phyto	**September 15** LP, WQ
	MEL-01-06	8.8	542952	6988993	219 m				
	MEL-01-07	7.7	542873	6989218	102 m				
	MEL-01-08	7.5	543044	6989067	259 m				
	MEL-01-09	7.1	542555	6989188	246 m				
	MEL-01-10	10.5	542861	6989059	110 m				
MEL-02 Mid-field	MEL-02-02	10.0	537093	6992642	6,689 m	**April 2** LP, WQ	**July 15** LP, WQ	**August 17** LP, WQ, Phyto	**September 15** LP, WQ
	MEL-02-03	9.8	537497	6992332	6,183 m				
	MEL-02-05	9.4	537831	6992692	6,101 m				
	MEL-02-06	10.2	536922	6992853	6,946 m				
	MEL-02-08	9.7	538342	6991952	5,264 m				
MEL-03 Reference Area 1	MEL-03-01	9.5	533321	6998540	16 km	**April 3** LP, WQ	**July 15** LP, WQ	**August 18** LP, WQ, Phyto	**September 15** LP, WQ, Phyto
	MEL-03-02	10.5	533253	6998664					
	MEL-03-03	10.5	532954	6998860					
	MEL-03-04	8.0	533629	6998660					
	MEL-03-05	8.1	533997	6998265					
MEL-04 Reference Area 2	MEL-04-01	8.3	525634	7000884	21 km	Not sampled	Not sampled	**August 18** LP, WQ, Phyto	Not sampled
	MEL-04-02	9.8	526151	7001525					
	MEL-04-03	10.7	525343	7001363					
	MEL-04-04	8.9	525401	7001085					
	MEL-04-05	8.5	525727	7001134					
MEL-05 Reference Area 3	MEL-05-01	9.6	530922	6990859	19.5 km	Not sampled	Not sampled	**August 18** LP, WQ, Phyto	Not sampled
	MEL-05-02	9.8	530675	6990883					
	MEL-05-03	8.6	530737	6991365					
	MEL-05-04	9.9	530573	6991231					
	MEL-05-05	10.5	530241	6991156					

Notes:
[a] Depth in meters at the fixed monitoring locations.
LP = limnology profile (temperature, dissolved oxygen, pH, and specific conductivity).
WQ = water chemistry.
Phyto = phytoplankton community survey and chlorophyll-a (results discussed in **Section 5**).

3.3 Methods

3.3.1 Field and Laboratory Procedures

Limnology measurements (temperature, dissolved oxygen, pH, and specific conductivity) were taken at 1 m depth intervals from the lake surface to within approximately 1 m of the sediment. Water samples were collected from approximately mid-depth at each station (~4 to 5 m below the surface) using a Kemmerer grab sampler during the open-water sampling events or an electric submersible pump connected to a length of C-Flex (Cole Parmer) silicon tubing for the winter sampling event. Bottles for chemistry analysis were pre-labelled before going into the field and handled (i.e., preserved and filtered) according to specifications provided by ALS Environmental. Water for dissolved organic carbon, dissolved nutrients, and dissolved metals were filtered using a syringe and 0.45 µm disc filter provided by ALS. A checklist is included with the field data sheet to verify the samples requiring filtration and to ensure preservation is handled correctly.

Water samples were sent to ALS Environmental in Winnipeg, MB. Analyses were conducted at the laboratory in Winnipeg, Edmonton, and Burnaby. The laboratory in Winnipeg arranges sample shipping to various ALS locations based on the analytical capabilities at these locations and the detection limits (DLs) for the project. ALS is an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). The list of parameters included in the AEMP are provided in **Table 3-2**. Target DLs are provided in the appendices.

Table 3-2. Water quality parameters collected for the AEMP

AEMP Water Quality Parameters
Station Information. Coordinates, depth, secchi depth (open-water), and ice thickness.
Field Parameters. Depth, pH, specific conductivity, dissolved oxygen, temperature, Secchi depth (open-water), and ice thickness.
Conventional Parameters and Major Ions. Bicarbonate alkalinity, chloride, carbonate alkalinity, turbidity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids (TDS), and total suspended solids (TSS).
Nutrients and Organic Carbon. Ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, orthophosphate, total phosphorus, total organic carbon, dissolved organic carbon, and reactive silica.
Total and Dissolved metals. Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.
Other Parameters. Total cyanide, free cyanide, and weak acid dissociable (WAD) cyanide.

3.3.2 Quality Assurance and Quality Control

Water chemistry QA/QC involved following appropriate sampling procedures, collecting field duplicates and blanks, laboratory QC, and data analysis QA/QC procedures as outlined in the *AEMP Design Plan* (Azimuth, 2022). The QA/QC results for the 2023 AEMP water chemistry program are summarized in **Appendix A**. The key findings from the QA/QC assessment in 2023 are presented below:

- ***In-situ* profiles** –pH measurements at MEL-03-05 in August were between 6.14 to 6.38. pH in Meliadine Lake in the summer is typically slightly basic (7 to 7.5). There was no indication on the field datasheets that the water quality meter was malfunctioning. However, compared to the other profiles taken at MEL-03, the pH results for MEL-03-05 were flagged as unreliable.
- **Sample Integrity** –The lab did not report any lost or damaged bottles in 2023. Hold-times were exceeded for some parameters, and the temperature inside the coolers was often above 10°C due to the travel time from Site to the laboratory. Long-term monitoring results from the AEMP and other monitoring programs in Nunavut indicate hold-time exceedances and sample temperatures greater than 10°C are unlikely to affect data quality.
- **Laboratory QC Assessment** –There were no data quality issues with the laboratory blanks, spikes, duplicates, and reference material that indicate potential issues with the accuracy and reliability of the results.
- **Blanks** – Similar to previous years, there were a few parameters detected above their respective DLs in the blanks. The equipment blank (EB) samples had more detected parameters compared to the deionized water blank (DB) and travel blank (TB) samples. Close examination of the water quality data from 2023 indicated concentrations were consistent with previously-reported results, and potential for cross-contamination to bias the interpretation of the 2023 water quality data is unlikely.
- **Field Duplicates** – Ten duplicate samples were collected in 2023, equal to 13.2% duplicate sampling frequency (76 samples were collected in 2023). Of the 1,190 comparisons across the 10 duplicate samples in 2023, only 13 parameters (or ~1% of the duplicate results) exceeded the data quality objectives (DQOs[5]), indicating there was good precision between the field duplicate samples in 2023. There is more uncertainty associated with concentrations measured close to the DL; however, the effect on interpretating data in the AEMP is negligible, as the AEMP Benchmarks and

[5] Two DQOs are used to evaluate precision between field duplicates depending on the concentrations in the samples. If the concentrations in the samples and duplicate are > 5-times the DL, the DQO is a relative percent difference (RPD) between the two samples of <30%. If the concentration between sample and duplicate is < 5-times the DL, the DQO is a difference between the sample and duplicate of <2-times the DL. This approach is based on how ALS Environmental evaluates precision between laboratory duplicate samples.

Action Level concentrations (i.e., water quality guidelines) are typically an order of magnitude or higher than the DLs.

- **Anomalous Results Excluded from the Analyses** – TSS concentrations at MEL-03-01 and MEL-03-02 in the August sampling event were 92 and 74 mg/L, respectively. These results indicate the bottles were contaminated during sampling. For MEL-03-01, high turbidity required sample dilution prior to analysis, which resulted in elevated detection limits for metals (total and dissolved). Metals results from MEL-03-01 were removed from the dataset due to the high detection limits. Some of the results from MEL-03-02 were also flagged as anomalous based on results from the other three stations. Other results that were flagged as outliers and removed from the dataset are included in **Appendix A**.

3.3.3 Data Analysis

Water quality data for the Meliadine project are managed within the EQuIS database administered by Agnico Eagle. Water quality data are uploaded directly to EQuIS by partner laboratories. Data analysis involved screening the current year data against the AEMP Benchmarks and corresponding Action Levels, calculating summary statistics, comparing the current year data to normal range[6], investigating temporal and spatial trend (plots and statistics), and comparing the current data to relevant predictions.

Descriptive Statistics and Data Screening

Water quality results from individual water samples were screened against the AEMP Benchmarks and corresponding Low-Action-Levels (aka triggers); the triggers of all water quality parameters are provided in **Appendix C1**. Descriptive statistics (mean, median, standard deviation, standard error, minimum, and maximum) were calculated for each sampling area and separately for the winter and open-water sampling events. Those tables are also provided in **Appendix C1**. Plots showing the temporal trends across sampling years and areas (1997 to 2023; MEL-01 to MEL-05) are provided in **Appendix C2**. The normal range and action levels were also included to assess the current conditions relative to the baseline conditions and associated triggers. The individual samples from 2023 are provided in **Appendix C3**.

Spatial and Temporal Changes

Spatial and temporal trends were evaluated using the normal range, statistical comparisons (analysis of variance [ANOVA]), and plots.

[6] Normal range is the natural water quality conditions in Meliadine Lake using data collected during the baseline period (1995 to 2013) and chemistry data from the three reference areas collected to the end of 2020.

Normal Range

The first step in the spatial and temporal trend assessment involved identifying those parameters that exceeded the normal range of baseline/reference concentrations at MEL-01. The normal range assessment focuses on results from the open-water season (July, August, and September) when treated surface contact water is discharged to Meliadine Lake. The upper 90th percentile is used as the limit for determining whether current concentrations have changed relative to baseline/reference conditions. Parameters were considered outside the normal range if the average concentration during the open water period exceeded the 90th percentile of reference/baseline concentrations. The approach to calculating the normal range for water quality parameters was outlined in detail in the 2019 AEMP report (Azimuth, 2020).

Analysis of Variance

Water quality parameters that exceeded the normal range were carried forward for quantitative analysis of year-over-year differences within MEL-01, MEL-02, and MEL-03 using ANOVA and Tukey post-hoc pairwise comparisons (significant difference at $\alpha = 0.05$). This assessment focused on data from MEL-01, MEL-02, and MEL-03 because these three areas are sampled monthly during the open water season. The magnitude of year-to-year changes in water quality parameter within each area was calculated using the model estimates for each water quality parameter.

The normal range assessment and statistical analysis help to differentiate parameters that are elevated compared to baseline/reference but stable in recent years versus those parameters that show consistent year-over-year increases related to mining activities, wider regional patterns of change, or a combination of factors.

Comparison to Predicted Changes in Water Quality

An important aspect of the water quality assessment for Meliadine Lake is determining if the pattern, timing, and magnitude of changes in water quality generally align with the predicted changes based on the approved design plan for the Mine. Comparing current versus predicted water quality provides insight about whether the Mine is effectively managing surface contact water on Site.

Two sets of predictions are available for the East Basin of Meliadine Lake. The first set of predictions came from the effluent mixing model in the 2014 FEIS in 2014. Predicted concentrations were developed for several parameters at the edge of the mixing zone (100 m from the diffuser), as well as for TDS, chloride, and sodium beyond the mixing zone in the East Basin of Meliadine Lake. The model was based on the extent of the approved mine plan in the 2014 FEIS, conservative assumptions regarding effluent quality, and the preliminary diffuser design. The *far-field*[7] effluent mixing model in Volume 7 of the FEIS predicted TDS, chloride, and sodium would increase gradually over time in the East Basin to maximum concentrations of 176 mg/L for TDS, 66 mg/L for chloride, and 19 mg/L for sodium in the last year of operations.

The major inputs to the mixing model in the 2014 FEIS are outdated. Therefore, in 2020, Agnico Eagle commissioned Tetra Tech to complete a multi-year simulation of effluent mixing in the sub-basin of the East Basin (termed the *model domain* in Tetra Tech's report) that included the final diffuser design, updated bathymetry in the model domain, and the conservative assumption that effluent discharged to Meliadine Lake would have a maximum average concentration of TDS of 3,500 mg/L, equal to the current limit in the Water Licence. Two multi-year scenarios were modelled, a base case "normal" precipitation scenario, in which TDS concentrations were predicted to increase to 170 mg/L, and a wet-year scenario, in which where TDS concentrations were predicted to increase to 183 mg/L, to provide a more accurate prediction of changes in TDS within the East Basin.

TDS and chloride are used as indicator parameters for assessing current water quality compared to predictions in the 2014 FEIS and 2020 hydrodynamic model.

3.4 Results and Discussion

Water quality results for Meliadine Lake are discussed in the following sections:

- *In-situ* water quality from the limnology profiles in 2023 (**Section 3.4.1**),
- Descriptive statistics and comparisons to AEMP triggers (**Section 3.4.2**),
- Temporal and spatial changes of water quality parameters (**Section 3.4.3**), and
- Comparison to water quality predictions (**Section 3.4.4**).

3.4.1 *In-situ* Water Quality

Field-measured water quality parameters provide important "real-time" information on potential changes to water quality and are an important tool for assessing water quality in Meliadine Lake. Average results by area for temperature, dissolved oxygen, pH, and specific conductivity are shown in **Figure 3-2**. Individual conductivity profiles are shown in **Figure 3-3**.

Dissolved Oxygen, pH, and Temperature

Conditions in Meliadine Lake varied naturally in 2023 according to seasonal patterns of change reported in previous AEMP cycles (**Figure 3-2**). The lake was well oxygenated in the winter and open water

[7] Far-field in this case means the broader east basin. This is not to be confused with the reference areas in Meliadine Lake

sampling events. Dissolved oxygen was higher under ice than near the bottom of the lake at MEL-01, MEL-02, and MEL-03 in April (13 to 17 mg/L). As the days become longer in late winter, increased sunlight can lead to increased primary productivity in the top layer of water near the ice, which in turn produces oxygen in the upper water column (Pernica et al., 2017). Dissolved oxygen levels were approximately 9 mg/L near the bottom of the lake at MEL-01 and MEL-03.

Field pH readings in 2023 were between 7.25 and 7.5 for most of the profiles. MEL-01 was closer to circumneutral in April (6.8 to 7.0). pH readings were also lower at MEL-03 in August. Average pH for MEL-03 shown in **Figure 3-2** was influenced by the profile at MEL-03-05 (6.14 to 6.38). There was no indication on the field datasheets that the probes were malfunctioning, but compared to other sampling events, these results are questionable. pH measurements from the other profiles at MEL-03 in August were in the range of 6.5 to 7.2.

Water temperatures vary between the sampling areas based on the timing of ice off and seasonal mixing patterns. Water temperatures typically vary by less than 2°C among the sampling areas within each sampling event. By mid-September, water temperature was uniform throughout the lake.

Conductivity

Conductivity, a measure of the electrical conductivity in water, is positively correlated with increases in major ions (e.g., TDS). In this respect, *in-situ* conductivity provides insight into effluent mixing in the East Basin. As expected, conductivity results were higher in MEL-01 than other study areas in each of the sampling events (**Figure 3-2**).

Under ice conductivity was higher in the winter compared to the open water sampling events because formation of ice leads to less water and therefore higher concentrations of dissolved salts. Under ice conductivity was in the range of 150 to 160 µS/cm at MEL-01, 120 to 140 µS/cm at MEL-02, and 110 to 120 µS/cm at MEL-03. Slightly higher conductivity readings were reported closer to the ice due to cyro-concentration. Conditions at MEL-01 appeared well-mixed in the late winter (**Figure 3-3**).

The effluent plume was detected at some of the MEL-01 stations during the July 16 sampling event (**Figure 3-3**). This was expected given the volume of water that was discharged from CP1 from early June to mid-July (**Figure 2-5**). Surface conductivity was in the range of 105-110 µS/cm at all six sampling locations. Conductivity readings were approximately 10-20 µS/cm higher at mid-depth and bottom profiles taken at MEL-01-01, MEL-01-07, MEL-01-09, and MEL-01-10. These results suggest the plume was migrating north and west of the diffuser in mid-July.

On August 22, conditions at MEL-01 were well-mixed except at MEL-01-01 (100 m west of the diffuser) (**Figure 3-3**). Discharge resumed on August 20, and the profile from MEL-01-01 indicates the plume was migrating west of the diffuser (**Figure 2-5**).

Conditions in MEL-01 were fully mixed on September 15 despite relatively higher discharge rates in early September to draw down water levels in CP1 before freeze-up. Heading into winter, conductivity was 115 µS/cm at MEL-01, 95 µS/cm at MEL-02, and 87 µS/cm at MEL-03.

3.4.2 Water Quality Screening Assessment

Descriptive statistics and results of the screening assessment are provided **Appendix C1**. Plots showing the concentrations of each parameter by area from 1997 to 2023 are provided in **Appendix C2**.

There were no exceedances of AEMP Action Levels in 2023 attributed to activities at the Mine. The concentrations of parameters of interest in 2023 represent a small percentage of their respective AEMP Action Levels (triggers) and Benchmarks (**Figure 3-4**).

Similar to previous years, a small number of samples naturally exceeded the aquatic life water quality guidelines for dissolved copper (ECCC, 2021). The exceedances in 2023 were at MEL-02 (n=1), MEL-03 (n=2), and MEL-04 (n=1) (**Figure 3-5**). The exceedance at MEL-02 was in sample MEL-02-06 in August (4.0 µg/L). This result was noticeably higher compared to the other four stations at MEL-02 (1.1 to 1.5 µg/L) and outside the range observed in Meliadine Lake (**Figure C2-53**). A description of the copper biotic ligand model (BLM) water quality guideline is provided in **Appendix C1**. Overall, exceedances of the AEMP Benchmark for copper are natural, transient, and low in magnitude.

Dissolved zinc exceeded the CCME water quality guideline at MEL-01-09 in August, but the dissolved concentration in this sample was 13.9 µg/L compared to 0.56 µg/L in the unfiltered (total) fraction. Dissolved zinc in three of the other samples from MEL-01 in August were below detection (0.5 µg/L). The results from MEL-01-09 was flagged as an outlier and not considered representative of current conditions.

Figure 3-2 Average temperature, dissolved oxygen, pH, and specific conductivity by month in 2023

Notes: The average value was computed for each month/area/depth (n=6 profiles at MEL-01; n=5 profiles at the other areas). The data were smoothed using Locally Estimated Scatterplot Smoothing (LOESS).

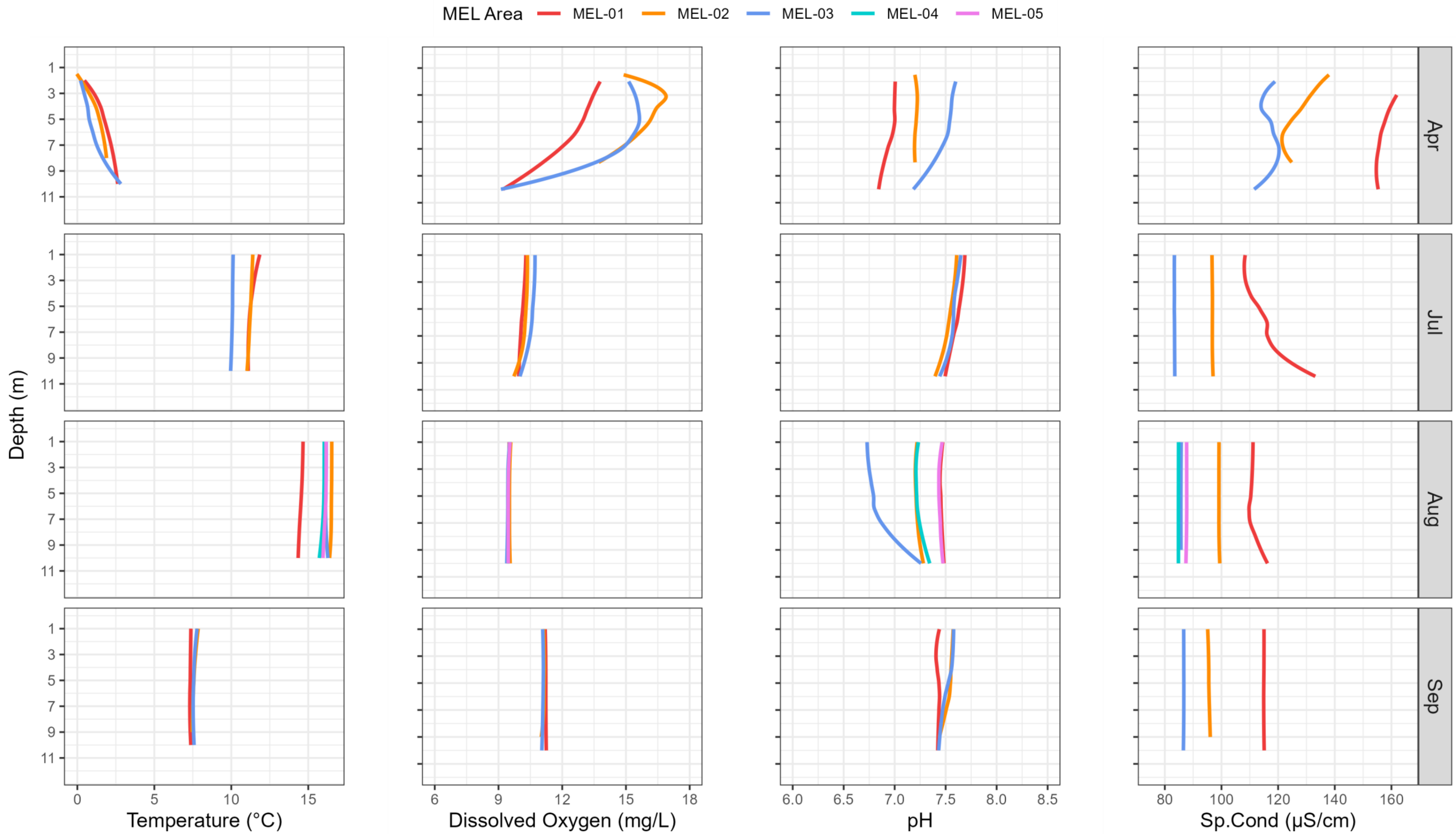


Figure 3-3 Specific conductivity (µS/cm) results from the 2023 limnology profiles

Notes: n=6 limnology profiles at MEL-01; n=5 limnology profiles at the other areas.

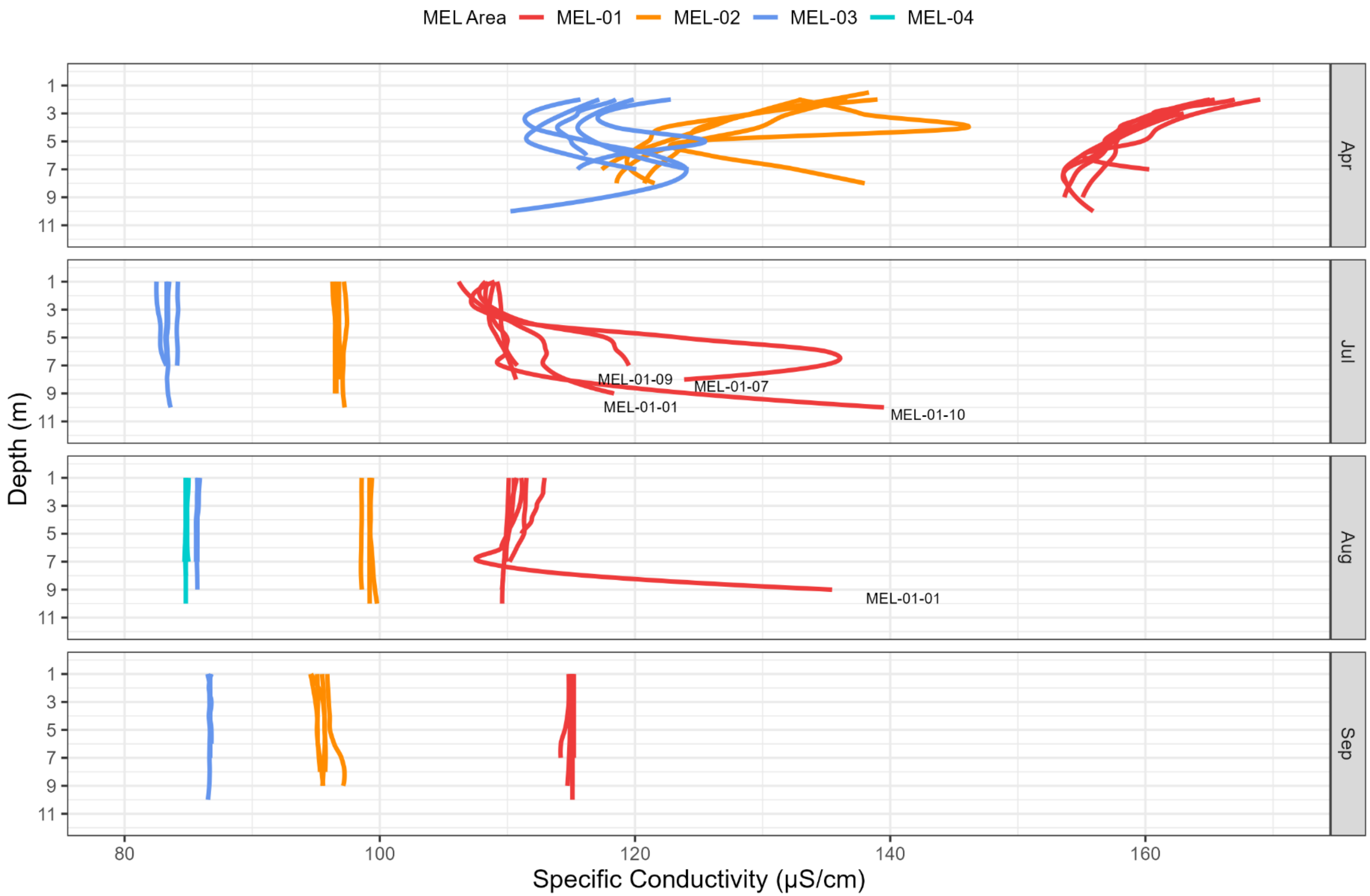


Figure 3-4. Water chemistry results from 2023 compared to the Normal Range, AEMP Action Levels, AEMP Benchmarks

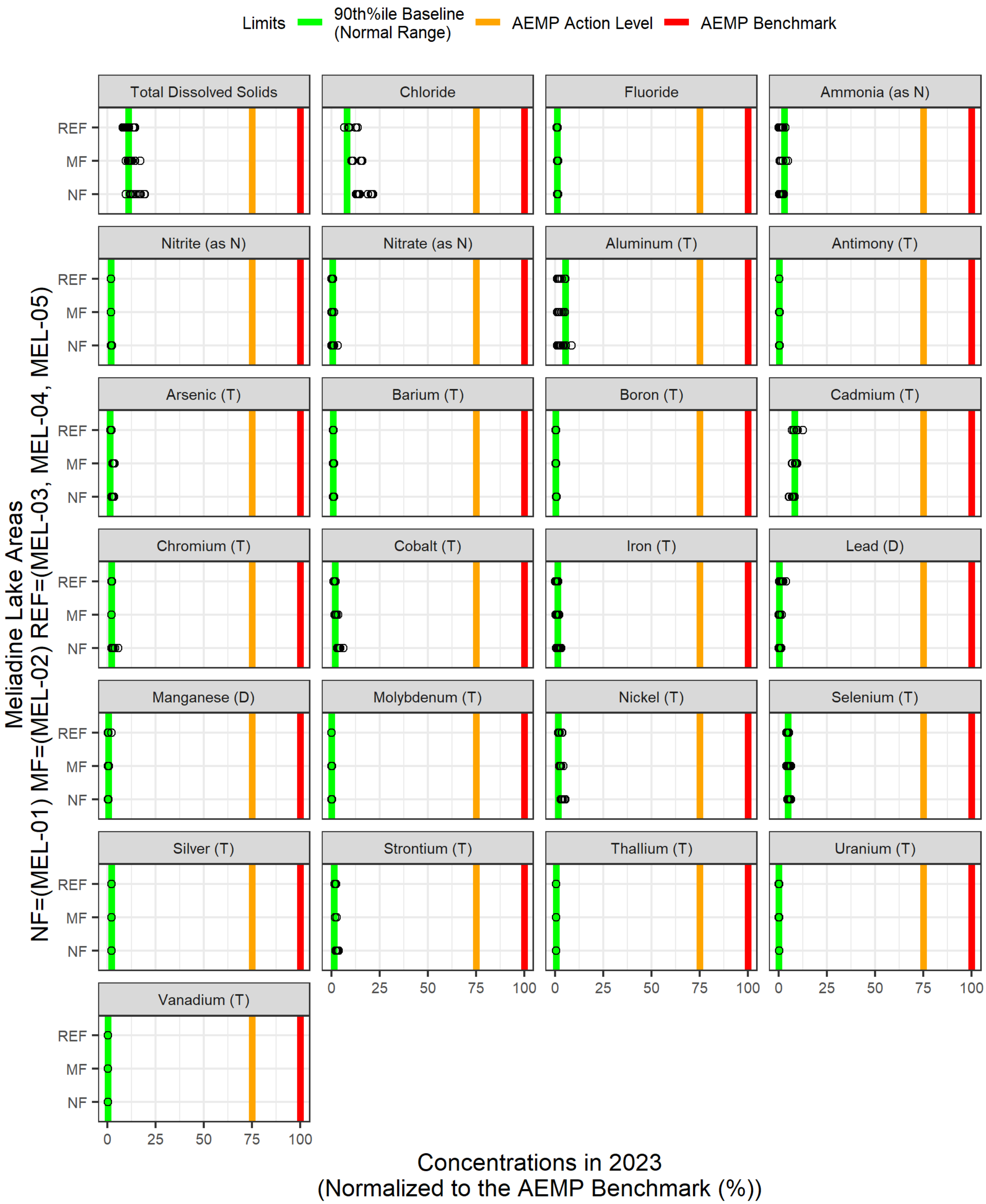
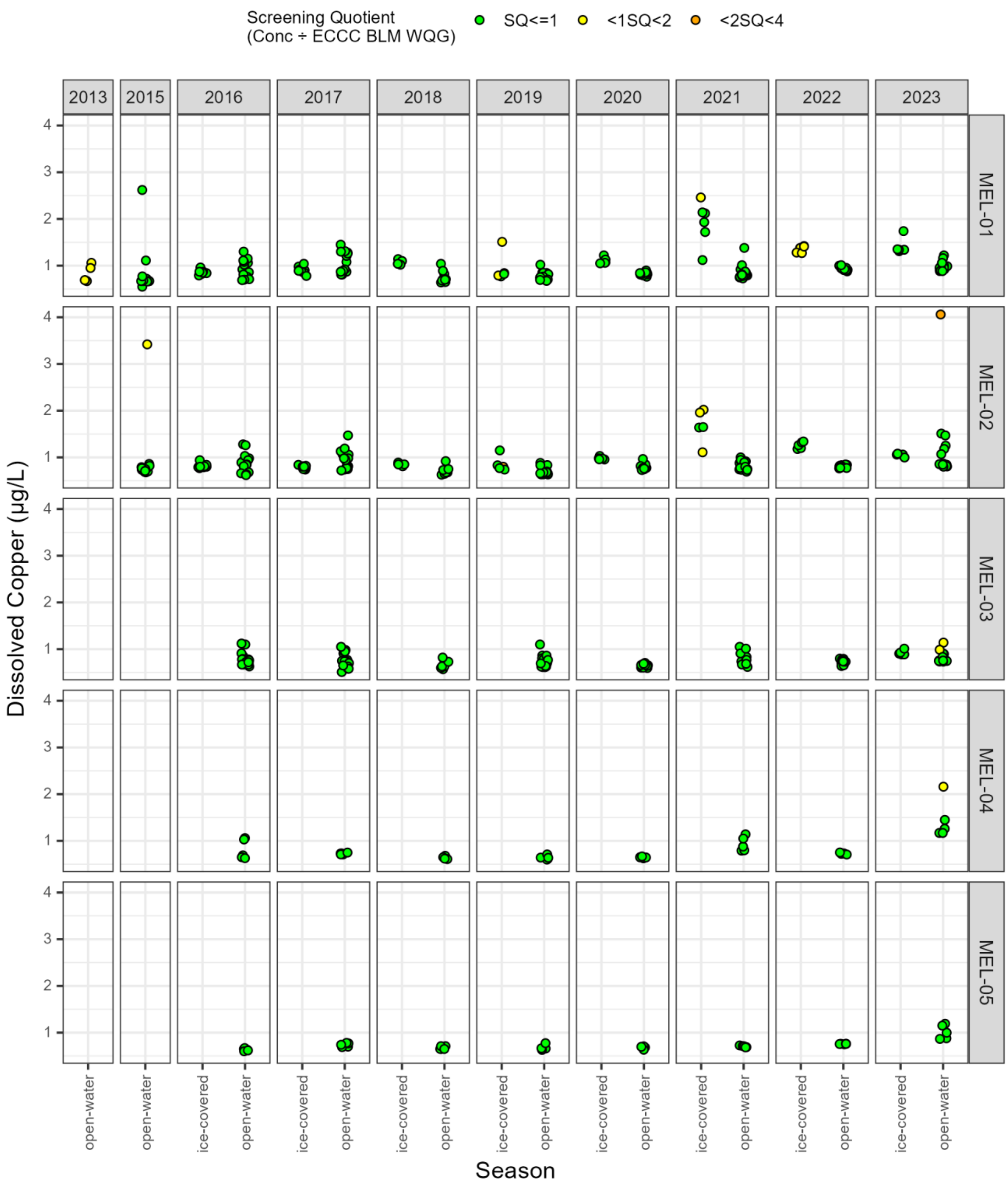


Figure 3-5. Copper concentrations in Meliadine Lake compared to the AEMP Benchmark

Notes: Screening quotients = concentration (µg/L) ÷ AEMP Benchmark (copper BLM; ECCC, 2021).



3.4.3 Spatial and Temporal Changes

The purpose of the temporal and spatial assessment is to understand the underlying cause of changes in water quality in Meliadine Lake. The potential for effluent to cause changes in water quality in the East Basin was predicted in the 2014 FEIS (Agnico Eagle, 2014) and the 2020 hydrodynamic model (Tetra Tech, 2020). What is not well understood is the effect of climate/weather patterns on changes in water quality in Meliadine Lake. In broad terms, water quality in northern latitude lakes is subject to change based on the timing, magnitude, and duration of the runoff regime and temperature (Wrona et al., 2016). The AEMP was not designed to monitoring the effect of changes in climate on water quality in Meliadine Lake; however, climate data presented in **Section 2.2** are incorporated into the discussion to help understand if changes in water quality are related solely to mining activities or if other factors may be affecting temporal and spatial trends in Meliadine Lake.

The following step-wise approach was taken to focus the discussion on parameters that are increasing in Meliadine Lake.

Step 1: Identify parameters at MEL-01 that exceeded the normal range in 2023 (long-list)

In total, there were 28 parameters where the annual mean concentration exceeded the normal range (**Table 3-3**). Titanium exceeded the normal range (0.17 µg/L) based on the annual mean (0.21 µg/L) but not the median (0.10 µg/L). The annual mean concentration was influenced by one sample (1.6 µg/L at MEL-10-10 in July) that biased the annual mean (positively skewed data). There is no evidence that effluent is causing titanium concentrations to increase in Meliadine Lake. Among the remaining 27 parameters that exceeded the normal range at MEL-01 in 2023, 12 parameters had average concentrations that were >5% higher compared to 2022, 11 parameters were ≤5% higher than 2022, and 4 parameters were lower in 2023 compared to 2022 (**Table 3-4**).

Step 2: Identify parameters that have always exceeded the normal range at MEL-01

Some parameters at MEL-01 have always exceeded the normal range of baseline/reference conditions, which suggests water quality the East Basin was naturally different compared to other areas of Meliadine Lake before the Mine started discharging treated effluent in 2018. Therefore, parameters that have always exceeded the normal range but have remained stable in recent years were not carried forward in the discussion. The following parameters were dropped at this step of the analysis:

- reactive silica, cobalt, copper, iron, and molybdenum

The stable temporal trends for these parameters are illustrated in the condense temporal plots (**Section 3.6**) and supported by the ANOVA and Tukey post hoc comparisons in **Table 3-5**.

Step 3: Identify parameters that have increased in MEL-01 in recent years (short-list)

The short-list of parameters that have trended higher in Meliadine Lake compared to the baseline period were identified using ANOVA and Tukey post hoc comparisons supported by the condensed temporal plots. The short-list of parameters that were carried forward for discussion are:

- Major ions: chloride, calcium, magnesium, potassium, sodium, and sulphate. Concentrations of these major ions are also reflected in compound measures of water quality parameters, such as total alkalinity, conductivity, total dissolved solids (TDS), and hardness. As a result, measurements of major ions and compound water quality parameters can covary and follow similar trends and patterns of change.
- Total Kjeldahl nitrogen (TKN) and organic carbon (TOC and DOC).
- Metals: arsenic, barium, lithium, manganese, strontium, uranium.

Table 3-3. Normal Range assessment for Meliadine Lake in 2023

Parameter	Units	Detection Limits (min | max)	Normal Range	Average Concentration (July-Sept)				
				MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
Conventional Parameters								
Conductivity (lab)	µS/cm	1.0	77.5	116	96.4	85.4	77.9	83.5
Hardness	mg/L	0.5	23.4	33.5	28.7	25.9	21.9	26.9
Total Dissolved Solids	mg/L	10	54	64	55.2	48.1	48.4	51.6
Total Dissolved Solids (Calculated)	mg/L	1.0	39.6	75.6	62.7	55.5	50.6	54.2
Major Ions								
Alkalinity, Total	mg/L	1.0	20.5	21	20.1	19.4	19.2	22.4
Calcium (T)	mg/L	0.01 | 0.02	7.33	10.2	8.9	8.27	7.82	8.17
Chloride	mg/L	0.1	9.56	16.6	13.1	11.1	10.4	11.1
Magnesium (T)	mg/L	0.004 | 0.01	1.18	1.88	1.52	1.4	1.29	1.31
Potassium (T)	mg/L	0.02 | 0.03	0.954	1.19	1.06	1.03	0.967	0.983
Reactive Silica (SiO2)	mg/L	0.01 | 0.1	0.268	0.544	0.435	0.342	0.331	0.409
Sodium (T)	mg/L	0.02	4.85	8.24	6.39	5.55	5.19	5.22
Sulphate	mg/L	0.3	3.87	7.21	5.55	4.46	4.28	4.49
Nutrients & Organic Carbon								
Total Kjeldahl Nitrogen	mg/L	0.05	0.25	0.273	0.252	0.225	0.198	0.204
Dissolved Organic Carbon	mg/L	0.5	2.72	4.28	3.99	3.47	4.27	3.93
Total Organic Carbon	mg/L	0.5	3	4.2	3.83	3.17	3.99	3.93
Metals								
Arsenic (T)	ug/L	0.02	0.275	0.642	0.749	0.406	0.364	0.492
Barium (T)	ug/L	0.02	8.05	9.53	9.14	8.81	8.66	8.99
Cobalt (T)	ug/L	0.005	0.016	0.0295	0.0188	0.0151	0.015	0.0153
Copper (T)	ug/L	0.05	0.86	0.992	1.09	0.907	1.08	0.877
Iron (T)	ug/L	1.0	15	24.6	16.1	13.8	8.14	12.1
Lithium (T)	ug/L	0.5	0.72	1.11	*0.914*	*0.839*	*0.816*	*0.818*
Manganese (T)	ug/L	0.05	3.06	9.5	5.33	3.96	3.76	5
Molybdenum (T)	ug/L	0.05	0.107	0.145	0.107	*0.0929*	*0.089*	*0.0962*
Nickel (T)	ug/L	0.05	0.441	0.829	0.699	0.525	0.64	0.503
Strontium (T)	ug/L	0.02	36.1	59.2	48.5	42.4	40.8	41.7
Titanium (T)**	ug/L	0.05	0.17	0.208	-	0.136	-	-
Uranium (T)	ug/L	0.001	0.0164	0.0284	0.0216	0.0204	0.0178	0.0188
Copper (D)	ug/L	0.05	0.861	0.972	1.2	0.845	1.44	1.02

Notes:
Italicized numbers indicate the mean concentration was <2*DL.
"-" = annual mean not calculated because more the 50% of the values were < DL.
Titanium was not carried forward as a parameter of interest. The median concentration in 2023 was 0.1 µg/L, below the normal range.
Light shaded values indicate the mean concentration exceeded the normal range.
Dark shaded values indicate the mean concentration exceeded the normal range by 20% or more.

Table 3-4. Annual mean concentrations at MEL-01 for parameters that exceed the Normal Range in 2023

Parameter	Normal Range	Average Concentration at MEL-01 (Open-Water Season)										2023 Rank	% Change from		
		2013	2015	2016	2017	2018	2019	2020	2021	2022	2023		Normal Range	Initial year	Previous year
Conventional Parameters															
Conductivity (lab)	77.5	64.4	68.9	74.1	80.7	86.2	82.6	109	107	116	116	**1**	50%	80%	0%
Hardness	23.4	19.3	20	22.5	24.1	24.7	22.7	29.5	28.1	31.3	33.5	**1**	43%	74%	7%
Total Dissolved Solids	54	40.3	38	45.1	53.4	54.4	49.2	70.6	56.9	64.5	64	3	19%	59%	-1%
Total Dissolved Solids (Calculated)	39.6	NA	33.1	37	41.5	42.4	41	55.3	51.8	56.4	75.6	**1**	91%	128%	34%
Major Ions															
Alkalinity, Total	20.5	16.9	14.1	15.8	17.3	16.1	16.5	19.5	17.5	21.7	21	2	2%	24%	-3%
Calcium (T)	7.33	6.17	6.36	7.22	7.85	7.77	7.16	8.79	8.4	9.56	10.2	**1**	39%	65%	7%
Chloride	9.56	7.57	8.6	9.35	10.6	12.7	11.9	17.8	16.2	16.2	16.6	2	74%	119%	2%
Magnesium (T)	1.18	1.05	1.1	1.23	1.37	1.39	1.31	1.74	1.63	1.79	1.88	**1**	59%	79%	5%
Potassium (T)	0.954	0.83	0.847	0.886	1.01	0.979	0.98	1.16	1.12	1.19	1.19	**1**	25%	43%	0%
Reactive Silica (SiO2)	0.268	0.5	0.358	0.427	0.546	0.39	NA	0.333	0.357	0.399	0.544	2	103%	9%	36%
Sodium (T)	4.85	3.85	4.37	4.8	5.32	5.63	5.58	8.17	7.7	8.01	8.24	**1**	70%	114%	3%
Sulphate	3.87	3.27	3.6	4.02	4.73	4.23	4.31	5.68	5.8	6.43	7.21	**1**	86%	120%	12%
Nutrients & Organic Carbon															
Total Kjeldahl Nitrogen	0.25	0.207	0.168	0.138	0.221	0.233	0.218	0.267	0.244	0.313	0.273	2	9%	32%	-13%
Dissolved Organic Carbon	2.72	2.68	2.88	2.69	3.32	3.07	2.8	3.44	3.47	4.19	4.28	**1**	57%	60%	2%
Total Organic Carbon	3	2.77	2.94	2.69	3.28	3.15	2.85	3.44	3.4	3.92	4.2	**1**	40%	52%	7%
Metals															
Arsenic (T)	0.275	0.42	0.338	0.4	0.434	0.385	0.398	0.523	0.524	0.576	0.642	**1**	133%	53%	11%
Barium (T)	8.05	6.57	6.82	7.33	7.95	8.33	7.68	8.49	8.44	8.62	9.53	**1**	18%	45%	11%
Cobalt (T)	0.016	0.1	0.0207	0.025	0.0225	0.0244	0.0275	0.0302	0.0361	0.0269	0.0295	4	84%	-71%	10%
Copper (T)	0.86	1.15	0.706	0.77	0.984	0.832	0.806	0.848	1.07	0.949	0.992	3	15%	-14%	5%
Iron (T)	15	24	19.7	22.2	25.4	25.1	32.4	25.9	31.4	23.2	24.6	6	64%	3%	6%
Lithium (T)	0.72	0.712	0.624	0.928	0.696	1.51	1.12	1.53	1.28	1.18	1.11	6	54%	56%	-6%
Manganese (T)	3.06	3.37	5.63	7.27	5.85	5.97	9.33	8.32	9.46	7.3	9.5	**1**	210%	182%	30%
Molybdenum (T)	0.107	0.0968	0.0621	0.0565	0.0827	0.077	0.0766	0.155	0.437	0.138	0.145	3	36%	50%	5%
Nickel (T)	0.441	0.692	0.534	0.566	0.699	0.672	0.638	0.781	0.733	0.795	0.829	**1**	88%	20%	4%
Strontium (T)	36.1	29	29	32.6	37.3	50.7	45.4	67.1	58.5	59.4	59.2	3	64%	104%	0%
Titanium (T)	0.17														
Uranium (T)	0.0164	0.0166	0.0139	0.0148	0.0185	0.0174	0.0155	0.0189	0.0215	0.0265	0.0284	**1**	73%	71%	7%
Copper (D)	0.861	0.812	0.846	0.928	1.08	0.751	0.785	0.827	0.854	0.939	0.972	2	13%	20%	4%

Notes:
% Change from = the difference between the annual mean concentration in 2022 and the normal range or mean concentration in 2021 or 2013.
NA = TDS calculated was not reported in 2013.
Light shaded values indicate the mean concentration exceeded the normal range;
Dark shaded values indicate the mean concentration exceeded the normal range by 20% or more.

Table 3-5. Results of the ANOVA and pairwise comparisons for parameters of interest in Meliadine Lake

Parameter	Sampling Area	ANOVA Model Estimates | Pairwise Statistical Differences Among Years | % Changes Relative to Previous Year									
		2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
Conventional Parameters											
Conductivity (lab)	MEL-01	64.44 | b | →	68.943 | ab | +7%	74.067 | a | +7%	80.653 | c | +9%	86.25 | c | +7%	82.5 | c | −4%	108.7 | d | +32%	106.9 | d | −2%	115.6 | e | +8%	116.2 | e | <1%
	MEL-02	-	70.527 | a | →	69.687 | a | −1%	74.607 | ab | +7%	76.82 | abc | +3%	80.2 | bc | +4%	84.1 | cd | +5%	88.8 | de | +6%	93.587 | ef | +5%	96.4 | f | +3%
	MEL-03	-	-	66.907 | b | →	68.113 | ab | +2%	70.23 | abc | +3%	75.353 | cd | +7%	73.247 | acd | −3%	77.2 | d | +5%	86.4 | e | +12%	85.4 | e | −1%
Hardness	MEL-01	19.3 | a | →	19.95 | a | +3%	22.54 | b | +13%	24.107 | cd | +7%	24.74 | c | +3%	22.733 | bd | −8%	29.5 | e | +30%	28.0 | e | −5%	31.2 | f | +11%	33.4 | g | +7%
	MEL-02	-	19.913 | b | →	21.313 | ab | +7%	22.087 | ac | +4%	21.456 | abc | −3%	23.193 | cd | +8%	24.313 | d | +5%	24.507 | d | <1%	26.5 | e | +8%	28.69 | f | +8%
	MEL-03	-	-	20.5 | a | →	20.987 | a | +2%	22.65 | ab | +8%	21.667 | a | −4%	21.84 | a | <1%	22.293 | ab | +2%	24.387 | bc | +9%	25.927 | c | +6%
Total Dissolved Solids	MEL-01	40.26 | ac | →	37.964 | a | −6%	45.067 | abc | +19%	53.4 | bd | +18%	54.4 | bd | +2%	49.2 | bcd | −10%	70.6 | e | +44%	56.944 | df | −19%	64.5 | ef | +13%	64.028 | ef | <1%
	MEL-02	-	38.653 | b | →	45.533 | ab | +18%	48.8 | ac | +7%	45.8 | ab | −6%	49.933 | ac | +9%	49.133 | ac | −2%	52.333 | ac | +6%	54.133 | c | +3%	55.187 | c | +2%
	MEL-03	-	-	40.98 | a | →	41.067 | a | <1%	38.6 | a | −6%	63.667 | b | +65%	45.133 | a | −29%	47.867 | a | +6%	51.467 | ab | +8%	48.053 | a | −7%
Total Dissolved Solids (Calculated)	MEL-01	-	33.064 | f | →	36.953 | a | +12%	41.493 | b | +12%	42.42 | b | +2%	41.04 | b | −3%	55.3 | c | +35%	51.778 | d | −6%	56.406 | c | +9%	75.583 | e | +34%
	MEL-02	-	33.847 | b | →	34.513 | ab | +2%	38.047 | ac | +10%	36.944 | ab | −3%	42.073 | cd | +14%	44.093 | d | +5%	42.807 | d | −3%	45.52 | d | +6%	62.68 | e | +38%
	MEL-03	-	-	32.993 | b | →	34.707 | ab | +5%	35.63 | abc | +3%	37.473 | cd | +5%	38.667 | d | +3%	37.167 | acd | −4%	42.073 | e | +13%	55.52 | f | +32%
Major Ions											
Alkalinity, Total	MEL-01	16.92 | bc | →	14.114 | a | −17%	15.807 | b | +12%	17.293 | bc | +9%	16.13 | bc | −7%	16.487 | bc | +2%	19.52 | d | +18%	17.533 | c | −10%	21.728 | e | +24%	21.017 | e | −3%
	MEL-02	-	14.887 | b | →	15.607 | ab | +5%	16.987 | ac | +9%	17.72 | cd | +4%	18.72 | de | +6%	20.267 | f | +8%	17.02 | ac | −16%	19.887 | ef | +17%	20.053 | ef | <1%
	MEL-03	-	-	15.547 | b | →	16.113 | ab | +4%	16.97 | ab | +5%	17.207 | a | +1%	19.767 | c | +15%	17 | a | −14%	19.167 | c | +13%	19.353 | c | +1%
Calcium (T)	MEL-01	6.174 | a | →	6.356 | a | +3%	7.219 | b | +14%	7.854 | c | +9%	7.767 | c | −1%	7.159 | b | −8%	8.793 | d | +23%	8.404 | d | −4%	9.562 | e | +14%	10.154 | f | +6%
	MEL-02	-	6.409 | e | →	6.945 | a | +8%	7.4 | b | +6%	7.435 | b | <1%	7.163 | ab | −4%	7.44 | b | +4%	7.538 | b | +1%	8.282 | c | +10%	8.896 | d | +7%
	MEL-03	-	-	6.579 | b | →	6.851 | ab | +4%	6.774 | ab | −1%	6.79 | ab | <1%	6.798 | ab | <1%	6.983 | a | +3%	7.763 | c | +11%	8.266 | d | +6%
Chloride	MEL-01	7.568 | a | →	8.601 | a | +14%	9.354 | ab | +9%	10.627 | bc | +14%	12.69 | d | +19%	11.88 | cd | −6%	17.8 | e | +50%	16.222 | f | −9%	16.211 | f | <1%	16.567 | ef | +2%
	MEL-02	-	8.821 | a | →	8.395 | a | −5%	9.376 | ab | +12%	9.372 | ab | <1%	10.885 | bc | +16%	11.927 | cd | +10%	12.167 | cd | +2%	12.021 | cd | −1%	13.12 | d | +9%
	MEL-03	-	-	7.758 | b | →	8.228 | ab | +6%	8.347 | ab | +1%	9.447 | a | +13%	9.388 | a | <1%	9.334 | a | <1%	10.911 | c | +17%	11.107 | c | +2%
Magnesium (T)	MEL-01	1.048 | a | →	1.098 | a | +5%	1.23 | b | +12%	1.365 | c | +11%	1.386 | c | +2%	1.315 | bc | −5%	1.743 | d | +33%	1.633 | e | −6%	1.786 | df | +9%	1.881 | f | +5%
	MEL-02	-	1.082 | a | →	1.134 | a | +5%	1.279 | bc | +13%	1.241 | ab | −3%	1.29 | bc | +4%	1.34 | bc | +4%	1.359 | bc | +1%	1.409 | cd | +4%	1.525 | d | +8%
	MEL-03	-	-	1.073 | a | →	1.121 | a | +4%	1.133 | a | +1%	1.174 | a | +4%	1.16 | a | −1%	1.153 | a | <1%	1.295 | b | +12%	1.401 | b | +8%
Potassium (T)	MEL-01	0.83 | a | →	0.847 | a | +2%	0.886 | a | +5%	1.005 | b | +13%	0.979 | b | −3%	0.98 | b | <1%	1.157 | cd | +18%	1.116 | c | −4%	1.194 | d | +7%	1.195 | d | <1%
	MEL-02	-	0.852 | a | →	0.875 | a | +3%	0.953 | b | +9%	0.951 | bc | <1%	0.979 | bcd | +3%	1.012 | cde | +3%	1.021 | de | <1%	1.057 | e | +4%	1.057 | e | <1%
	MEL-03	-	-	0.849 | b | →	0.915 | a | +8%	0.886 | ab | −3%	0.927 | a | +5%	0.936 | a | <1%	0.942 | a | <1%	1.029 | c | +9%	1.028 | c | <1%
Sodium (T)	MEL-01	3.848 | a | →	4.366 | a | +13%	4.805 | ab | +10%	5.325 | bc | +11%	5.633 | bc | +6%	5.585 | c | <1%	8.167 | d | +46%	7.7 | d | −6%	8.014 | d | +4%	8.244 | d | +3%
	MEL-02	-	4.37 | a | →	4.469 | a | +2%	4.771 | ab | +7%	4.936 | abc | +4%	5.71 | bcd | +16%	5.742 | cd | <1%	5.959 | cd | +4%	6.071 | d | +2%	6.391 | d | +5%
	MEL-03	-	-	4.242 | b | →	4.356 | ab | +3%	4.386 | ab | <1%	5.007 | ac | +14%	4.743 | ab | −5%	4.75 | ab | <1%	5.596 | c | +18%	5.545 | c | <1%
Sulphate	MEL-01	3.268 | b | →	3.598 | ab | +10%	4.023 | abc | +12%	4.732 | d | +18%	4.225 | acd | −11%	4.309 | cd | +2%	5.677 | e | +32%	5.802 | e | +2%	6.434 | f | +11%	7.211 | g | +12%
	MEL-02	-	3.665 | a | →	3.579 | a | −2%	4.065 | b | +14%	3.866 | ab | −5%	4.119 | bc | +7%	4.425 | cd | +7%	4.484 | d | +1%	4.636 | d | +3%	5.548 | e | +20%
	MEL-03	-	-	3.251 | d | →	3.517 | a | +8%	3.528 | a | <1%	3.742 | a | +6%	3.747 | a | <1%	3.674 | a | −2%	4.021 | b | +10%	4.459 | c | +11%

Table 3-5. Results of the ANOVA and pairwise comparisons for parameters of interest in Meliadine Lake

Parameter	Sampling Area	ANOVA Model Estimates | Pairwise Statistical Differences Among Years | % Changes Relative to Previous Year									
		2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
Nutrients & Organic Carbon											
Total Kjeldahl Nitrogen	MEL-01	0.207 | abcd | →	0.168 | ab | −19%	0.138 | a | −18%	0.221 | bc | +61%	0.233 | bcd | +6%	0.218 | bc | −6%	0.267 | cd | +22%	0.244 | cd | −9%	0.313 | d | +29%	0.273 | cd | −13%
	MEL-02	-	0.214 | bc | →	0.137 | a | −36%	0.17 | ab | +24%	0.233 | bc | +37%	0.2 | abc | −14%	0.264 | c | +32%	0.222 | bc | −16%	0.221 | bc | <1%	0.252 | c | +14%
	MEL-03	-	-	0.143 | a | →	0.158 | a | +10%	0.182 | abc | +15%	0.167 | ab | −8%	0.209 | bc | +25%	0.138 | a | −34%	0.224 | c | +62%	0.225 | c | <1%
Total Phosphorus	MEL-01	0.004 | a | →	0.006 | a | +74%	0.008 | a | +32%	0.007 | a | −23%	0.006 | a | −4%	0.006 | a | −1%	0.008 | a | +27%	0.007 | a | −7%	0.007 | a | −7%	0.006 | a | −12%
	MEL-02	-	0.005 | ab | →	0.005 | ab | −6%	0.005 | a | +15%	0.003 | b | −44%	0.004 | ab | +40%	0.006 | a | +36%	0.005 | a | −7%	0.004 | ab | −27%	0.004 | ab | +13%
	MEL-03	-	-	0.005 | b | →	0.005 | ab | −2%	0.003 | c | −39%	0.003 | ac | +14%	0.003 | abc | <1%	0.004 | abc | +21%	0.003 | ac | −20%	0.004 | abc | +22%
Dissolved Organic Carbon	MEL-01	2.676 | ab | →	2.881 | ab | +8%	2.69 | a | −7%	3.319 | cd | +23%	3.072 | bc | −7%	2.799 | ab | −9%	3.445 | d | +23%	3.474 | d | <1%	4.187 | e | +20%	4.285 | e | +2%
	MEL-02	-	2.739 | bc | →	2.399 | a | −12%	2.893 | b | +21%	2.725 | abc | −6%	2.518 | ac | −8%	2.985 | b | +18%	3.025 | b | +1%	3.819 | d | +26%	3.986 | d | +4%
	MEL-03	-	-	2.294 | ab | →	2.217 | a | −3%	2.346 | ab | +6%	2.206 | a | −6%	2.209 | a | <1%	2.633 | b | +19%	3.171 | c | +20%	3.469 | c | +9%
Total Organic Carbon	MEL-01	2.77 | ab | →	2.937 | ab | +6%	2.689 | a | −8%	3.281 | c | +22%	3.151 | bc | −4%	2.851 | ab | −10%	3.436 | c | +20%	3.398 | c | −1%	3.923 | d | +15%	4.197 | e | +7%
	MEL-02	-	2.619 | a | →	2.415 | a | −8%	2.967 | b | +23%	2.668 | ac | −10%	2.623 | a | −2%	3.059 | b | +17%	2.923 | bc | −4%	3.561 | d | +22%	3.825 | e | +7%
	MEL-03	-	-	2.269 | a | →	2.269 | a | <1%	2.309 | ab | +2%	2.345 | ab | +2%	2.154 | a | −8%	2.587 | b | +20%	2.905 | c | +12%	3.167 | c | +9%
Metals											
Arsenic (T)	MEL-01	0.42 | abd | →	0.338 | a | −19%	0.4 | ab | +18%	0.434 | b | +8%	0.385 | ab | −11%	0.398 | ab | +3%	0.523 | cd | +31%	0.524 | cd | <1%	0.576 | ce | +10%	0.642 | e | +11%
	MEL-02	-	0.244 | a | →	0.258 | a | +6%	0.266 | a | +3%	0.257 | a | −3%	0.296 | a | +15%	0.471 | b | +60%	0.56 | c | +19%	0.592 | c | +6%	0.749 | d | +27%
	MEL-03	-	-	0.198 | a | →	0.199 | a | <1%	0.196 | a | −1%	0.222 | a | +13%	0.271 | b | +22%	0.341 | c | +26%	0.333 | c | −2%	0.406 | d | +22%
Barium (T)	MEL-01	6.572 | a | →	6.821 | a | +4%	7.329 | b | +7%	7.949 | cd | +8%	8.328 | ce | +5%	7.676 | bd | −8%	8.494 | e | +11%	8.436 | e | <1%	8.62 | e | +2%	9.527 | f | +10%
	MEL-02	-	7.305 | b | →	7.662 | ab | +5%	7.761 | ac | +1%	8.15 | cd | +5%	8.046 | acd | −1%	8.32 | d | +3%	8.151 | cd | −2%	7.853 | ac | −4%	9.141 | e | +16%
	MEL-03	-	-	7.482 | bc | →	7.492 | abc | <1%	7.579 | abc | +1%	7.305 | b | −4%	7.766 | ac | +6%	7.815 | a | <1%	7.789 | ac | <1%	8.812 | d | +13%
Cobalt (T)	MEL-01	0.1 | c | →	0.021 | a | −79%	0.025 | a | +21%	0.023 | a | −10%	0.024 | ab | +8%	0.027 | ab | +13%	0.03 | ab | +10%	0.036 | b | +19%	0.027 | ab | −26%	0.029 | ab | +10%
	MEL-02	-	0.018 | a | →	0.014 | a | −22%	0.016 | a | +14%	0.018 | a | +11%	0.016 | a | −8%	0.018 | a | +9%	0.018 | a | +4%	0.014 | a | −26%	0.019 | a | +38%
	MEL-03	-	-	0.012 | acd | →	0.01 | a | −22%	0.017 | b | +73%	0.013 | cd | −22%	0.012 | acd | −4%	0.012 | ac | −6%	0.012 | ac | <1%	0.015 | bd | +30%
Copper (T)	MEL-01	1.148 | d | →	0.706 | a | −38%	0.77 | ab | +9%	0.984 | cd | +28%	0.832 | abc | −15%	0.806 | abc | −3%	0.848 | abc | +5%	1.067 | d | +26%	0.949 | bcd | −11%	0.992 | cd | +5%
	MEL-02	-	0.754 | a | →	0.789 | ab | +5%	0.934 | ab | +18%	0.727 | a | −22%	0.923 | ab | +27%	0.999 | ab | +8%	0.907 | ab | −9%	0.807 | ab | −11%	1.086 | b | +35%
	MEL-03	-	-	0.685 | a | →	0.795 | ab | +16%	0.708 | ab | −11%	0.98 | ab | +38%	0.676 | a | −31%	1.129 | b | +67%	0.747 | ab | −34%	0.907 | ab | +21%
Iron (T)	MEL-01	24 | ab | →	19.686 | a | −18%	22.227 | ab | +13%	25.367 | ab | +14%	25.07 | ab | −1%	32.433 | b | +29%	25.94 | ab | −20%	31.433 | b | +21%	23.167 | ab | −26%	24.606 | ab | +6%
	MEL-02	-	18.013 | ab | →	14.02 | ab | −22%	15.233 | ab | +9%	19.28 | ab | +27%	20.82 | a | +8%	17.633 | ab | −15%	15.667 | ab | −11%	11.14 | b | −29%	16.08 | ab | +44%
	MEL-03	-	-	12.32 | a | →	10.887 | a | −12%	14.97 | a | +38%	13.887 | a | −7%	12.88 | a | −7%	11.013 | a | −14%	10.027 | a | −9%	13.846 | a | +38%
Lithium (T)	MEL-01	0.712 | ac | →	0.624 | a | −12%	0.928 | bc | +49%	0.696 | a | −25%	1.507 | d | +116%	1.123 | be | −26%	1.532 | d | +36%	1.279 | e | −16%	1.178 | e | −8%	1.108 | be | −6%
	MEL-02	-	0.593 | c | →	0.793 | ab | +34%	0.628 | ac | −21%	0.819 | ab | +30%	0.852 | b | +4%	0.942 | b | +11%	0.949 | b | <1%	0.937 | b | −1%	0.914 | b | −2%
	MEL-03	-	-	0.534 | c | →	0.619 | ab | +16%	0.555 | ac | −10%	0.653 | b | +18%	0.679 | bd | +4%	0.742 | de | +9%	0.817 | ef | +10%	0.839 | f | +3%
Manganese (T)	MEL-01	3.374 | b | →	5.634 | ab | +67%	7.27 | ab | +29%	5.846 | ab | −20%	5.971 | ab | +2%	9.331 | ab | +56%	8.316 | ab | −11%	9.455 | a | +14%	7.301 | ab | −23%	9.501 | a | +30%
	MEL-02	-	3.586 | ac | →	4.785 | ab | +33%	4.271 | abc | −11%	4.218 | abc | −1%	4.247 | abc | <1%	3.941 | ac | −7%	3.905 | ac | <1%	3.107 | c | −20%	5.334 | b | +72%
	MEL-03	-	-	2.762 | a | →	2.261 | ab | −18%	2.8 | a | +24%	2.521 | ab | −10%	2.721 | a | +8%	2.512 | ab | −8%	1.9 | b | −24%	3.958 | c | +108%
Molybdenum (T)	MEL-01	0.097 | a | →	0.062 | a | −36%	0.056 | a | −9%	0.083 | a | +46%	0.077 | a | −7%	0.077 | a | <1%	0.155 | a | +103%	0.437 | a | +181%	0.138 | a | −68%	0.145 | a | +5%
	MEL-02	-	0.061 | a | →	0.056 | a | −8%	0.083 | a | +48%	0.08 | a | −4%	0.07 | a | −12%	0.47 | a | +574%	0.085 | a | −82%	0.125 | a | +47%	0.107 | a | −15%
	MEL-03	-	-	0.055 | a | →	0.073 | a | +32%	0.077 | a | +6%	0.07 | a | −8%	0.987 | a | +1304%	0.08 | a | −92%	0.087 | a | +10%	0.093 | a | +6%
Nickel (T)	MEL-01	0.692 | cde | →	0.534 | a | −23%	0.566 | ab | +6%	0.699 | cd | +23%	0.672 | cd | −4%	0.638 | bc | −5%	0.781 | ef | +22%	0.733 | de | −6%	0.795 | ef | +8%	0.829 | f | +4%
	MEL-02	-	0.503 | ac | →	0.479 | a | −5%	0.527 | abc | +10%	0.63 | bd | +20%	0.529 | abc | −16%	0.618 | bd | +17%	0.582 | bc | −6%	0.554 | abc | −5%	0.699 | d | +26%
	MEL-03	-	-	0.361 | b | →	0.406 | ab | +12%	0.497 | ac | +22%	0.388 | ab | −22%	0.422 | ab | +9%	0.428 | abc | +1%	0.429 | abc | <1%	0.525 | c | +22%

Table 3-5. Results of the ANOVA and pairwise comparisons for parameters of interest in Meliadine Lake

		ANOVA Model Estimates | Pairwise Statistical Differences Among Years | % Changes Relative to Previous Year									
Parameter	**Sampling Area**	**2013**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Strontium (T)	MEL-01	28.98 | a | →	29.036 | a | <1%	32.58 | ab | +12%	37.3 | b | +14%	50.72 | c | +36%	45.353 | c | −11%	67.08 | d | +48%	58.467 | e | −13%	59.394 | e | +2%	59.222 | e | <1%
	MEL-02	-	28.993 | f | →	31.34 | a | +8%	35.473 | b | +13%	37.67 | bc | +6%	39.627 | c | +5%	43.54 | d | +10%	46.247 | e | +6%	46.673 | e | <1%	48.453 | e | +4%
	MEL-03	-	-	30.06 | a | →	31.373 | a | +4%	32.29 | ab | +3%	33.68 | bc | +4%	35.553 | cd | +6%	37.087 | d | +4%	41.387 | e | +12%	42.45 | e | +3%
Titanium (T)	MEL-01	10 | d | →	0.151 | ab | −98%	0.115 | ab | −24%	0.521 | c | +354%	0.173 | ab | −67%	0.354 | ac | +105%	0.114 | ab | −68%	0.335 | ac | +194%	0.084 | b | −75%	0.208 | ab | +149%
	MEL-02	-	0.281 | ab | →	0.1 | a | −64%	0.5 | b | +400%	0.102 | a | −80%	0.161 | a | +58%	0.078 | a | −52%	0.115 | a | +48%	0.052 | a | −54%	0.062 | a | +19%
	MEL-03	-	-	0.139 | b | →	0.5 | a | +261%	0.105 | b | −79%	0.209 | b | +99%	0.106 | b | −49%	0.089 | b | −16%	0.149 | b | +67%	0.136 | b | −9%
Uranium (T)	MEL-01	0.017 | abc | →	0.014 | a | −16%	0.015 | a | +6%	0.019 | bc | +25%	0.017 | ab | −6%	0.015 | ab | −11%	0.019 | bc | +22%	0.022 | c | +14%	0.026 | d | +23%	0.028 | d | +7%
	MEL-02	-	0.015 | a | →	0.015 | a | −4%	0.017 | ab | +14%	0.015 | a | −7%	0.015 | a | −2%	0.016 | a | +4%	0.016 | ab | +1%	0.018 | b | +15%	0.022 | c | +18%
	MEL-03	-	-	0.014 | a | →	0.015 | a | +6%	0.018 | ab | +17%	0.016 | a | −12%	0.014 | a | −9%	0.015 | a | +7%	0.018 | ab | +18%	0.02 | b | +14%
Copper (D)	MEL-01	0.812 | ab | →	0.846 | ab | +4%	0.928 | ab | +10%	1.077 | a | +16%	0.751 | b | −30%	0.785 | b | +4%	0.827 | b | +5%	0.854 | ab | +3%	0.939 | ab | +10%	0.972 | ab | +4%
	MEL-02	-	0.922 | ab | →	0.869 | ab | −6%	0.958 | ab | +10%	0.716 | ab | −25%	0.702 | a | −2%	0.789 | ab | +12%	0.83 | ab | +5%	0.809 | ab | −2%	1.204 | b | +49%
	MEL-03	-	-	0.792 | bc | →	0.767 | abc | −3%	0.67 | ab | −13%	0.737 | abc | +10%	0.645 | a | −12%	0.771 | abc | +20%	0.731 | abc | −5%	0.845 | c | +16%

Notes

Difference letters indicated statistically significant differences between years ($p < 0.05$).

Major Ions and Compound Water Quality Parameters

Major ions (dissolved salts) are the ionic compounds found in greatest abundance in freshwater systems. They include the cations (e.g., calcium, magnesium, potassium, and sodium) and the anions (e.g., chloride, bicarbonate, and sulphate). Concentrations of these major ions are also reflected in composite parameters: conductivity, hardness, total alkalinity, and total dissolved solids (TDS). As a result, measurements of major ions and compound water quality parameters can covary and follow similar trends and patterns of change. Temporal and spatial changes in major ions and compound water quality parameters are discussed below, supported by the statistical analyses and plots:

- Composite parameters (conductivity, hardness, total alkalinity, and TDS): **Figure 3-6**
- Major cations (calcium, magnesium, potassium, and sodium): **Figure 3-7**
- Major anions (chloride and sulphate): **Figure 3-8**

Major ions have trended higher at MEL-01 dating back to 2016, but the biggest changes occurred between 2019 and 2020 (**Figure 3-6**). Since 2020, the concentrations of calcium, magnesium, and sulphate at MEL-01 have continued to increase year-over-year while chloride, sodium, and potassium have remained relative stable. The pattern of change is generally that same at MEL-02 and MEL-03, but more gradual compared to MEL-01 (i.e., no large step increase between 2019 and 2020). Annual loadings shown in **Figure 2-10** suggest effluent is the leading cause of the temporal trend for sulphate at MEL-01 since 2020. The relative stable pattern for chloride since 2020 matches lower total loadings in recent years compared to 2020 (**Figure 2-10**).

Effluent has contributed to an increase in the concentration of major ions in the East Basin, but the gradual increase observed for some major ions at reference area MEL-03 suggests natural climate variability may also be responsible. As mentioned in **Section 2.2**, the area experienced an unusually high rainfall in July and August 2019, which likely led to substantial runoff from the surrounding tundra based on the large volume of surface contact water that was discharged in June and July 2020. One of the well-know effects of climate change in northern regions is an increase the depth of the active layer (the top layer of the permafrost that thaws annually). Researchers studying the effects of climate change on water quality in northern latitude lakes have hypothesized a deeper active layer would expose mineral soils and contribute to higher concentrations of major ions (e.g. calcium, magnesium, sulphate) (Frey & McClelland, 2009; Vonk et al., 2015). The temporal trends at MEL-03 align with this hypothesis.

Figure 3-6. Spatial and temporal changes in conductivity, hardness, total alkalinity, and total dissolved solids in Meliadine Lake from 2013 to 2023

Note: ANOVA results (model fits ± 95% confidence intervals) are shown along with pairwise comparisons from Tukey post hot tests; within each sampling area, years that do not share a similar letter are statistically different (α = 0.05). The percentages indicate year-to-year changes in water quality parameters.

The measured TDS results from MEL-03 in 2019 were flagged by the laboratory as being anomalous. They were retained in the dataset but are not considered representative of conditions in the reference area in 2019.

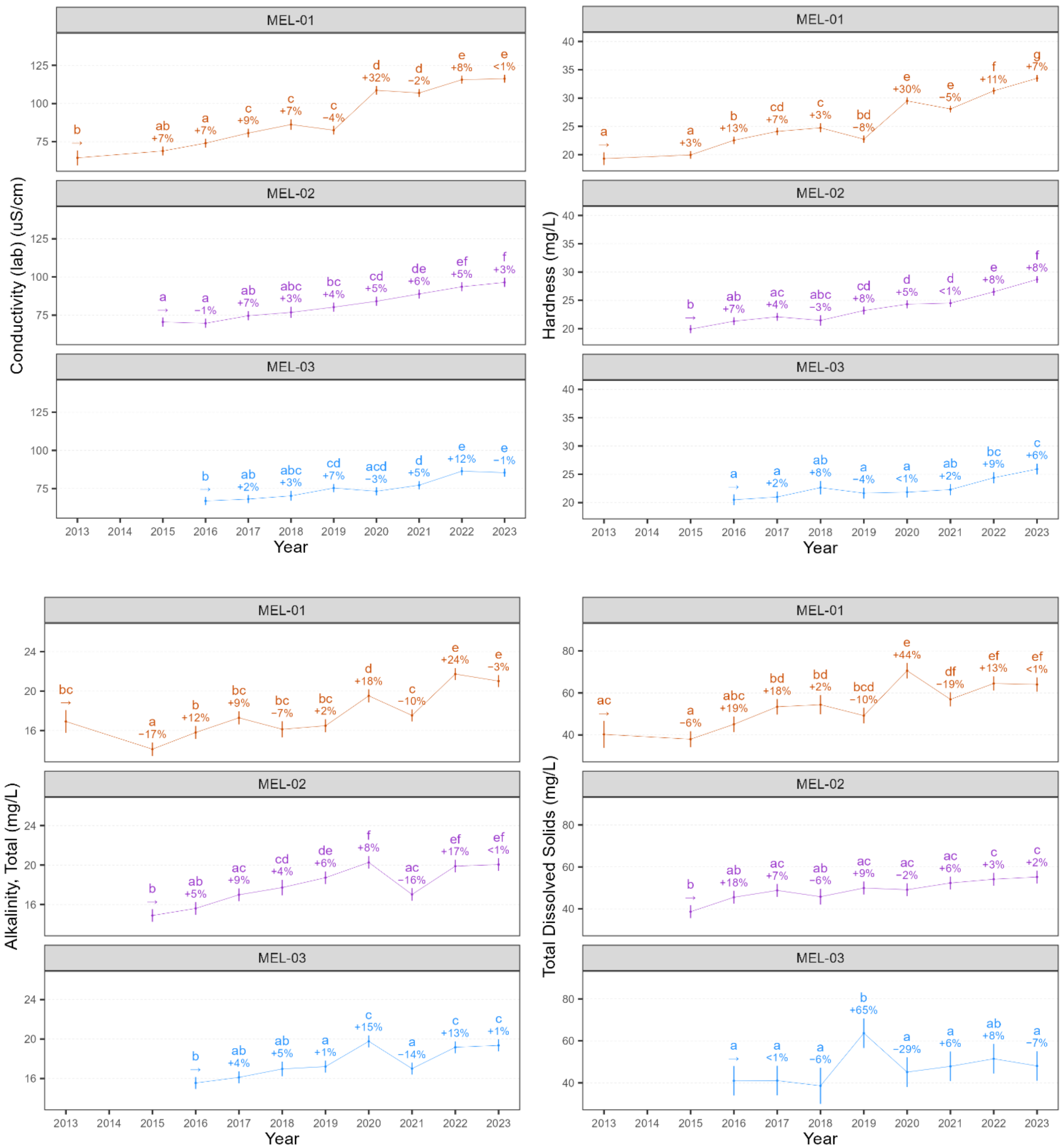


Figure 3-7. Spatial and temporal changes in major cations (Ca, Mg, K, Na) in Meliadine Lake from 2013 to 2023

Note: ANOVA results (model fits ± 95% confidence intervals) are shown along with pairwise comparisons from Tukey post hot tests; within each sampling area, years that do not share a similar letter are statistically different (α = 0.05). The percentages indicate year-to-year changes in water quality parameters.

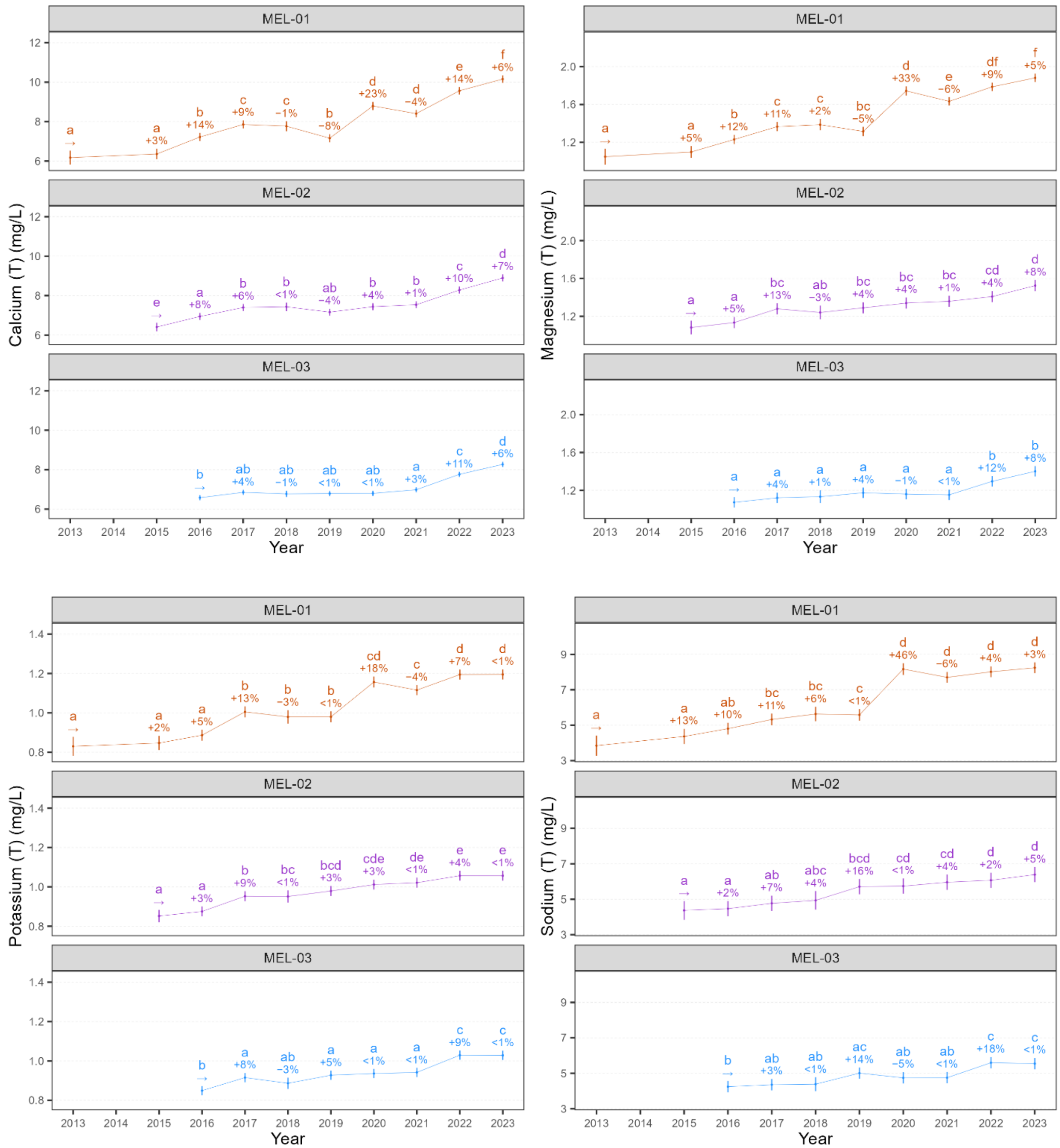
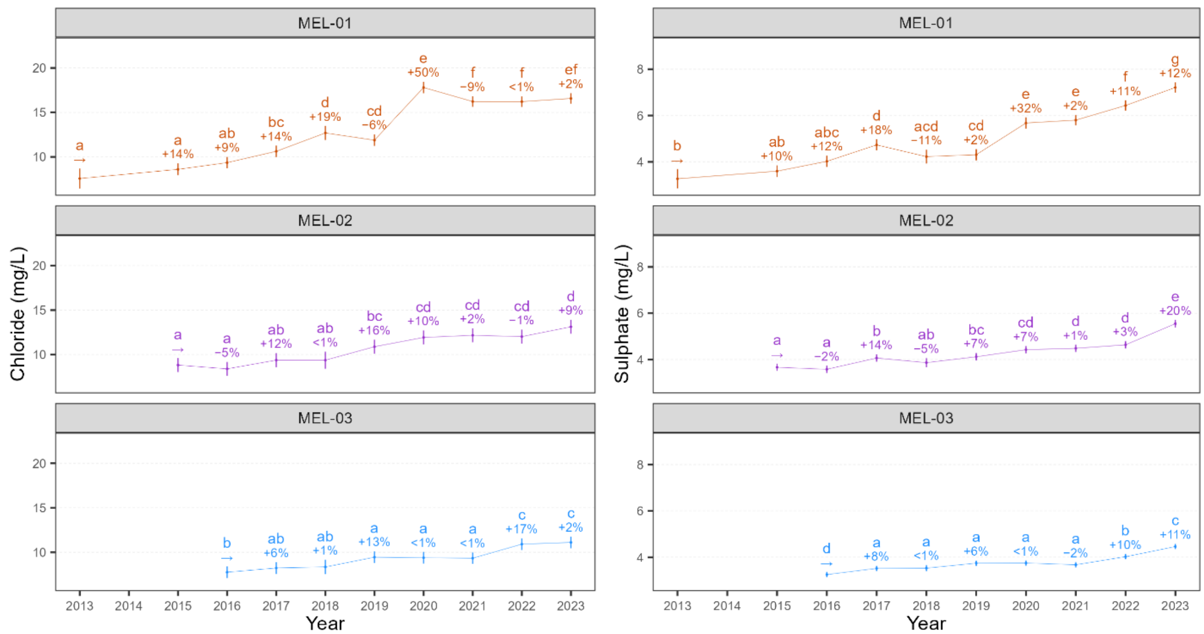


Figure 3-8. Spatial and temporal changes in chloride and sulphate in Meliadine Lake from 2013 to 2023

Note: ANOVA results (model fits ± 95% confidence intervals) are shown along with pairwise comparisons from Tukey post hot tests; within each sampling area, years that do not share a similar letter are statistically different (α = 0.05). The percentages indicate year-to-year changes in water quality parameters.



Nutrients & Organic Carbon

Temporal and spatial changes in key nutrients and organic carbon components are discussed below, with a focus on results from statistical analyses (ANOVA and Tukey post hoc test at alpha = 0.05) performed using parameters that exceeded the normal range in 2023. These parameters included Total Kjeldahl Nitrogen (TKN; the sum of organic nitrogen and ammonia) and organic carbon (total and dissolved). Total phosphorus is also included in the discussion because of questions around natural versus mining-related differences in primary productivity between the East Basin of Meliadine Lake compared to MEL-02 and the reference areas.

TKN was flagged as a parameter of interest based on the normal range assessment at MEL-01. Looking at the condensed temporal plot (**Figure 3-15**), TKN concentrations have increased in a similar pattern in the East Basin and at the reference areas throughout the pre-construction, construction, and operations phase. At MEL-01, the concentration exceeded the normal range in 2023, but concentrations were on average 13% lower in 2023 compared to 2022. At MEL-02, TKN concentrations trended higher in 2023 (14% increase compared to 2022). In MEL-03, 2023 results remained largely unchanged compared to 2022. While recent measurements (2022-2023) are still higher than those measured during early years

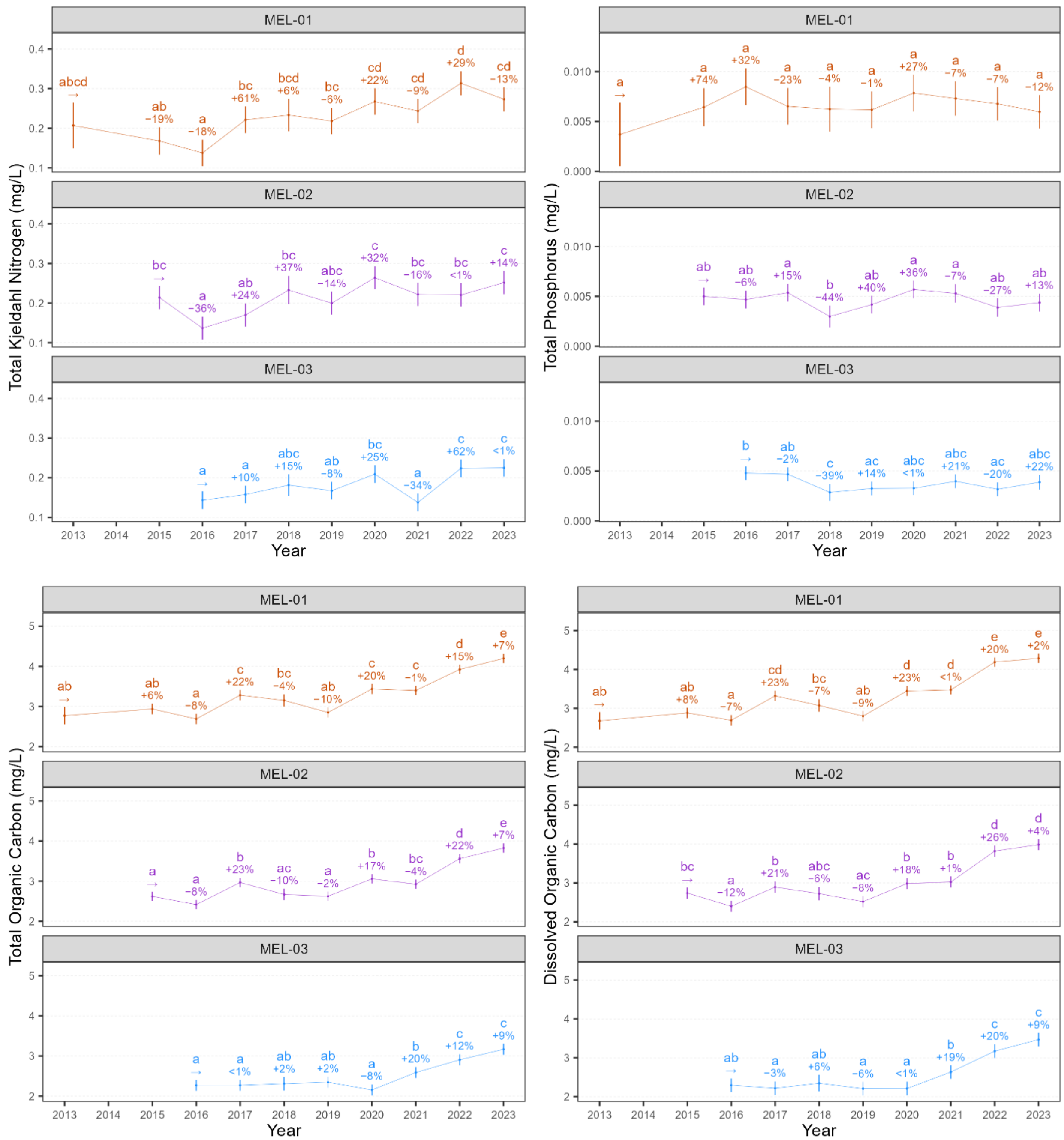
(2013-2015), concentrations of TKN appear to be stable in Meliadine Lake, with no statistical differences among recent sampling events.

Total organic carbon (TOC) and dissolved organic carbon (DOC) concentrations have trended higher throughout Meliadine Lake, particularly since 2019. The temporal trend is evident in **Figure 3-9**, and the magnitude of the increase for TOC and DOC from 2021 to 2023 was between 20 and 30 %. In general, TOC concentrations have gone up by roughly 1-1.5 mg/L at MEL-01, MEL-02, and MEL-03 compared to baseline. Mining activities do not appear to be a leading cause of the increase in organic carbon in Meliadine Lake based on the concentration of organic carbon in MEL-14 and loadings from CP1 compared to the volume of the East Basin. Since 2018, the cumulative load of organic carbon to Meliadine Lake was 30,000 kg (see **Figure B2-18**). Conservatively assuming that the entire 30,000 kg mass of TOC from 2018 to 2023 stayed in the surface water of East Basin (98,851,000 m^3), the concentration of TOC in the East Basin would have increased by approximately 0.3 mg/L since 2018. Effluent may be a minor source of organic carbon to Meliadine Lake, but the primary cause of the observed increase in TOC is most likely wider climatic trends leading to deepening of the active layer and increased runoff from the tundra.

Total phosphorus concentrations have decreased year-over-year at MEL-01 since 2020. In 2023, the annual mean concentration of phosphorus at MEL-01 during the open water period decreased by 12% compared to 2022. Concentrations at MEL-02 and MEL-03 have remained stable throughout the monitoring period (**Figure 3-9**). The downward trend in total phosphorus at MEL-01 demonstrates that the Water Management Plan has been effective at decreasing phosphorus loadings to Meliadine Lake.

Figure 3-9. Spatial and temporal changes in phosphorus and organic carbon in Meliadine Lake (2013 to 2023).

Note: ANOVA results (model fits ± 95% confidence intervals) are shown along with pairwise comparisons from Tukey post hot tests; within each sampling area, years that do not share a similar letter are statistically different (α = 0.05). The percentages indicate year-to-year changes in water quality parameters.



Metals

The discussion below focuses on temporal and spatial trends for metals that exceeded the normal range in 2023 and where concentrations were trending higher in 2023 compared to 2022 (supported by the ANOVA and pairwise comparisons in **Table 3-5**).

The following metals have increased in recent years: arsenic, barium, lithium, manganese, strontium, and uranium. Some of these parameters appear to be trending higher (e.g., arsenic and uranium) while other parameters appear to have stabilized since 2019 (e.g., lithium and strontium) (**Figure 3-10**). The concentrations of arsenic, barium, and uranium increased at MEL-01 in 2023 compared to 2022 and the differences were statistically significant ($p<0.05$). On average, the concentrations of these metals at MEL-01 increased between 7 and 11 % in 2023 compared to 2022. The same temporal trend was observed at MEL-02 and MEL-03 and the magnitude of increases were generally higher compared to MEL-01. For example, arsenic concentrations increased 27 % at MEL-02 and 22 % at MEL-03 between 2022 and 2023 whereas the concentration at MEL-01 increased 11 %. Manganese was also higher in 2023 compared to 2022 at all three areas and the differences were statistically significant for MEL-02 and MEL-03.

Strontium concentrations at MEL-01 increased by nearly 50% between 2019 and 2020. Since 2020, concentrations appear to have stabilized. Downstream at MEL-02, the temporal trend has been more gradual, which may indicate a lag as effluent slowly mixes beyond MEL-01.

Temporal trends for lithium at MEL-01 closely match loadings from CP1 to Meliadine Lake. The increasing temporal trend for lithium started between 2017 and 2018, coinciding with the first year of discharge to Meliadine Lake. On average, lithium concentrations at MEL-01 increased by 116% between 2017 and 2018. From 2018 to 2019, concentrations decreased by 26% as less water was discharged to Meliadine Lake. Lithium concentrations peaked again in 2020 along with several other parameters. However, there has been an overall downward trend since 2021 that broadly aligns with lower concentrations of lithium in effluent and corresponding reductions in annual loadings between 2021 and 2023 (**Figure B2-31**).

Based on the available data, it is not possible to say conclusively whether effluent or climate-related factors are the leading cause of the observed increase in the concentration of some metals since 2018. The timing and magnitude of the increases for arsenic and uranium appear more closely aligned with effluent as the source, although regional trends are like a contributing factor. Manganese and barium show more gradual lake-wide changes that appear decoupled from any effluent related pattern. The underlying cause of the changes in water quality are an uncertainty in the AEMP. However, the magnitude of the increases for these parameters of interest represents a small fraction of the guidelines for protection of aquatic life and human health.

Figure 3-10. Spatial and temporal changes in arsenic, barium, lithium, manganese, strontium, and uranium (2013 to 2023)

Note: ANOVA results (model fits ± 95% confidence intervals) are shown along with pairwise comparisons from Tukey post hot tests; within each sampling area, years that do not share a similar letter are statistically different (α = 0.05). The percentages indicate year-to-year changes in water quality parameters.

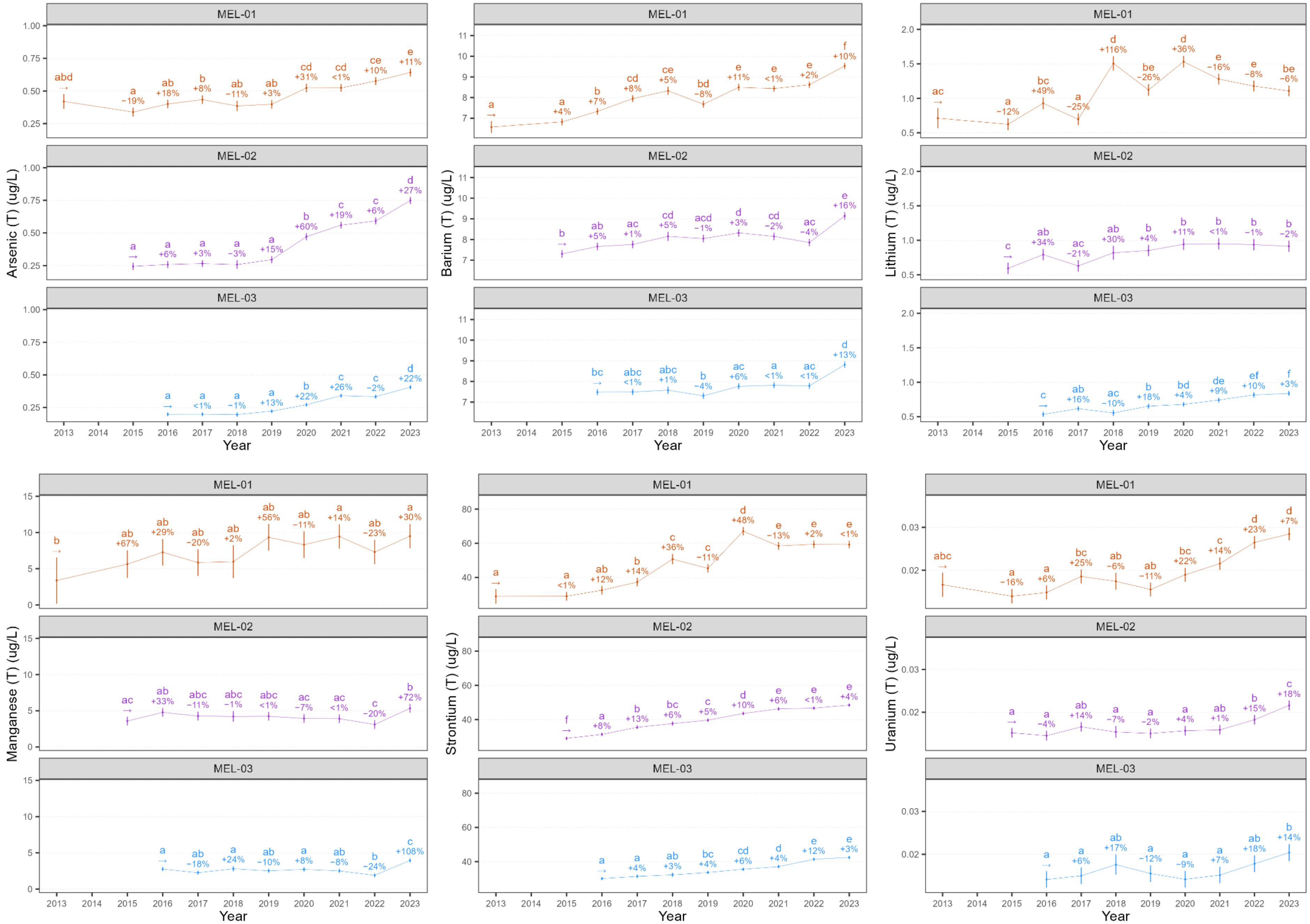
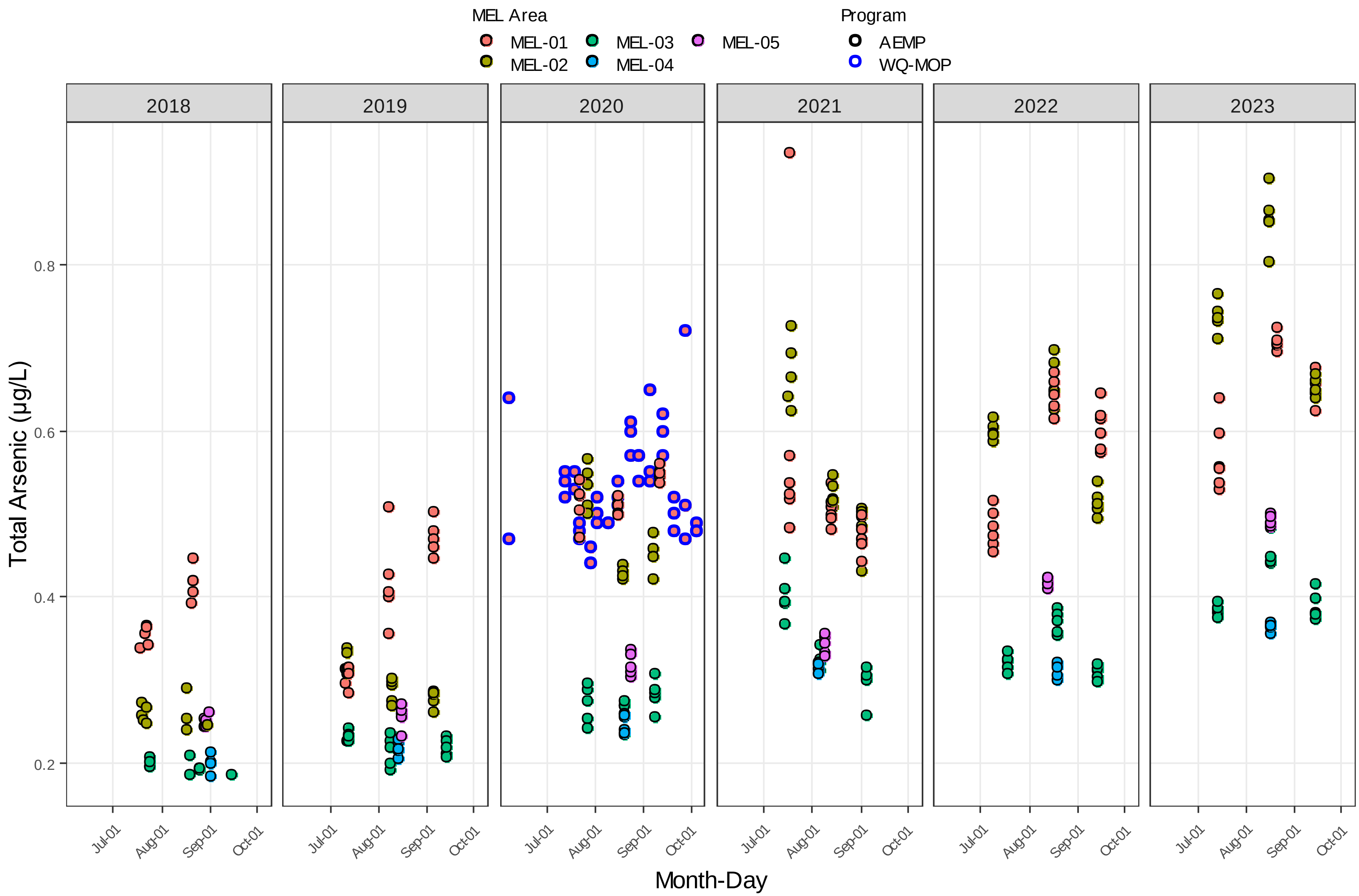


Figure 3-11. Temporal trends for arsenic from July to September, 2018-2023



3.4.4 Comparison to Water Quality Predictions

The prediction for TDS and chloride in the 2014 FEIS (Agnico Eagle, 2014) and the 2020 hydrodynamic model are shown in **Figure 3-12** and **Figure 3-13**, respectively.

Total Dissolved Solids

The Tetra Tech model predicted TDS would increase more rapidly than the far-field mixing model in the 2014 FEIS. The Tetra Tech base case[8] model predicted maximum TDS concentrations at the edge of the mixing zone would increase from 89 mg/L in 2020 to 153 mg/L in 2021. From 2022 to 2028, a relatively modest increase in TDS of 17 mg/L was predicted. The 2014 FEIS predicted a more gradual increase in TDS from early through late operations, with peak TDS of 176 mg/L occurring around 2030 before gradually decreasing as the Mine transitions from operations to closure. The timing of mine development in the 2014 FEIS is slightly different than the current life of the mine based on development of the Tiriganiaq deposit.

Monthly mean concentrations of TDS at MEL-01 in July, August, and September 2023 were 70 mg/L, 57 mg/L, and 65 mg/L, respectively. The East Basin has shown capacity to assimilate major ions from CP1 and TDS has increased gradually, as predicted in the 2014 FEIS, as opposed to the rapid increase that was predicted in the Tetra Tech model (**Figure 3-12**). The discrepancy between the modelled and observed increase in TDS is due to the combined effect of less effluent and lower concentrations of TDS in effluent. TDS concentrations in weekly samples from MEL-14 in 2023 ranged between 780 mg/L in July to approximately 2,200 mg/L in September (Figure 2-6). By comparison, the Tetra Model assumed a continuous concentration of 3,500 mg/L, equal to the maximum average concentration in the Water Licence.

Chloride

Chloride concentrations in the 18 samples collected at MEL-01 in July, August, and September 2023 ranged from 15 mg/L to 18 mg/L. Current concentrations are approximately 50% lower than the predicted concentration of 38 mg/L at the edge of the mixing zone in 2023 assuming median effluent concentrations and average dilution (Tetra Tech, 2020) (**Figure 3-13**).

[8] The base case scenario used estimates for mean precipitation. The wet year scenario corresponds to wet conditions applied to years 2021, 2025 and 2026, with year 2025 corresponding to a 100-year return period precipitation (Golder, August 2020). Other years present an average trend in terms of precipitation.

Figure 3-12. Predicted versus measured concentrations of Total Dissolved Solids (calculated; mg/L) in the East Basin of Meliadine Lake

Notes: The FEIS (2014) predictions (purple line) were presented in Volume 7.4-A of Agnico Eagle (2014). The blue dashed line represents the updated model prediction for changes in TDS from 2018 to 2028 (Tetra Tech 2020). The dots represent the observed TDS calculated data collected to date from the NF area as part of the AEMP.

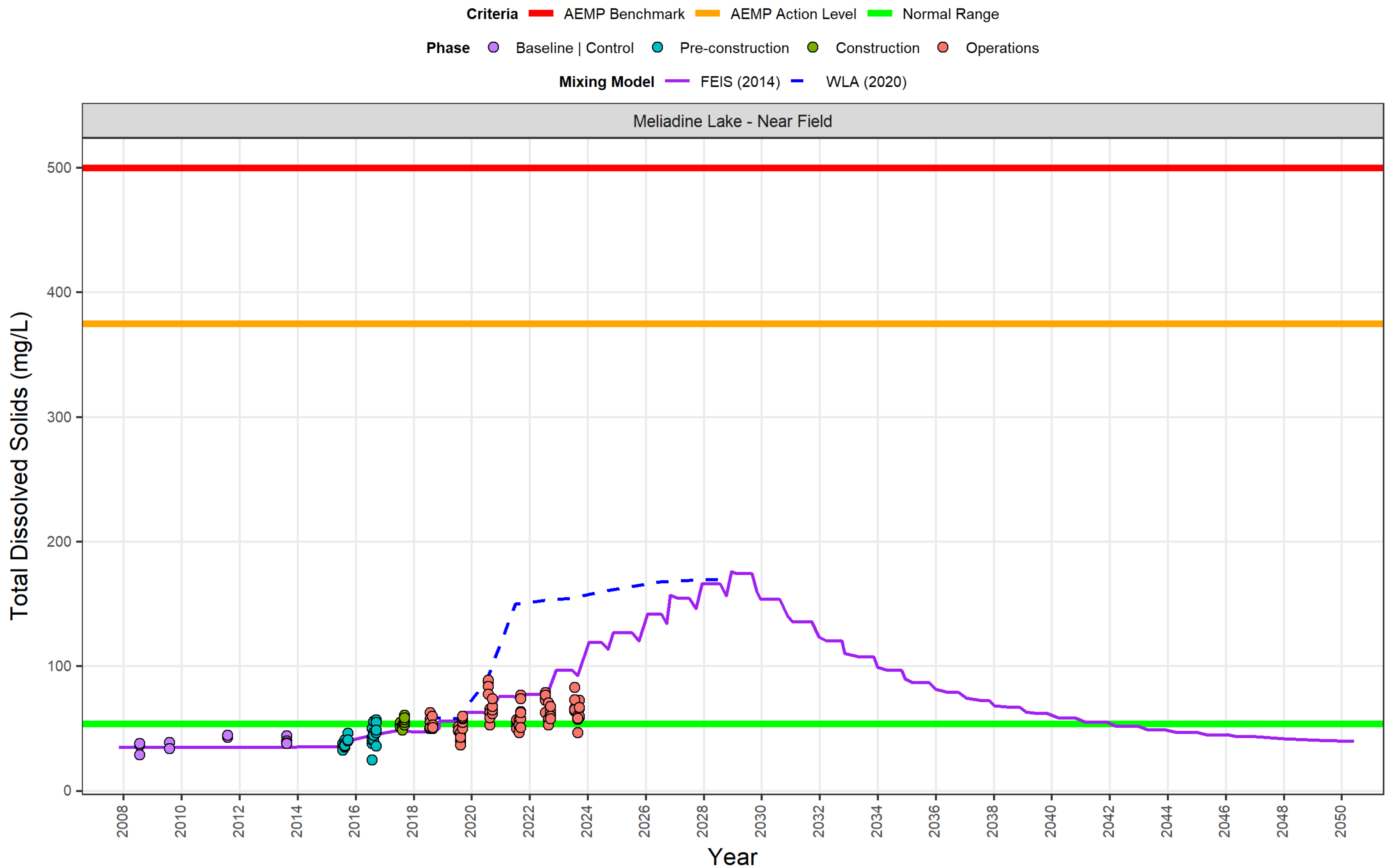
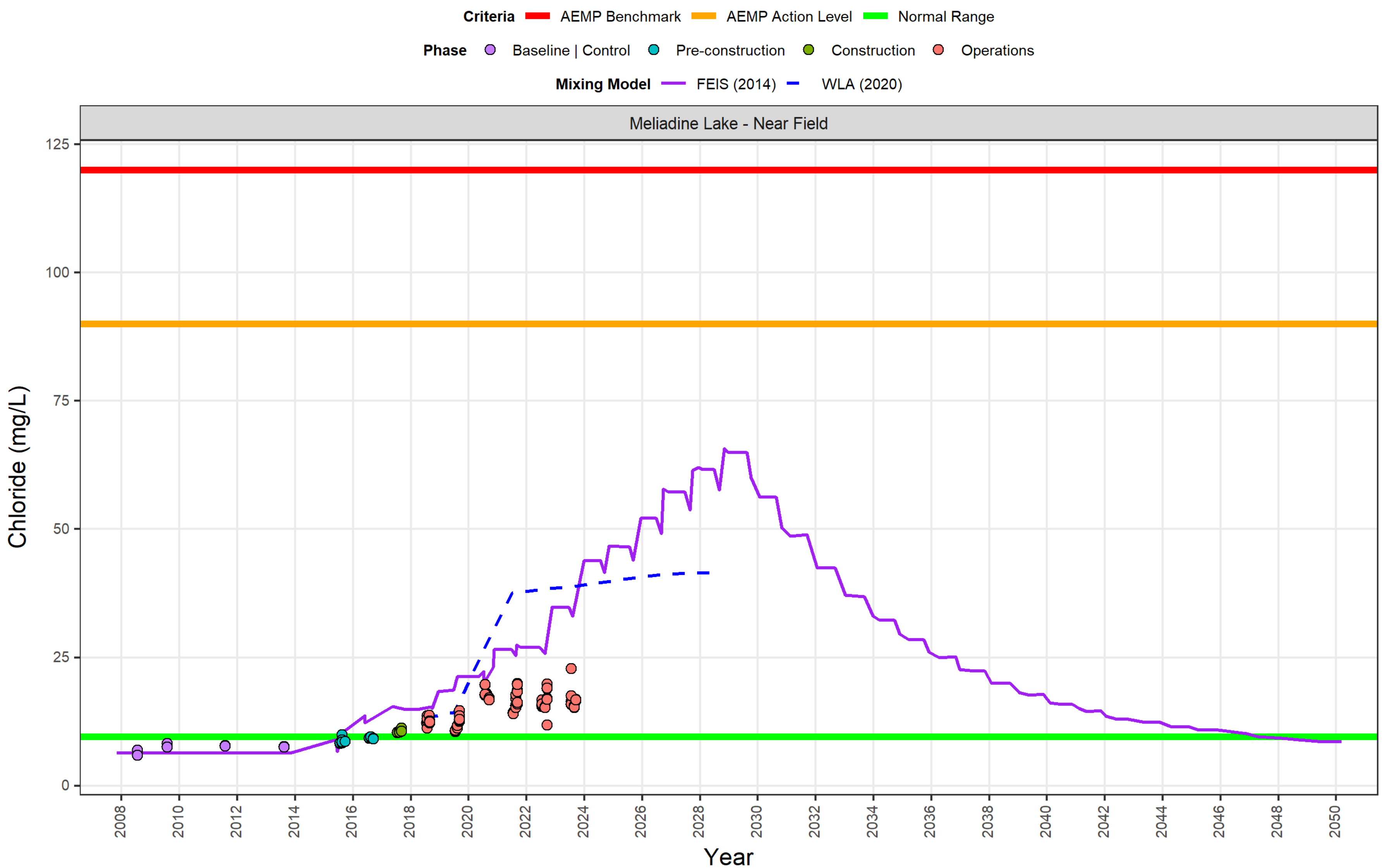


Figure 3-13. Predicted versus measured concentrations of chloride (mg/L) in the East Basin of Meliadine Lake

Notes: The FEIS (2014) predictions (purple line) were presented in Volume 7.4-A of Agnico Eagle (2014). The blue dashed line represents the updated model prediction for changes in chloride from 2018 to 2028 (Tetra Tech 2020). The dots represent the observed chloride data collected to date from the NF area as part of the AEMP.



3.5 Conclusions

Results of the 2023 Meliadine Lake water quality monitoring program are summarized below in the context of the key questions. The Low Action Level assessment for the Meliadine Lake water quality results is presented in **Section 6.1**.

Key Question: Are concentrations of parameters in the effluent less than limits specified in the Water Licence?

There were no exceedances of limits in the Water Licence in 2023 (**Section 2.3.2**).

Key Question: Has water quality in the exposure areas changed over time, relative to reference/baseline areas?

Concentrations have increased for some water quality parameters over time in the East Basin. These parameters include major ions and compound parameters (magnesium, sulfate, calcium, and hardness), Nutrients and organic carbon (TKN, TOC, and DOC), and metals (arsenic, barium, and uranium). Changes can be seen dating back to early years (e.g., 2015) when there was no discharge of treated effluent by the mine and also in the mid-field and far-field area. Effluent is likely a contributing factor for some of the changes in water quality observed in the East Basin and the potential effect of effluent on water quality outside the East Basin is difficult to account for because of the confounding effects of natural variability among the basins. Results to date suggest that natural factors, such as increased runoff associated with permafrost thaw and unusually high precipitation in the past (2019-2020), are contributing to changes in water quality parameters throughout the lake. On-going water quality monitoring should help provide a better understanding of the potential causes for changes in water quality in Meliadine Lake.

Key Question: Is water quality consistent with predictions outlined in the Final Environmental Impact Statement (FEIS) and less than AEMP Action Levels?

The 2014 FEIS predicted *minor changes* in water quality at the edge of the mixing zone and no residual impacts from effluent discharge in Meliadine Lake outside the mixing zone (e.g., at the NF area)[9]. *Minor changes* were defined as a measurable increase in a parameter that is outside the range of baseline values (e.g., above the normal range) but below guidelines for the protection of aquatic life and drinking water quality. The TDS and chloride results from 2023 are well below predicted concentrations. Furthermore, the water quality screening assessment showed that current water quality is well below

[9] See Section 7.4.7 (Residual Impact Summary) in the FEIS for more information (Volume 7; Agnico Eagle 2014)

guidelines developed to protect aquatic life and human health. In short, *minor* changes in water quality have occurred, consistent with what was predicted in the FEIS.

3.6 Condensed Temporal Water Quality Plots

The condensed temporal plots show concentrations of major ions, nutrients, and metals in surface water samples from Meliadine Lake going back to 2013. The dates on the x-axis are *condensed* to show the results for samples collected during the open water sampling events (July through September) each year. The green line indicates the normal range, which corresponds to the upper 90th percentile concentration for samples collected during baseline and from the reference areas.

List of Condensed Temporal Plots

Figure 3-14. Concentrations of TDS and constituent ions (Ca, Mg, K, Na, Cl, SO_4) since 2013

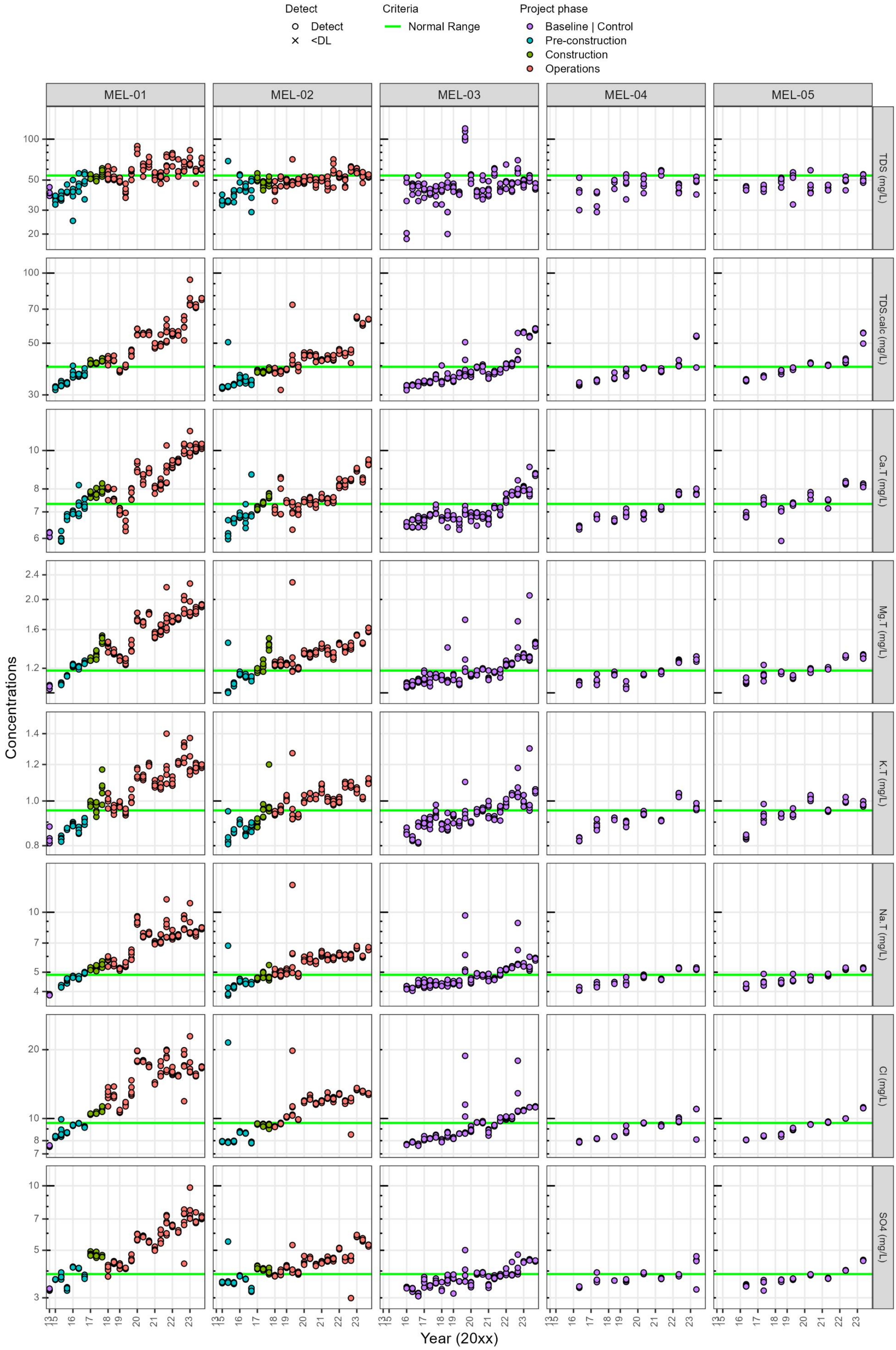


Figure 3-15. Conductivity, hardness, and concentrations of selected nutrients since 2013

Notes: Ammonia (NH3) concentrations in August and September 2021 should be interpreted with caution because of elevated detection limits at the lab during these two sampling events (see "x" symbols for non-detects in 2021).

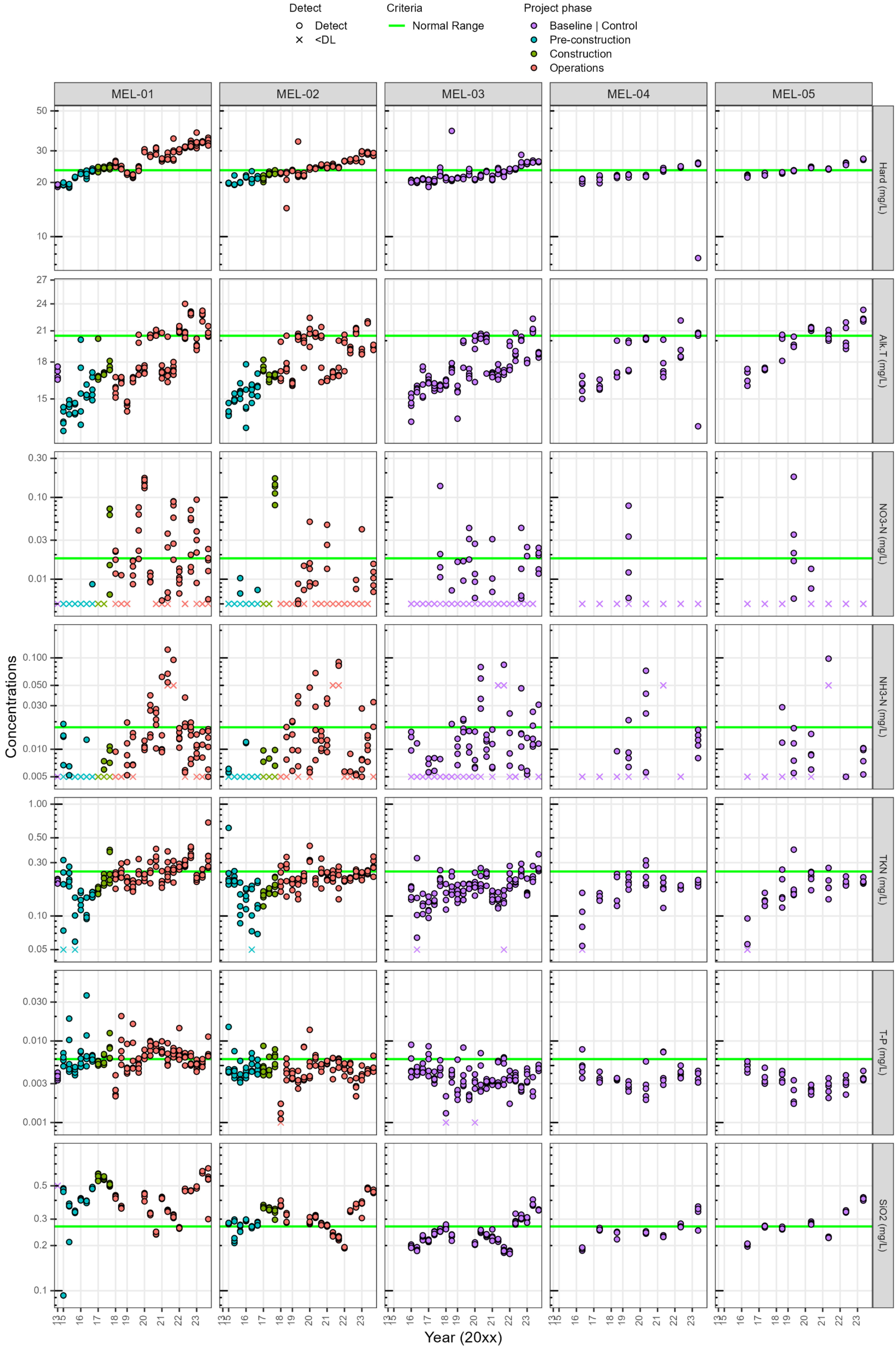


Figure 3-16. Concentrations of aluminum, arsenic, barium, and boron since 2013

Notes: Detection limits have changed over time for some parameters.

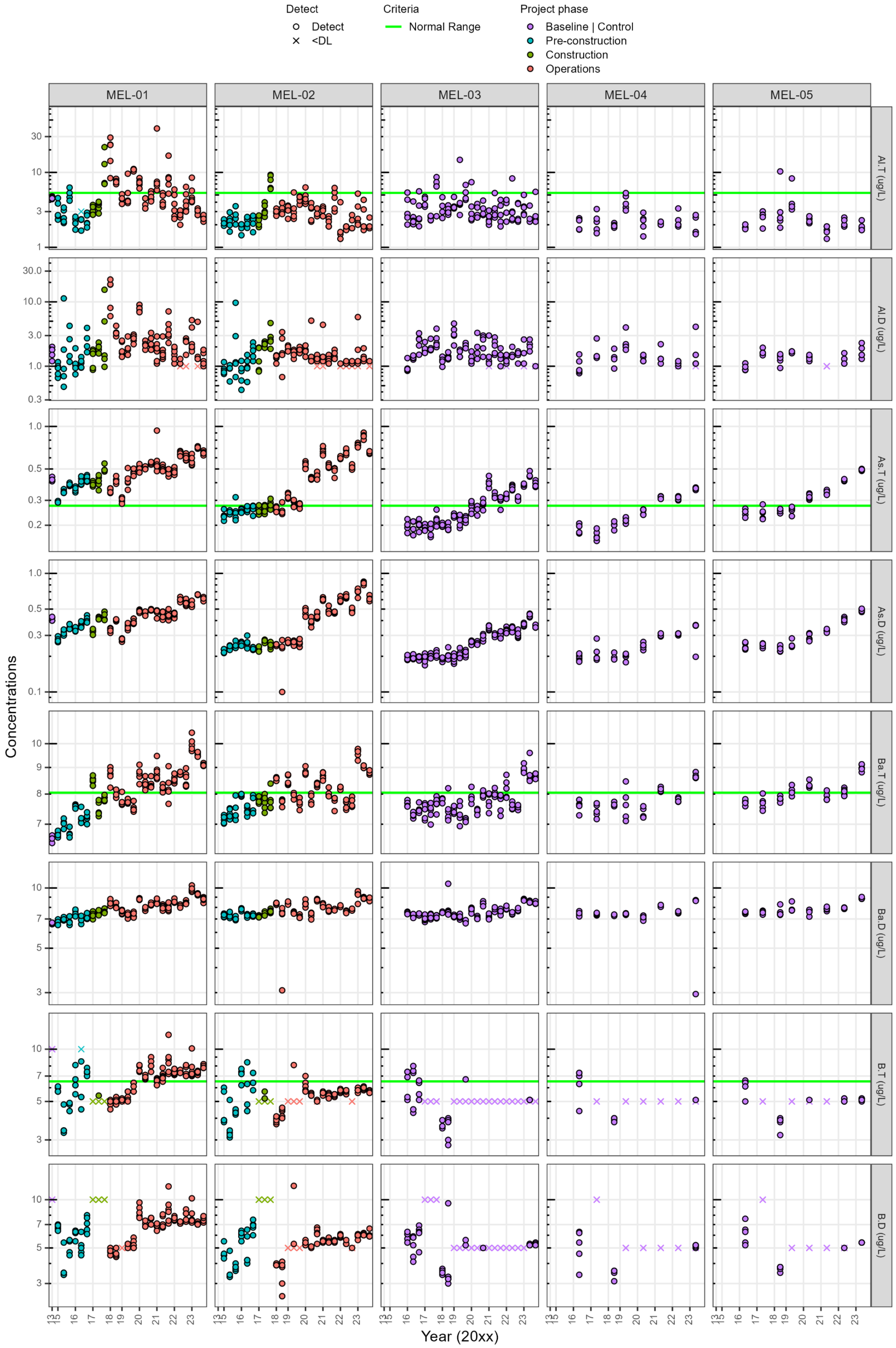


Figure 3-17. Concentrations of cobalt, copper, iron, and lead since 2013

Notes: Detection limits have changed over time for some parameters.

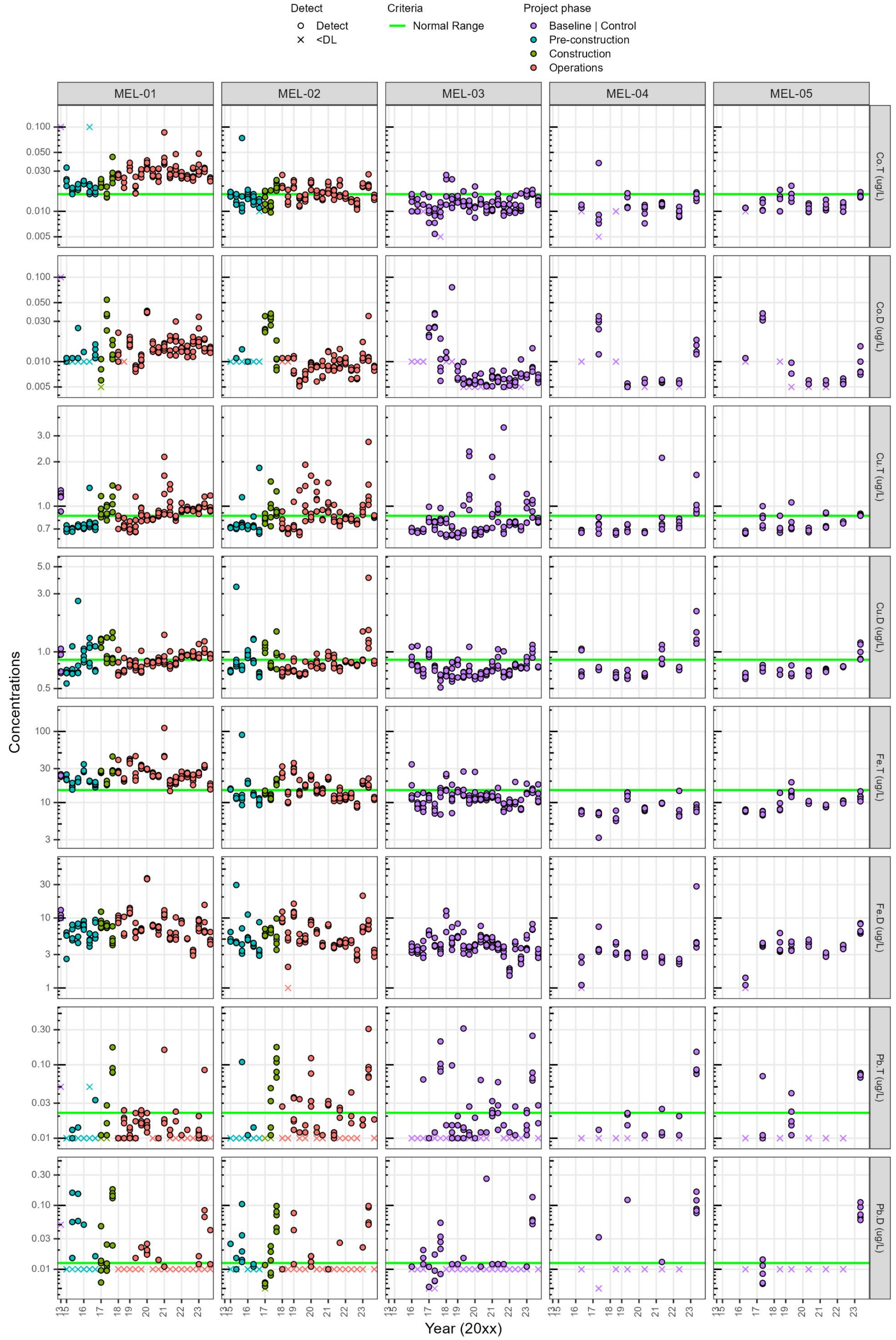


Figure 3-18. Concentrations of lithium, manganese, molybdenum, and nickel since 2013

Notes: Detection limits have changed over time for some parameters.

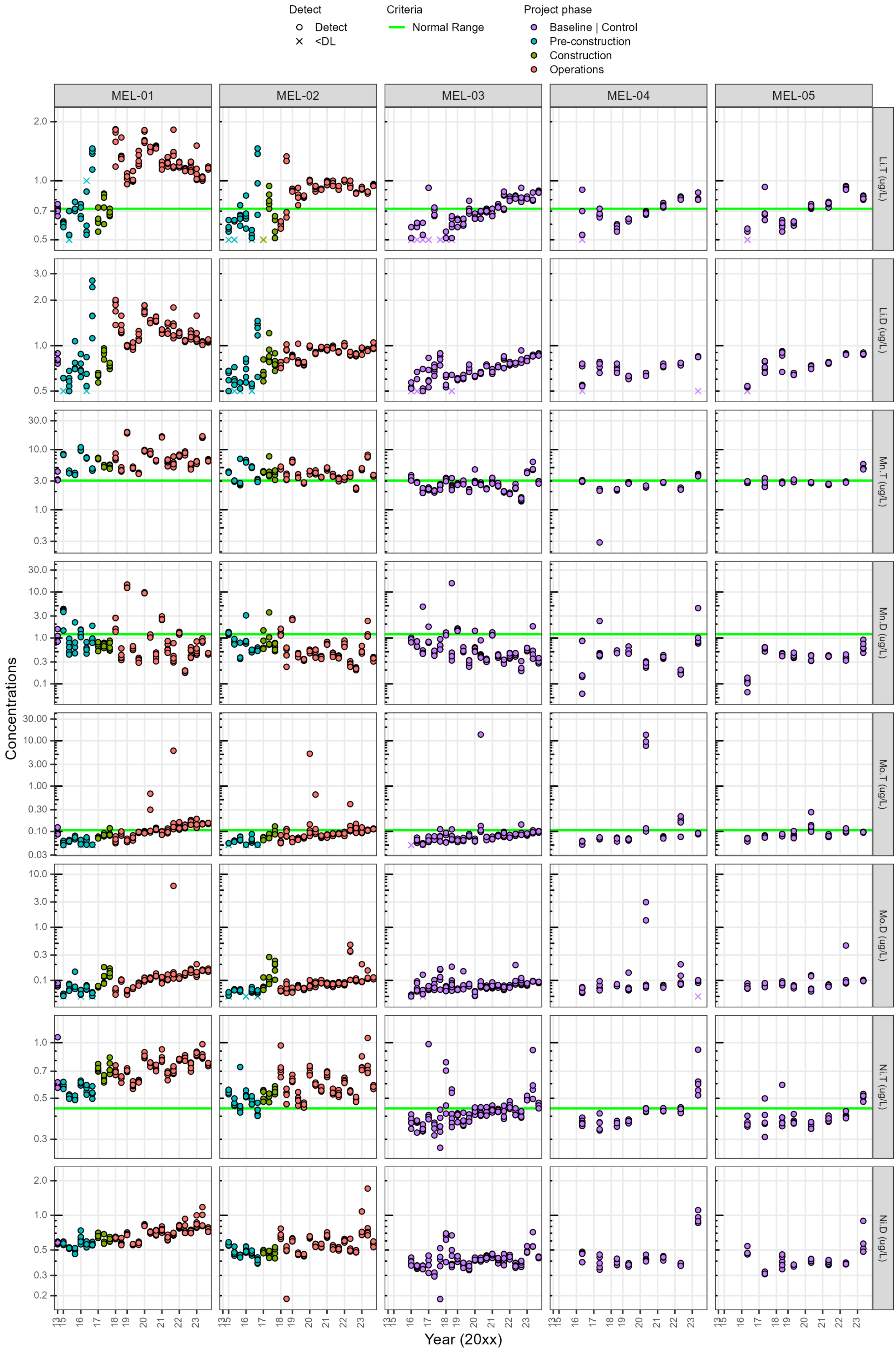
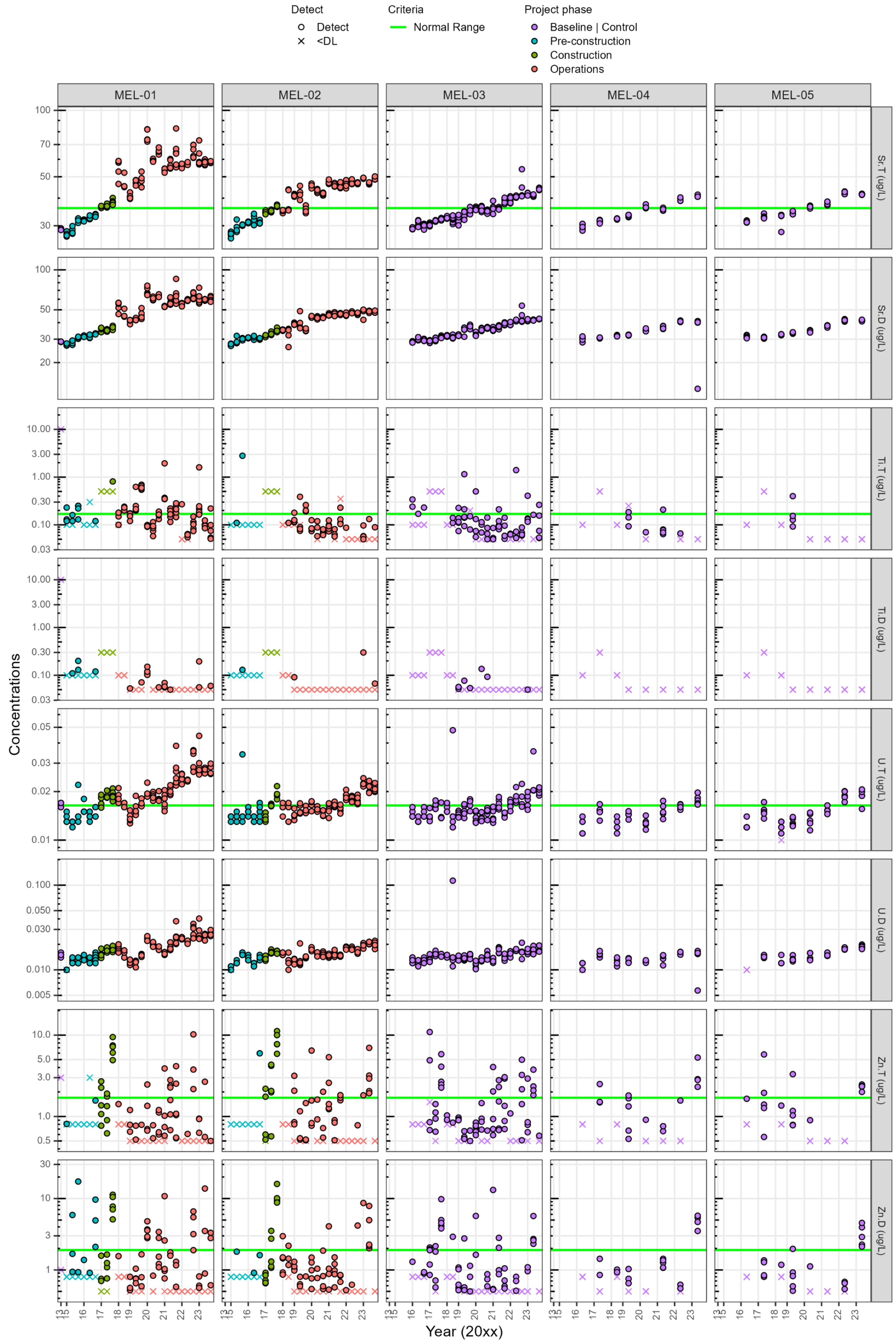


Figure 3-19. Concentrations of strontium, titanium, uranium, and zinc since 2013

Notes: Detection limits have changed over time for some parameters.



4 PENINSULA LAKES WATER QUALITY

4.1 Introduction

The Peninsula Lakes water quality monitoring program is completed annually to determine if dust, aerial emissions, and alterations to the local hydrology are impacting water quality in small lakes near the Mine. The cumulative effect of these "non-point source discharges" are evaluated based on water quality in Lake A8, Lake B7, and Lake D7. Lake A8 is located south of Tiriganiaq Pit 1, Lake B7 is located next to the TSF, and Lake D7 is located southwest of Lake B7 in a separate watershed. Water quality data from Lake D7 helps define the spatial extent of changes in water quality caused by the Mine.

Surface water samples were collected in July and August as per the *AEMP Design Plan*. A third sampling event was completed at Lake B7 in early October. The purpose of this sampling event was to verify the increasing temporal pattern that was observed for arsenic in July and August.

Objectives and Key Questions

The Peninsula Lakes water quality program has four objectives, as stated in the *AEMP Design Plan* (Azimuth, 2022):

- Determine if water quality in lakes close to the Mine is changing,
- Evaluate the accuracy of predicted changes in water quality,
- Assess whether mitigation measures are effective at reducing impacts to the aquatic environment, and
- Provide recommendations (as required) for follow-up monitoring or mitigation to lower the impact of mining-related activities on changes in water quality.

The approach to meeting these objectives is centered around answering the following key questions: *1) Has water quality in the exposure areas changed over time relative to baseline conditions, and 2) are concentrations greater than AEMP Action Levels?*

4.2 Findings from the 2023 Peninsula Lakes Water Quality Program

- Construction and operation of the Mine has contributed to changes in water quality in Lake A8 and Lake B7. Parameters that show the clearest link to mining-related effects are major ions, sulphate, arsenic, and barium
- No exceedances of AEMP Action Levels were reported in any of the samples collected from Lake D7 or Lake A8 in 2023. Arsenic exceeded the AEMP Action Level in Lake B7 in August 2023. Follow-up monitoring was competed in October, and concentrations had decreased from roughly 20 µg/L to

10 µg/L. Off-site migration of dust in the winter of 2019/2020 was likely the main source of arsenic to Lake B7 and Lake A8. Year-over-year increases in arsenic are likely caused by internal mobilization of arsenic from the sediment to the surface water and not on-going external loadings from uncontrolled deposition of dust from the Mine.

- There is no evidence that mining activities have caused changes in water quality in Lake D7. Some parameters have increased compared to baseline, but the underlying cause is likely natural variability and interannual climate variability.

4.3 Methods

4.3.1 Study Areas and Sample Collection

In-situ water quality measurements (temperature, dissolved oxygen (% and mg/L), pH, and specific conductivity) were recorded at the three fixed sampling stations in each lake. Measurements were recorded at discrete intervals just below the surface and every 0.5 m through the water column. The bottom profile was taken within 0.5 m of the sediment water interface.

Surface water samples were collected from mid-depth at each station using a Kemmerer grab sampler. Samples were processed and analyzed according to methods described previously for Meliadine Lake.

Table 4-1. Overview of sampling completed in Lake A8, Lake B7, and Lake D7 in 2023

Area	Station ID	Depths	UTM (zone 15V)		Sampling Dates		
		Total	Easting	Northing	July	August	October
Lake B7	B7-01	1.0	538631	6989096	July 16	August 19	October 14
	B7-02	1.7	538195	6989436			
	B7-03	1.7	537713	6989798			
Lake A8	A8-01	2.3	540007	6987659	July 17	August 19	Not required
	A8-02	2.2	540211	6987204			
	A8-03	1.7	540925	6987421			
Lake D7	D7-01	1.7	536390	6989340	July 17	August 21	Not required
	D7-02	1.7	536567	6988868			
	D7-03	1.8	536852	6988689			

Notes:
[a] Total depths are reported as the average if the station was sampled more than once (Golder, 2018).

4.3.2 Data Analysis

Water Quality Screening Assessment

The AEMP Benchmarks are the effects thresholds meant to protect aquatic life and drinking water quality for the Project. AEMP Benchmarks and corresponding Action Levels apply equally at Meliadine and the Peninsula Lakes except for sulphate, lead, cadmium, cobalt, copper, manganese, and zinc.

Aquatic life guidelines for these parameters vary according to site-specific water quality characteristics, resulting in lake-specific, and in some cases, sample specific guidelines. The phosphorus benchmark of 0.01 mg/L for oligotrophic status is not used in the Peninsula Lakes study because samples collected during the baseline period often exceeded the 0.01 mg/L limit for oligotrophic conditions.

Temporal Trend Assessment

Temporal changes in water chemistry were determined by comparing current water quality results against the normal ranges for each lake. The temporal trend assessment was supported by plots showing changes in water quality over time.

The normal range of baseline conditions for Lake A8, Lake B7, and Lake D7 were defined in the 2018 AEMP (Golder, 2019). Data included in the normal range calculations were collected during the baseline period from 1995 to 2011 and during the pre-construction period from 2015 to 2017 (pre-construction). Golder conducted a review of the baseline data as part of the 2018 normal range assessment and concluded that conventional parameters, major ions, and selected nutrients from 1995 to 2011 were fit for use in the normal range estimation. However, nitrogen and metals data from the baseline were not included in the normal range calculations because detection limits in these samples were not comparable with more recent detection limits. Statistical methods used to estimate the normal range of concentrations for the Peninsula Lakes are described in the 2019 AEMP/EEMP report (Golder, 2019). Parameters where the annual mean/median concentration that *exceeded* the normal range were carried forward for closer examination.

Comparison to FEIS Predictions

Water quality modeling was completed as part of the 2014 FEIS submission to predict how construction and mining activities would affect water quality in small lakes located in the A, B, and D watersheds on the peninsula[10]. The original Project Certificate No.006 included development of deposits that require dewatering of Lake A8 and nearby Lake A6. Based on the expectation that Lake A8 would be dewatered to make way for development of other deposits south of Tiriganiaq, water quality predictions were developed for the baseline phase (pre-development) and post-closure phases (after the lake is flooded) for Lake A8, but not for constructions and operations. The mine plan in the 2014 FEIS also included dewatering of Lake B7 to accommodate the TSF. For this reason, water quality predictions were not developed for Lake B7.

[10] Refer to Table 7.4-A2 (Inventory of Waterbodies) in Appendix 7.4-A of the FEIS (Agnico Eagle 2014) for lakes that were carried forward for water quality modelling.

For waterbodies that were included in the water quality model for the construction and operations period, changes to water quality were predicted to occur due to diversion of water, alteration of the watershed size and contributing areas, natural hydrological processes, evaporation, and aerial deposition of particulate matter (modelled as TSS), nutrients from blasting activities, and metals (modelled by individual parameters).Water quality was predicted to change in waterbodies closest to the Mine, but for most water quality parameters, these changes were predicted to be *minor*. *Minor* changes, in the context of the FEIS, are defined as an increase from baseline but less than guidelines for the protection of aquatic life, drinking water quality, and SSWQO. During operations, water quality was predicted to meet MMER (now MDMER) discharge limits at all CPs on site, except for arsenic in CP3 during operations, which receives runoff from the TSF. Arsenic infiltration and seepage are minimized by dewatering (dry stacking) the tailings and subsequent freezing (Agnico Eagle, 2015).

4.4 Results and Discussion

4.4.1 Field-Measured Water Quality Parameters

This section summarizes results from the 2023 *in-situ* water quality profiles compared to profiles that were taken from 2015-2022 (AEMP period). Temporal plots are used to support the discussion. Average surface water temperatures in each lake from 2015 to 2023 are shown in **Figure 4-1**. The temperature data are plotted for the day-of-the-month to illustrate the interannual variability in surface water temperatures. Dissolved oxygen, pH, and specific conductivity results are shown in **Figure 4-2**. The results are shown as the mean ± 1 SD of the three profiles collected in each lake in each monthly sampling event.

The Peninsula Lakes are small and shallow with an average depth of approximately 1.5 m and most areas are less than 2 m deep (Appendix SD7-2 of the 2014 FEIS). Areas less than 2 m deep likely freeze to the bottom by late winter. Areas that are not frozen likely exhibit naturally low oxygen levels.

When the ice comes of these lakes, typically in late May or early June, wind and wave action contribute to well-mixed conditions throughout the lakes with no evidence of stratification based on the profiles collected since 2015 or baseline data in the 2014 FEIS.

Temperature. Surface water temperatures rise quickly after ice-off. By mid-July, water temperatures are typically in the range of 13 and 16 °C. Surface water temperatures in 2023 were within the range observed in previous years (see the red dots in **Figure 4-1**). 2022 is the exception. On average, surface water temperatures in July and August 2022 were 2 to 3 °C warmer compared to other years. This is directly related to higher air temperatures recorded in June, July, and August (**Table 2-1**). Interannual variability in surface water temperatures can have an effect on the concentrations of some parameters, notably arsenic, iron, and manganese. This is discussed in more detail in the water quality assessment for Lake B7.

Dissolved oxygen. Wind and wave action during the open water season contributes to fully-oxygenated conditions in each of the Peninsula Lakes. Since 2015, there has been no indication of summer anoxia in any of the profiles. Dissolved oxygen levels likely naturally decrease during the winter because most of the areas within each lake freeze to the bottom by late winter.

pH. The Peninsula Lakes are slightly alkaline, with pH typically measuring between 7.5 and 8.5. Each of lakes exhibit seasonal variability in pH. This is particularly evident in Lake B7 in 2023 when pH decreased from approximately 8 in July and August to 7.5 in October (**Figure 4-2**). Seasonal variability in pH is also evident in Lake D7. For example, pH in mid-July 2023 was 8.25 but by mid-August pH had decreased to 7.75. The results for Lake D7 provide insight into natural fluctuations in the pH of small headwater lakes.

Conductivity. Specific conductivity has increased in Lake B7 and Lake A8 in recent years coinciding with construction of the Mine and operations. In Lake A8, the increasing temporal trend for conductivity appeared between 2015 and 2016 (**Figure 4-2**). The timing of the increase is plausibly linked to surface activities in the A watershed. Conductivity in Lake A8 peaked at roughly 280 to 300 µS/cm in 2016 and 2017, but by July 2018 conductivity had dropped to 200 µS/cm. Above average precipitation in May and June 2018 (**Table 2-1**) may have contributed to dilution during spring freshet. The temporal trend for Lake B7 and Lake D7 supports this conclusion.

Conductivity in Lake B7 has increased steadily since 2019, coinciding with the start of production at the Mine and construction of the TSF and WRSF1. Between 2019 and 2023, conductivity in Lake B7 has approximately doubled, from 130-150 µS/cm in 2018 to 275-300 in 2023 (**Figure 4-1**). The spatial extent of changes in conductivity do not extend to southwest toward Lake D7. Specific conductivity at Lake D7 in 2023 was similar to previous years (130-150 µS/cm).

Figure 4-1. Average surface water temperatures at the Peninsula Lakes, 2015-2023

Notes: Surface water temperatures are unstratified during the open water season with no discernable difference in temperatures recorded near the surface compared to near the bottom of the lakes.

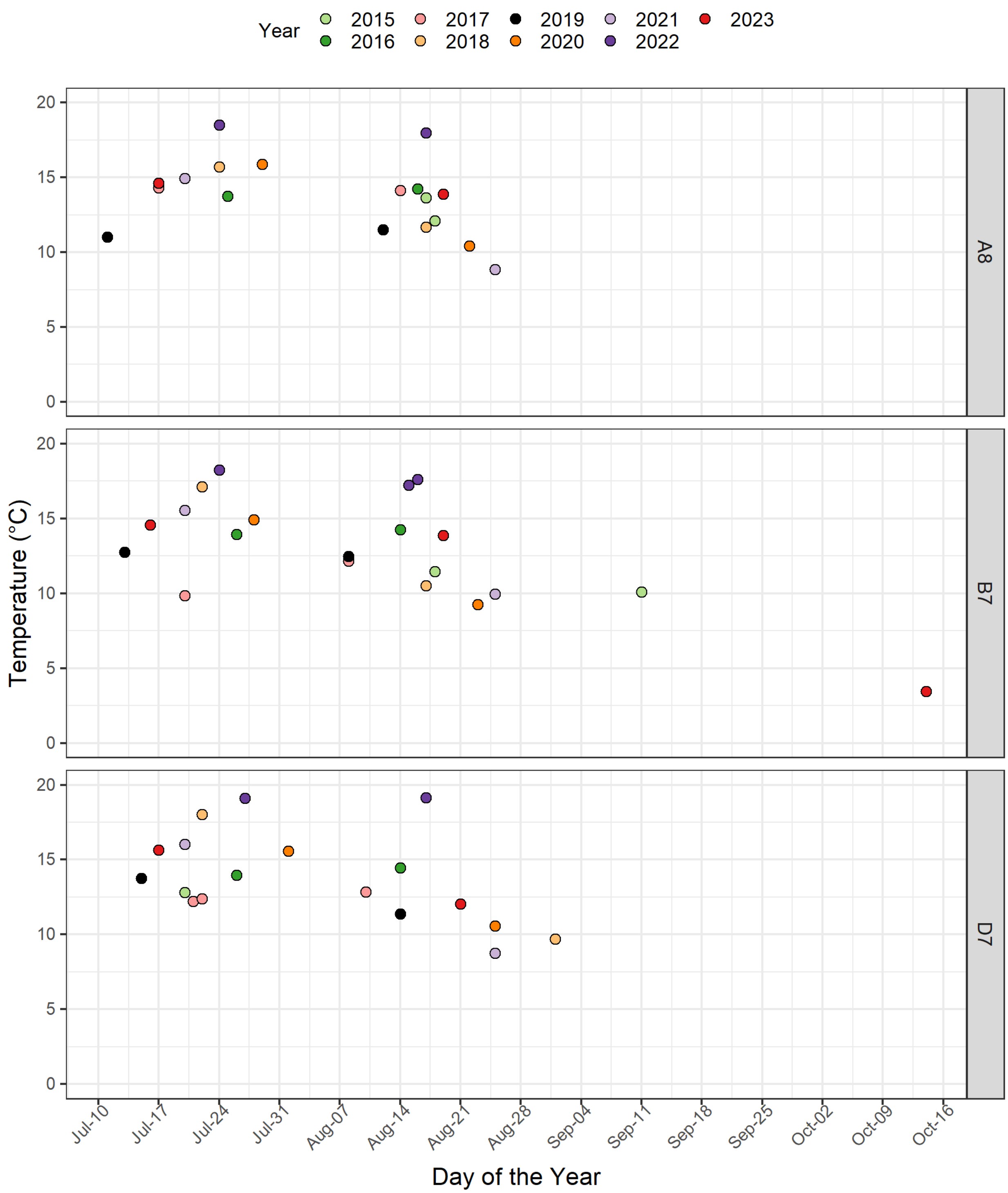
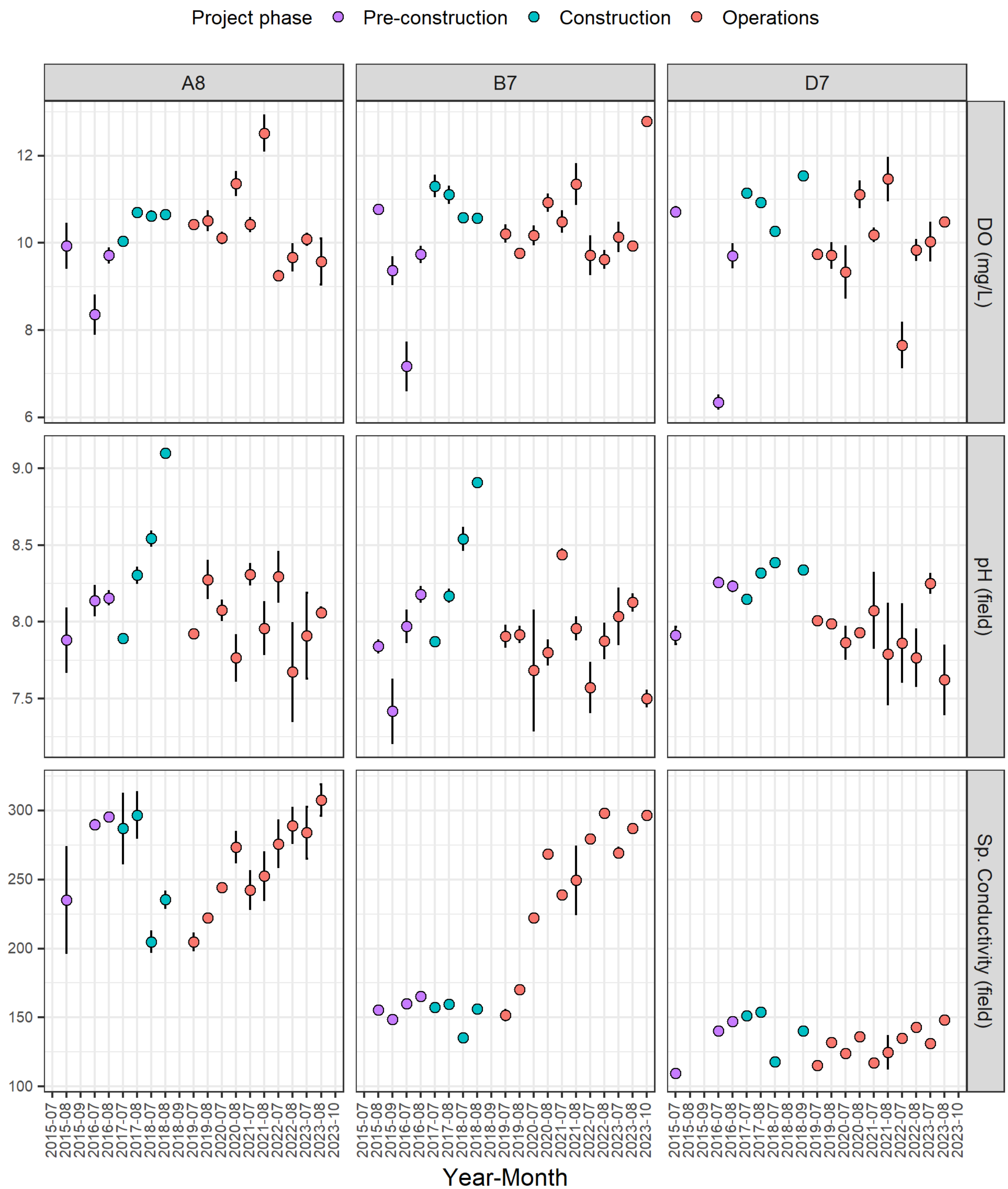


Figure 4-2. ***In-situ* water quality at the Peninsula Lakes, 2015-2023**

Notes: The lakes are small, shallow, and unstratified. The results are presented as the mean ± 1 SD of the three profiles taken at each lake in each month.



4.4.2 Temporal Trends in the Peninsula Lakes

The purpose of this section is to identify parameters that appear to be increasing in the Peninsula Lakes in recent years and, if possible, determine if the cause is related to mining activities or natural variability/climate-related factors. The starting point for the temporal trend assessment is the short-list of parameters that exceeded the normal range of baseline conditions in 2023. The normal range screening results for each lake are provided in the following tables and corresponding figures.

- Lake D7: **Table 4-2** and **Figure 4-3**
- Lake A8: **Table 4-3** and **Figure 4-4**
- Lake B7: **Table 4-4** and **Figure 4-5**

The screening tables include those parameters where at least one sample exceeded the normal range in 2023. Parameters where the annual mean concentration exceeded the normal range were carried forward for plotting. Supplemental plots for the various major ions, nutrients, and metals in are provided in **Section 4.6**.

Overview of Natural versus Mining-Related Changes in Water Quality

As mentioned in the introduction, Lake A8 and Lake B7 are located adjacent to major infrastructure, and changes in water quality are expected due to the cumulative effect of aerial emissions, dust, and changes in the hydrology in the A and B watersheds. Predictions were not derived for either of these lakes during operations because the lakes were scheduled to be dewatered to accommodate development of the Pump and Wesmeg deposits. Lake D7 is in a watershed that is not directly impacted by the Mine, and the water quality results from Lake D7 provide important insight into regional background changes in water quality caused by natural variability and climate-related processes. Spatial and temporal trends for parameters of interest are plotted in **Figure 4-6**. to show divergent trends among the different lakes.

Mining activities have contributed to higher concentrations of some major ions (calcium, sodium, chloride, sulphate), arsenic, and barium in Lake A8 and Lake B7 since 2019. This conclusion is based on divergent trends in Lake A8 and Lake B7 compared to Lake D7 since 2019/2020 (**Figure 4-6**). Unusually high rainfall likely contributed to some of the observed changes in water quality in the Peninsula Lakes. However, the snow core chemistry data from SNOCOR4 (north of Lake A8) in April 2020 suggest off-site migration of dust in the winter of 2019/2020 was likely a significant source of major ions, arsenic, and barium to Lake A8 and Lake B7 (**Figure 2-12** and **Figure 2-13**).

Based on the snow core chemistry data from other locations around the Mine, the effect of off-site migration of dust is localized to Lake A8 and Lake B7 and limited to a small number of parameters. Other metals were elevated in SNOCOR4 in April 2023 compared to the reference station, including aluminum, cobalt, copper, uranium, and vanadium (**Figure 2-12** and **Figure 2-13**). However, the effect of dust on water quality was transient and minor compared to background changes in water quality, based on the temporal trends at Lake D7 (**Figure 4-6**). Since 2019, most of the metals have followed a similar temporal trend among the three lakes, implying natural variability and climate-related factors are primarily responsible for the observed temporal trends.

Arsenic in Lake B7

Additional mitigation efforts were implemented in 2021 to minimize the off-site migration of dust from the TSF during the winter. These efforts appear to have been effective, based on the concentrations of most parameters in Lake B7 and Lake A8 within the range of background at Lake D7. However, some major cations, sulphate, arsenic, and barium have continued to increase in Lake A8 and Lake B7 and the temporal pattern has diverged from Lake D7. The divergent trend is most apparent for arsenic in Lake B7. On average, arsenic concentration in Lake B7 increased by approximately 10-fold between 2019 and 2023. In mid-July 2023, arsenic concentrations in Lake B7 ranged from 12.9 to 15.6 µg/L and by mid-August concentrations had increased to 19.0 and 23.4 µg/L. All three samples collected in August exceeded the AEMP Action Level of 18.8 µg/L. After reviewing the results from the August sampling event, Agnico Eagle conducted a third sampling event on October 14 to determine if concentrations were stable, increasing, or decreasing in the lead up to winter. Arsenic concentrations in the three October samples were 9.6, 9.9, and 10.2 µg/L.

Arsenic mobility in aquatic systems is a complex process that varies with pH, redox potential, microbial activity, accumulation by algae, and interactions with iron, sulfur, and organic matter (Hussain et al., 2019). These biogeochemical processes also vary seasonally in northern latitude lakes in response to changes in hydrology, surface water and sediment temperatures, ice cover, and phytoplankton-mediated uptake (Palmer et al., 2021). The substantial decrease in arsenic observed in Lake B7 between August and October was likely due to co-precipitation with iron oxy-hydroxides. Low iron concentrations during the October sampling event corroborate this conclusion (**Figure 4-7**). After the ice comes off Lake B7 and Lake A8 in the late spring, changes in pH, redox, and temperature may contribute to remobilization of arsenic from the sediment to the water column. A recent study in Puget Sound, WA found that seasonal temperature increases at the sediment-water interface of small (0.12 km^2), shallow (2.6 m) lake led to increased microbial activity, which in turn promoted reductive dissolution of arsenic from iron oxyhydroxides. The overall effect was remobilization of arsenic from sediment to the water column (Barrett et al., 2019).

Based on the available data, and considering information in primary literature on arsenic mobilization in aquatic systems, sediment is likely a significant source of arsenic to the surface water in Lake B7 and Lake A8.

4.5 Conclusions

Results of the 2023 water quality monitoring program for the Peninsula Lakes are summarized below. The Low Action Level assessment for the Peninsula Lakes is presented in **Section 6.2**.

Key Question: Has water quality in the exposure areas changed over time compared to baseline conditions?

Water quality has changed in all three lakes compared to baseline conditions. Water quality data from Lake D7 suggest that most parameters have increased due to the combined effect of natural variability and climate-related factors (e.g., earlier freshet, higher summer temperatures, variable and extreme precipitation).

Mining activities likely contributed to some of the observed increase in TDS, sulphate, arsenic, and barium at Lake B7 and Lake A8 since 2019. Off-site migration of dust is the most likely source of metals and other parameters to Lake B7 and Lake A8. Based on the results from the snow chemistry monitoring program, efforts to minimize off-site migration of dust resulted in lower concentrations of metals to the snow pack in recent years.

Key Question: Are concentrations greater than AEMP Action Levels?

Based on the annual mean, there were no exceedances of the AEMP Action Levels in any of the lakes in 2023. There is some uncertainty about whether the biogeochemical processes responsible for arsenic cycling in Lake B7 and Lake A8 have peaked or if concentrations will continue to trend higher.

Table 4-2. Lake D7 water quality screening assessment, 2023

Parameter	Detection Limit	Screening Criteria				Summary Statistics for Lake D7 in 2023							
		Normal Range	FEIS	Benchmark	Action Level	N	N<DL	Mean	Median	SD	SE	Min	Max
Conventional Parameters, Nutrients, Organic Carbon (µg/L)													
Total Dissolved Solids (Calculated)	1	81	-	500	375	6	0	**91.9**	92	4.98	2.03	87.1	96.8
Total Suspended Solids	1	2	5.1	-	-	6	1	1.77	2.05	0.659	0.269	1	2.2
Alkalinity, Total	1	55	83	-	-	6	0	50.9	50.8	5.54	2.26	45.5	57
Calcium (T)	0.01	17	36	-	-	6	0	16.5	16.4	1.09	0.443	15.4	17.6
Fluoride	0.02	0.05	0.036	2.8	2.1	6	0	0.049	0.049	0.0038	0.0016	0.045	0.052
Reactive Silica (SiO2)	0.01 | 0.1	0.28	-	-	-	6	0	**0.39**	0.39	0.185	0.076	0.22	0.57
Ammonia (as N)	0.005	0.009	0.086	0.141	0.106	6	0	**0.017**	0.016	0.0080	0.0033	0.0092	0.0324
Nitrate (as N)	0.005	0.005	1.2	2.9	2.17	6	3	-	0.0061	-	-	0.005	0.021
Dissolved Organic Carbon	0.5	5.1	-	-	-	6	0	**5.49**	5.5	1.05	0.428	4.01	6.65
Metals (µg/L)													
Aluminum (T)	1	6.7	37	100	75	6	0	**7.57**	6.75	2.88	1.17	4.7	12.9
Arsenic (T)	0.02	1.2	1.3	25	18.8	6	0	**1.57**	1.63	0.122	0.0499	1.41	1.68
Barium (T)	0.02	17	34	1000	750	6	0	**17.2**	17.2	0.366	0.149	16.7	17.6
Cadmium (T)	0.005	0.005	0.071	0.0928	0.0696	6	5	-	0.005	-	-	0.005	0.0069
Cobalt (T)	0.005	0.05	0.33	0.781	0.586	6	0	**0.051**	0.0509	0.00552	0.00225	0.0443	0.0573
Copper (T)	0.05	1	2.1	2	1.5	6	0	**1.05**	1.07	0.0574	0.0235	0.953	1.11
Lead (T)	0.01	0.02	0.14	5	3.75	6	0	**0.0393**	0.0225	0.045	0.0184	0.012	0.129
Manganese (T)	0.05	13	67	120	90	6	0	10.5	10.4	2.76	1.13	7.47	14.4
Molybdenum (T)	0.05	0.48	0.61	73	54.8	6	0	**0.63**	0.63	0.12	0.050	0.52	0.75
Nickel (T)	0.05	0.75	2.3	25	18.8	6	0	**0.76**	0.77	0.045	0.018	0.71	0.81
Strontium (T)	0.02	83	162	2500	1880	6	0	81.1	81	5.96	2.43	75.1	87
Tin (T)	0.02	0.05	0.21	-	-	6	0	0.045	0.037	0.020	0.0080	0.029	0.082
Titanium (T)	0.05	0.34	2.38	-	-	6	0	**0.36**	0.30	0.18	0.075	0.19	0.70
Vanadium (T)	0.05	0.07	0.71	120	90	6	0	**0.086**	0.085	0.0097	0.0040	0.074	0.10
Zinc (T)	0.5	2	5.8	-	-	6	3	-	0.795	-	-	0.5	5.5

Notes:

"-"mean, SD, and SE were not calculated if >50% of the samples were below the detection limit.

Bold values indicate the mean concentration is greater than the upper limit of the normal range.

Gray highlighted cells indicate the mean concentration exceeds the FEIS prediction (Agnico Eagle, 2014).

Figure 4-3. Lake D7 – temporal trends for parameters that exceeded the normal range in 2023

Notes: Data are shown as the annual mean ± 1 SD.

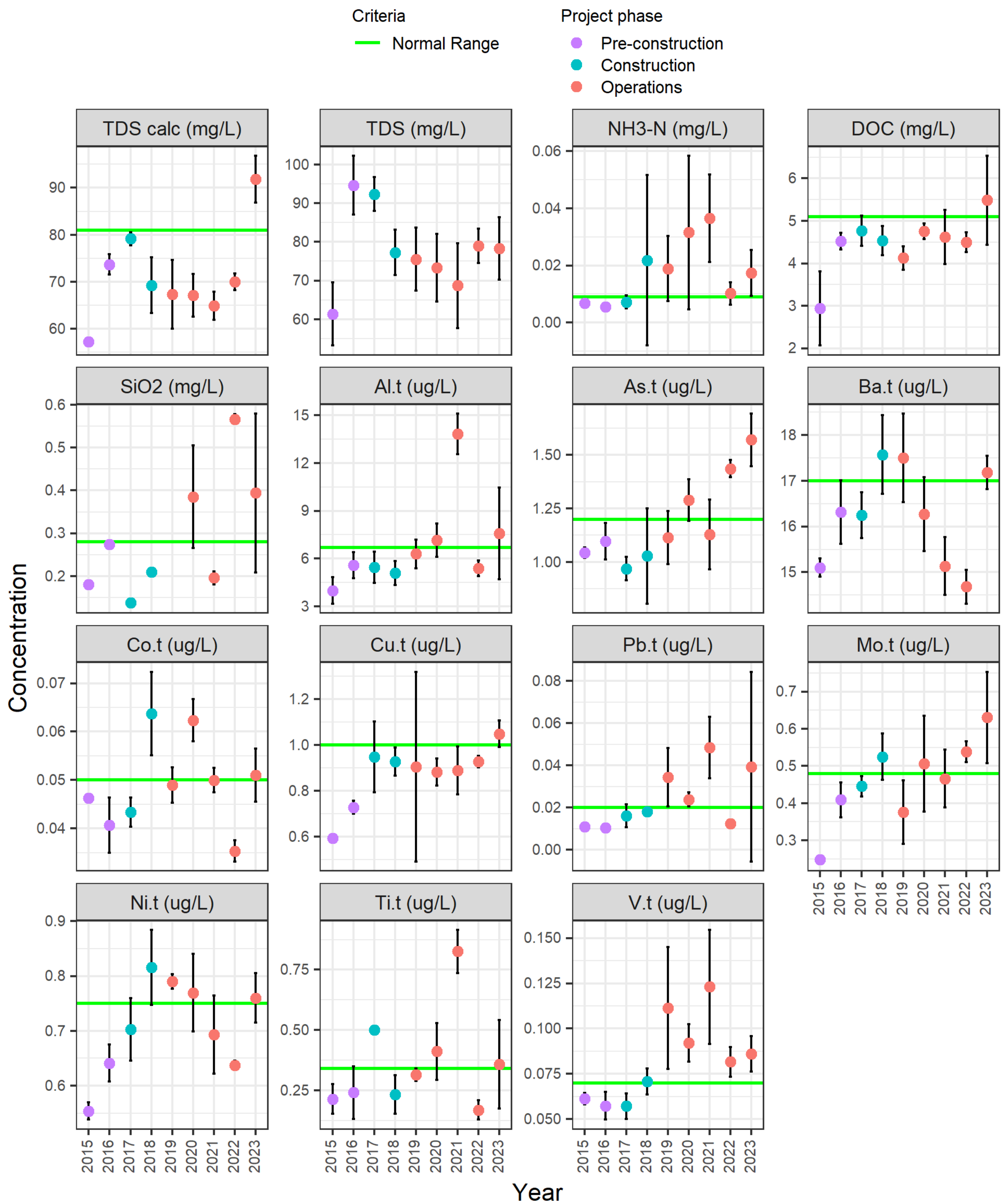


Table 4-3. Lake A8 water quality screening assessment, 2023

Parameter	Detection Limit	Screening Criteria				Summary Statistics for Lake A8 in 2023							
		Normal Range	FEIS	Benchmark	Action Level	N	N<DL	Mean	Median	SD	SE	Min	Max
Major Ions, Nutrients, and Organic Carbon (mg/L)													
Total Dissolved Solids (Calculated)	1	152	-	500	375	6	0	**188**	189	12.5	5.1	166	200
Calcium (T)	0.01	40	47	-	-	6	0	37.2	36.9	2.8	1.14	33	41.2
Fluoride	0.02	0.04	0.038	2.8	2.1	6	0	**0.0418**	0.041	0.00325	0.00133	0.039	0.046
Magnesium (T)	0.004	5.6	6.9	-	-	6	0	5.08	5.06	0.42	0.172	4.45	5.65
Potassium (T)	0.02	2.5	2.3	-	-	6	0	2.23	2.2	0.255	0.104	1.83	2.56
Reactive Silica (SiO2)	0.01 | 0.1	1.3	-	-	-	6	0	0.845	0.78	0.662	0.27	0.226	1.81
Sodium (T)	0.02	8.4	8.3	-	-	6	0	**11.6**	11.9	1.5	0.612	9.14	13.2
Sulphate	0.3	9.3	11.6	218	164	6	0	**13.7**	14.2	1.65	0.674	11.2	15.2
Ammonia (as N)	0.005	0.011	0.118	0.141	0.106	6	0	**0.0122**	0.0119	0.00231	0.000941	0.0094	0.0154
Nitrate (as N)	0.005	0.015	0.2	2.9	2.17	6	3	-	0.00605	-	-	0.005	0.0178
Dissolved Organic Carbon	0.5	4.9	-	-	-	6	0	**5.92**	5.84	1.21	0.495	4.62	7.57
Total Organic Carbon	0.5	4.7	-	-	-	6	0	**5.3**	5.1	1.2	0.489	4.12	7.33
Metals (µg/L)													
Aluminum (T)	1	3	4.6	100	75	6	0	**3.63**	3.45	0.944	0.385	2.5	5
Arsenic (T)	0.02	2.4	1.7	25	18.8	6	0	**9.75**	8.75	4.19	1.71	4.74	14.8
Boron (T)	5	5	27	1500	1120	6	1	**6.98**	7.9	2.7	1.1	5	9.4
Cobalt (T)	0.005	0.05	0.24	1.04	0.78	6	0	0.0454	0.0445	0.00508	0.00207	0.0397	0.0533
Copper (T)	0.05	0.89	2.7	2.47	1.85	6	0	**0.906**	0.891	0.0505	0.0206	0.854	1
Iron (T)	1	67	96	1060	795	6	0	**67.3**	69.8	21.3	8.68	41.9	88.9
Lead (T)	0.01	0.03	2	5	3.75	6	0	**0.0433**	0.046	0.0104	0.00424	0.029	0.056
Lithium (T)	0.5	10	5.3	-	-	6	0	9.12	9.68	1.23	0.5	7.03	10.1
Manganese (T)	0.05	13	30	120	90	6	0	11.5	12.2	3.25	1.32	7.67	15.6
Molybdenum (T)	0.05	0.22	0.59	73	54.8	6	0	**0.405**	0.404	0.0617	0.0252	0.308	0.478
Nickel (T)	0.05	0.92	2.3	99.2	74.4	6	0	0.821	0.802	0.0928	0.0379	0.728	0.966
Strontium (T)	0.02	273	101	2500	1880	6	0	243	246	25.9	10.6	202	276
Uranium (T)	0.001	0.054	0.061	15	11.2	6	0	**0.0831**	0.0852	0.0113	0.00461	0.0696	0.096

Notes:

"-"mean, SD, and SE were not calculated if >50% of the samples were below the detection limit.

Bold values indicate the mean concentration is greater than the upper limit of the normal range.

Gray highlighted cells indicate the mean concentration exceeds the predicted concentration (median) in the 2014 FEIS (Agnico Eagle, 2014). No predictions were developed for the operations phase because Lake A8 was scheduled to be dewatered in the 2014 FEIS.

Figure 4-4. Lake A8 – temporal trends for parameters that exceeded the normal range in 2023

Notes: Data are shown as the annual mean ± 1 SD.

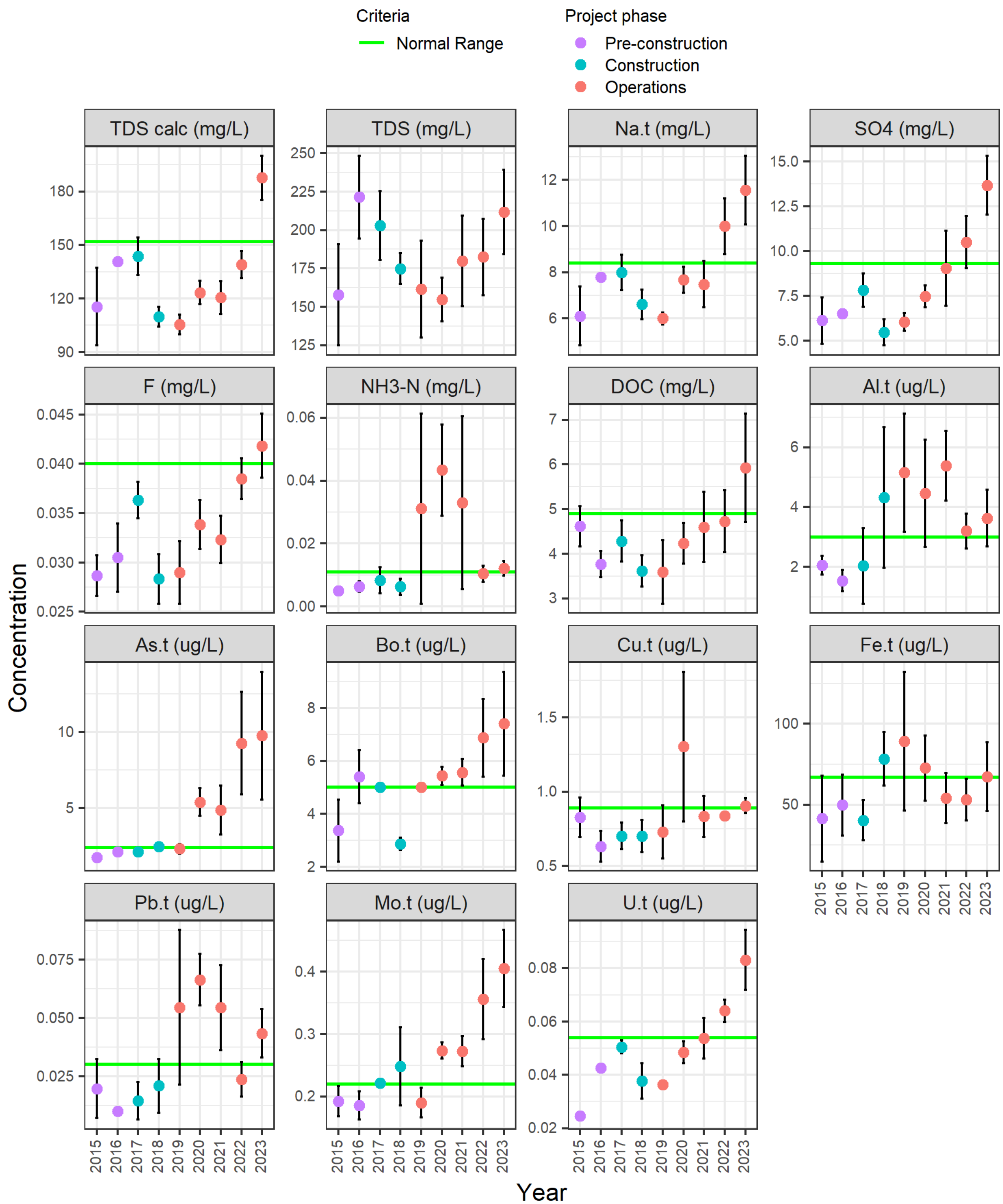


Table 4-4. Lake B7 water quality screening assessment, 2023

Parameter	Detection Limit	Screening Criteria			Summary Statistics for Lake B7 in 2023							
		Normal Range	Benchmark	Action Level	N	N<DL	Mean	Median	SD	SE	Min	Max
Major Ions, Nutrients, and Organic Carbon (mg/L)												
Total Dissolved Solids (Calculated)	1	171	500	375	9	0	**183**	183	10.5	3.5	170	197
Turbidity (lab)	0.1	0.69	-	-	9	0	0.563	0.47	0.16	0.0533	0.4	0.87
Calcium (T)	0.01	39	-	-	9	0	37.8	38.3	1.01	0.337	36.4	39.2
Chloride	0.1	25	120	90	9	0	**44.4**	44.0	2.16	0.719	41.8	47.2
Fluoride	0.02	0.04	2.8	2.1	9	0	**0.040**	0.041	0.00206	0.000687	0.038	0.043
Sodium (T)	0.02	7.5	-	-	9	0	**10.1**	10.1	0.301	0.1	9.64	10.5
Sulphate	0.3	6	218	164	9	0	**12.3**	12.2	0.801	0.267	11.4	13.4
Ammonia (as N)	0.005	0.025	0.197	0.148	9	0	0.0239	0.0204	0.0112	0.00374	0.0141	0.0481
Nitrate (as N)	0.005	0.005	2.9	2.17	9	5	-	0.005	-	-	0.005	0.0116
Dissolved Organic Carbon	0.5	5.5	-	-	9	0	**6.43**	6.27	1.04	0.345	5.13	7.81
Metals (µg/L)												
Antimony (T)	0.02	0.02	6	4.5	9	0	**0.044**	0.045	0.0028	0.000928	0.038	0.046
Arsenic (T)	0.02	1.8	25	18.8	9	0	**14.9**	13.8	4.94	1.65	9.64	23.4
Barium (T)	0.02	20	1000	750	9	0	**29.1**	28.7	1.11	0.369	28.1	31.5
Cobalt (T)	0.005	0.05	1.02	0.765	9	0	**0.065**	0.067	0.021	0.007	0.038	0.088
Iron (T)	1	103	1060	795	9	0	68.7	66.6	30.1	10	37.8	132
Lead (T)	0.01	0.08	5	3.75	9	0	0.0696	0.069	0.0193	0.00644	0.04	0.104
Lithium (T)	0.5	7.5	-	-	9	0	**17.1**	17.4	0.671	0.224	16.2	18
Manganese (T)	0.05	8.6	120	90	9	0	**10.1**	10.7	6.06	2.02	3.28	22.4
Molybdenum (T)	0.05	0.24	73	54.8	9	0	**0.372**	0.365	0.0279	0.0093	0.342	0.414
Selenium (T)	0.04	0.04	1	0.75	9	0	**0.050**	0.049	0.0049	0.0016	0.044	0.058
Strontium (T)	0.02	155	2500	1880	9	0	**313**	312	9.75	3.25	301	326
Thallium (T)	0.005	0.005	0.8	0.6	9	5	-	0.005	-	-	0.005	0.0068
Tin (T)	0.02	0.05	-	-	9	1	**0.033**	0.033	0.014	0.00467	0.02	0.062
Uranium (T)	0.001	0.03	15	11.2	9	0	**0.0812**	0.0819	0.00279	0.000931	0.0752	0.0844

Notes:

"-"mean, SD, and SE were not calculated if >50% of the samples were below the detection limit.

Bold values indicate the mean concentration is greater than the upper limit of the normal range.

Gray highlighted cells indicate the mean concentration exceeds the FEIS prediction (Agnico Eagle, 2014).

Orange highlighted cells indicate arsenic concentrations exceeded the AEMP Action Level in 2023.

Figure 4-5. Lake B7 – temporal trends for parameters that exceeded the normal range in 2023

Notes: Data are shown as the annual mean ± 1 SD.

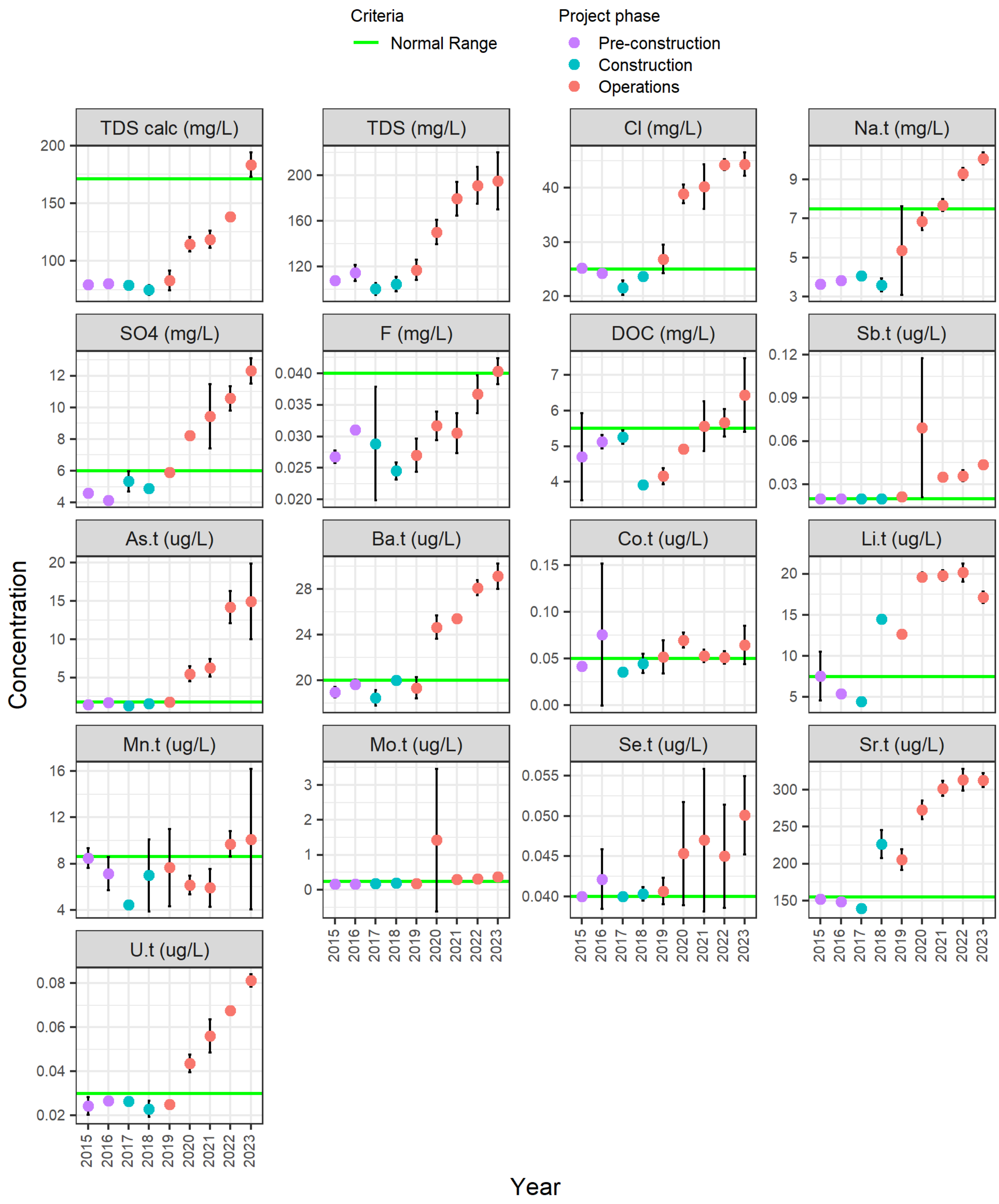


Figure 4-6. Temporal trends for key parameters of interest in the Peninsula Lakes since 2015

Notes: Data are shown as the annual mean ± 1 SD (error bars). Points are jittered to avoid overplotting.
The large standard deviation for molybdenum in Lake B7 in 2020 is due to two samples from July with concentrations greater than 5 µg/L.

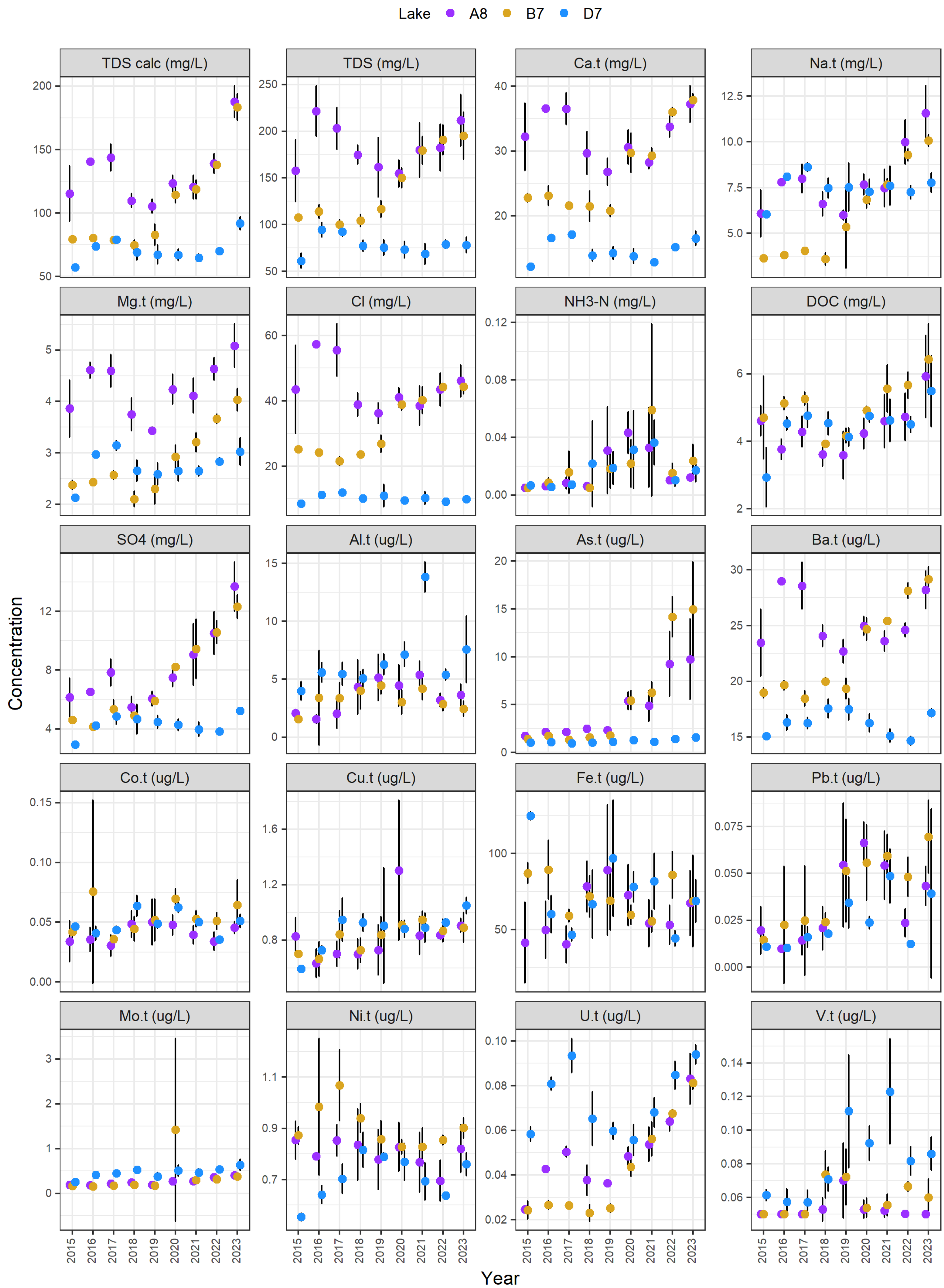
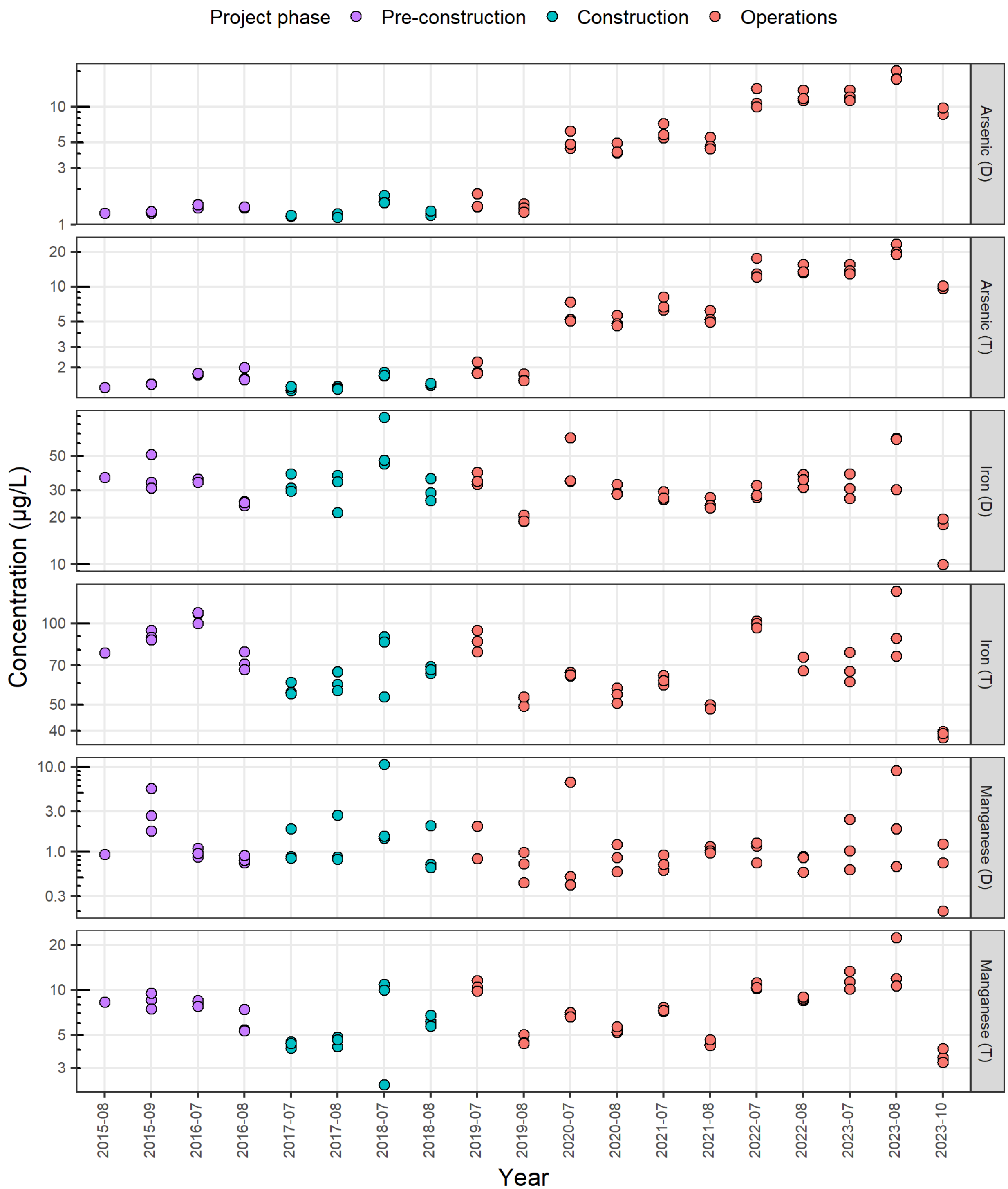


Figure 4-7. Temporal trends for arsenic, iron, and manganese in Lake B7



4.6 Supplemental Water Quality Plots

The following figures show the concentrations of selected major ions, nutrients, and metals in surface water samples from the Peninsula Lakes since 2015. The green line indicates the normal range, which corresponds to the upper 90th prediction interval or percentile of samples collected prior to 2018.

List of Plots

Figure 4-8. Concentration of total dissolved solids and constituent major Ions in the Peninsula Lakes since 2015

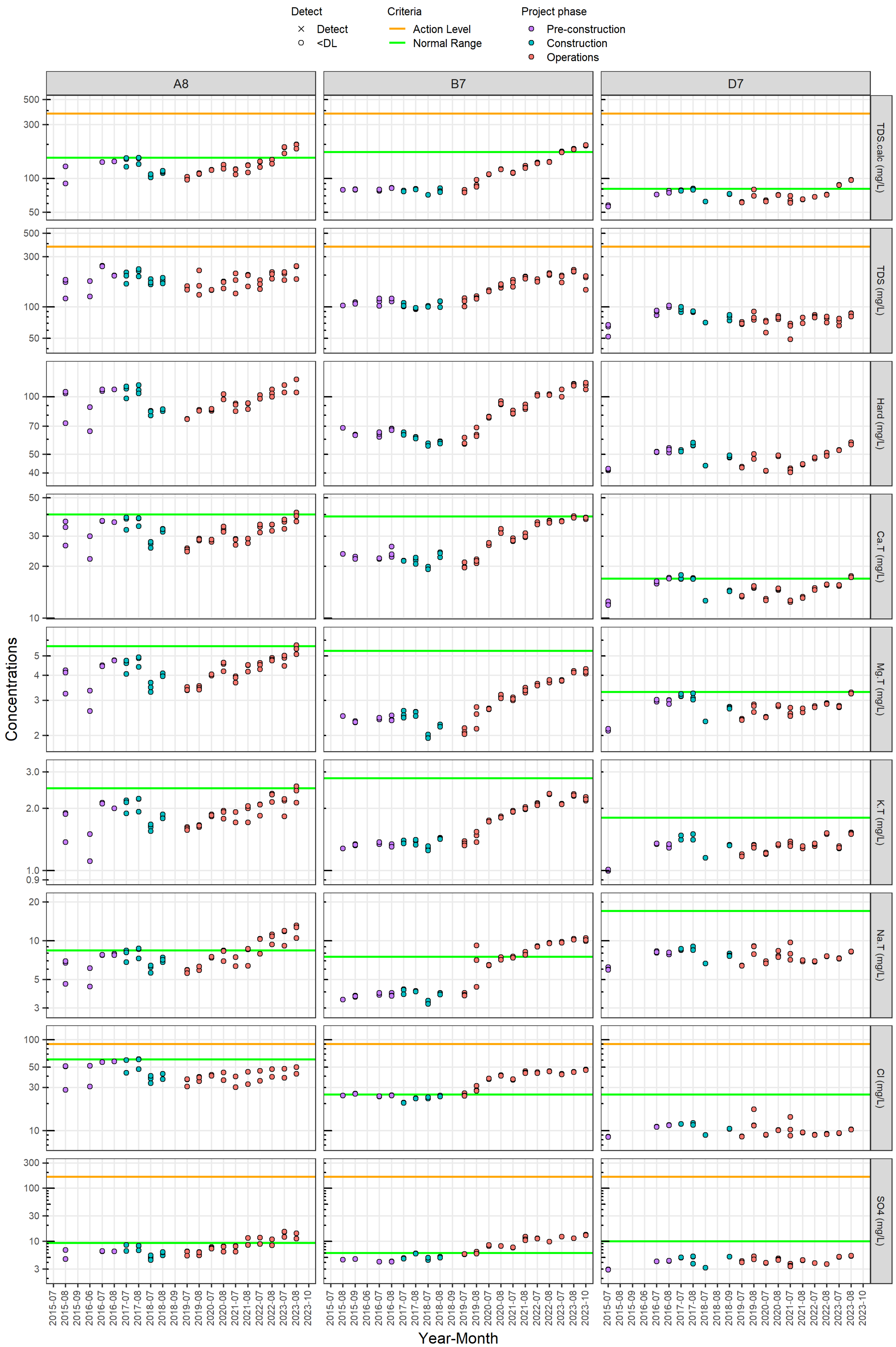


Figure 4-9. Conductivity, alkalinity, and the concentration of selected nutrients in the Peninsula Lakes since 2015

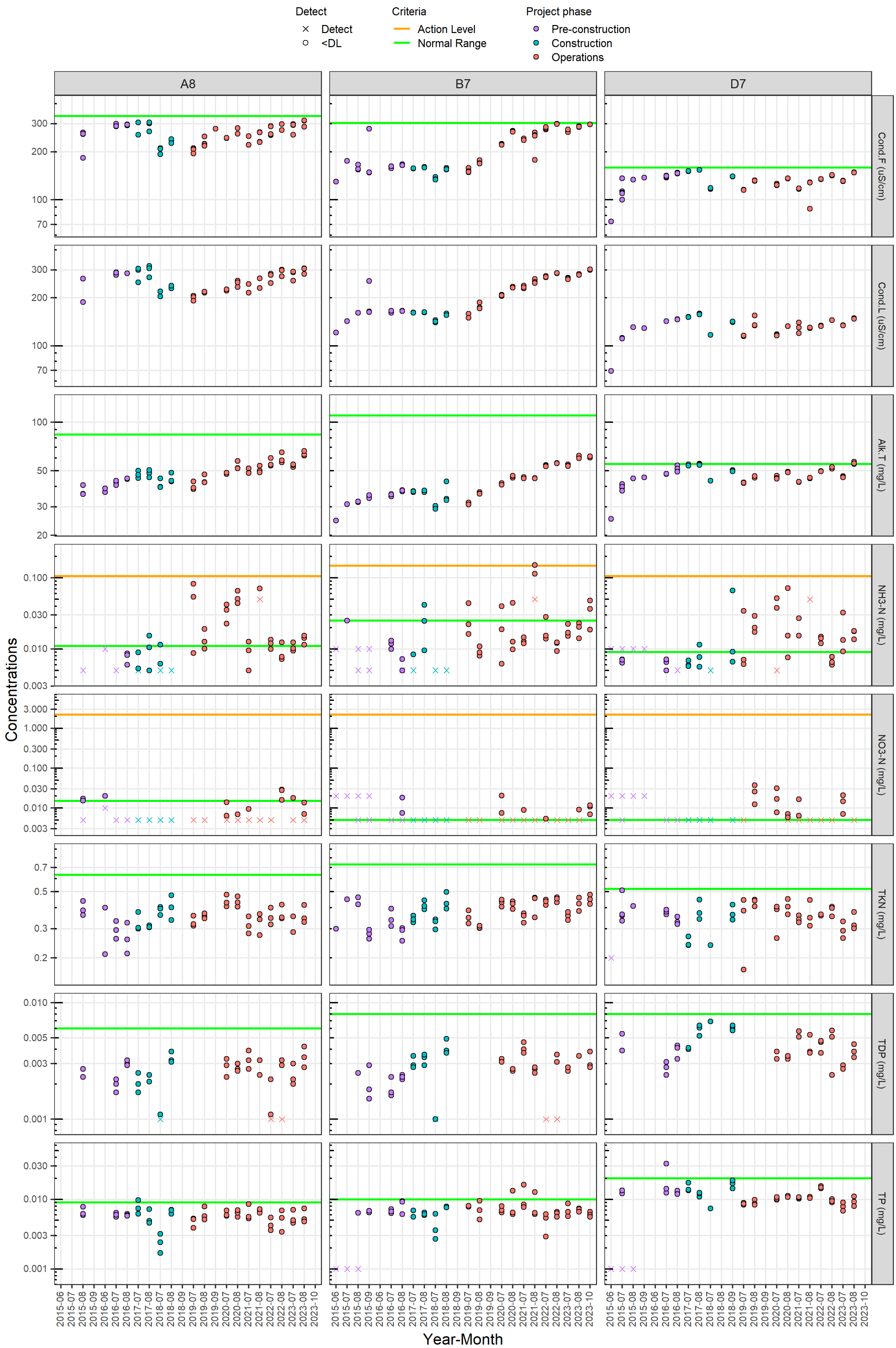


Figure 4-10. Aluminum, arsenic, barium, and boron concentrations in the Peninsula Lakes since 2015

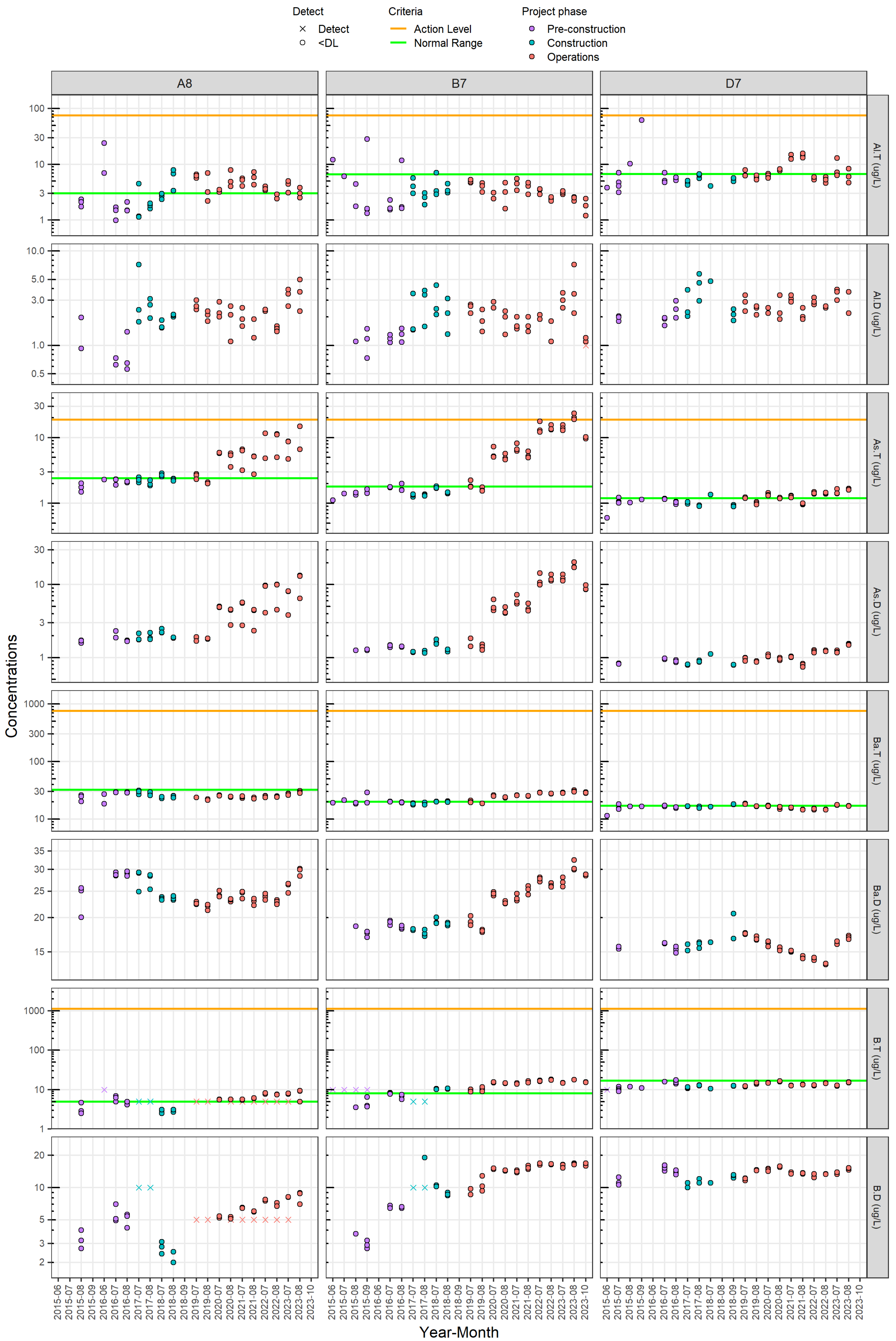


Figure 4-11. Cobalt, copper, iron, and lead concentrations in the Peninsula Lakes since 2015

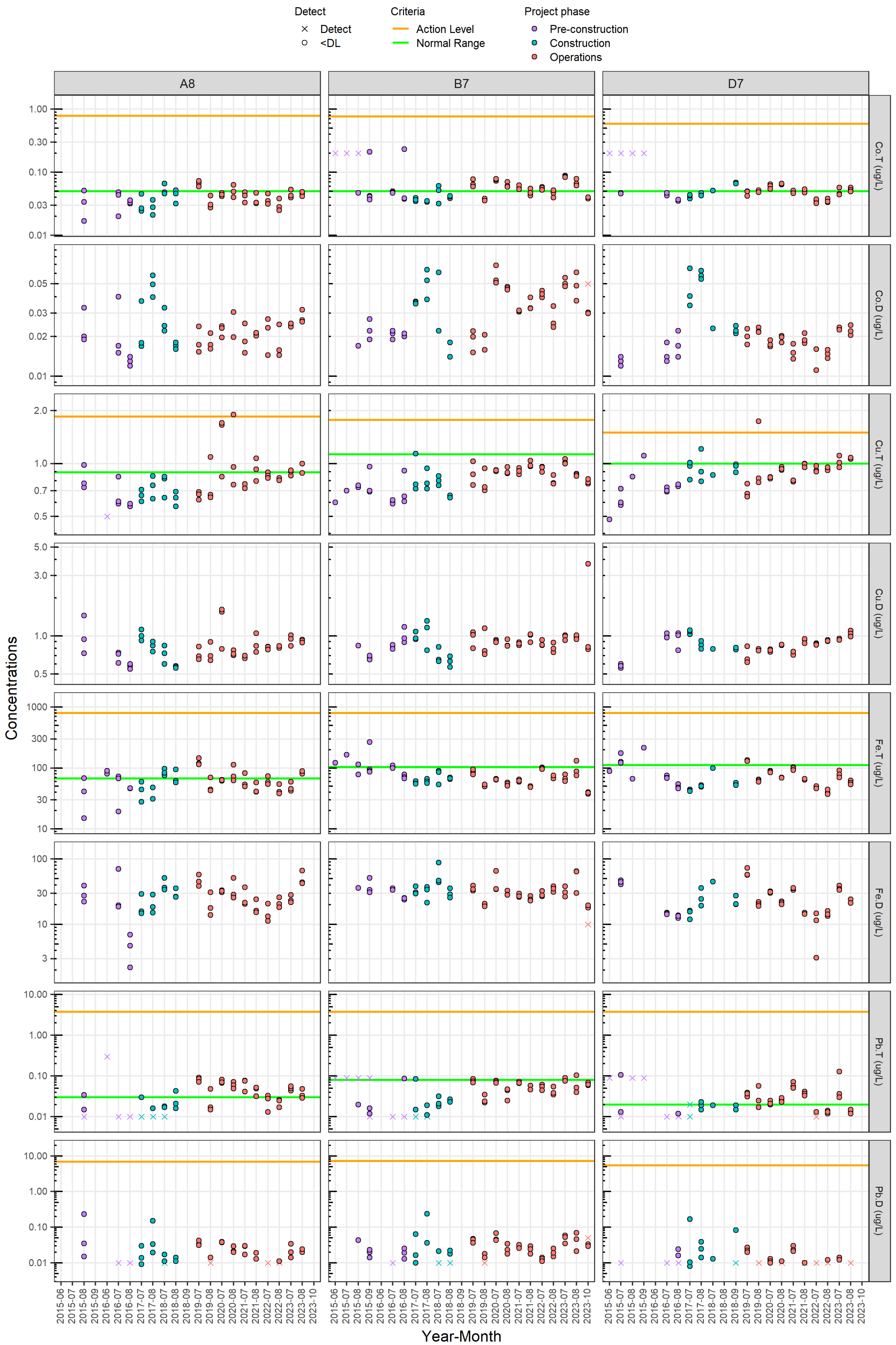


Figure 4-12. Lithium, manganese, molybdenum, and nickel concentrations in the Peninsula Lakes since 2015

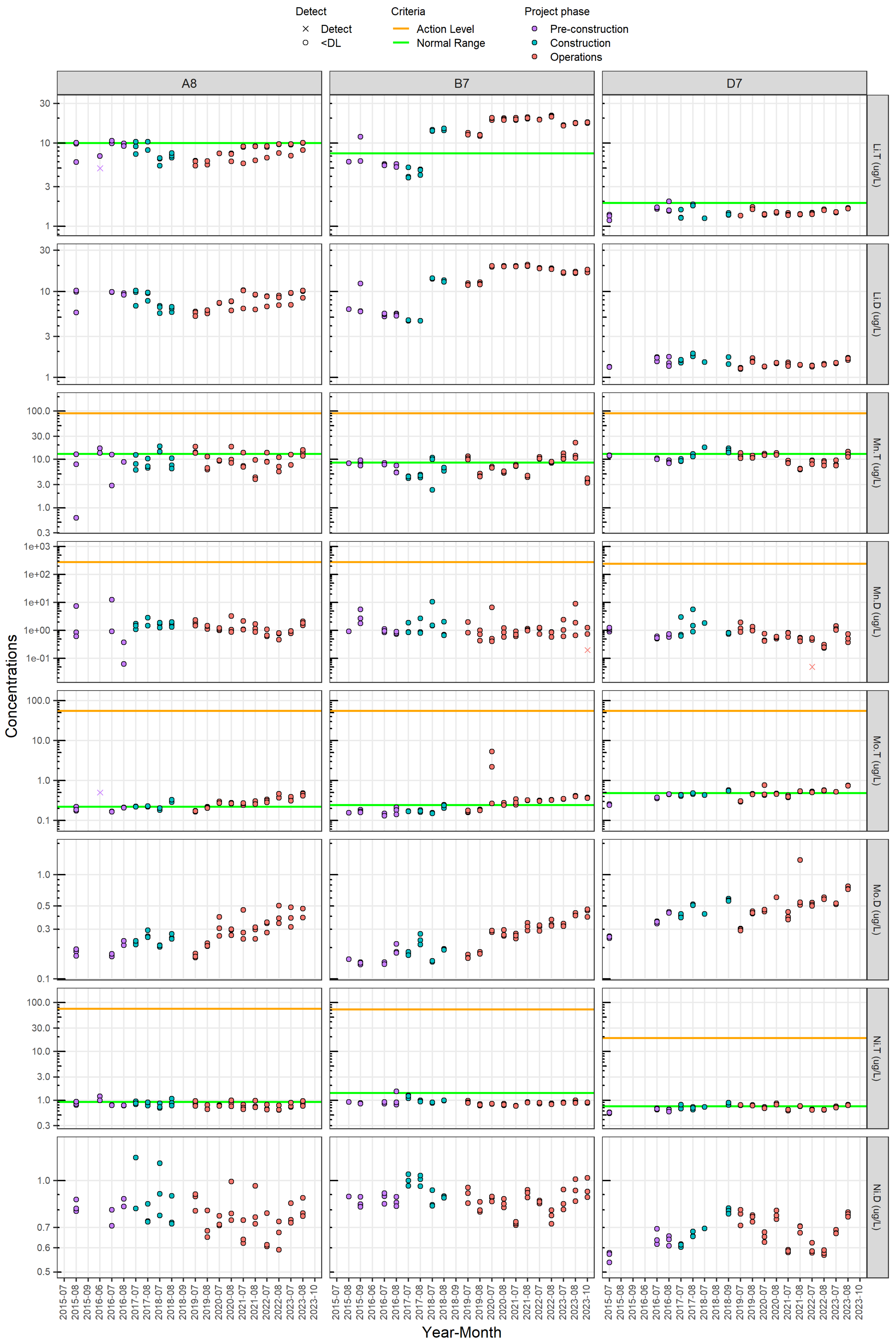


Figure 4-13. Strontium, titanium, uranium, and zinc concentrations in the Peninsula Lakes since 2015