GROUNDWATER MONITORING OF SHALLOW WELL NETWORKS

Ignace Chemistry Data Annual Report 2023

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KGS Group

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Groundwater Monitoring of Shallow Well Network – Ignace Chemistry Data Annual Report 2023

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STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This report has been prepared for Nuclear Waste Management Organization (NWMO) in accordance with the agreement between KGS Group and NWMO (the "Agreement"). This report represents KGS Group's professional judgment and exercising due care consistent with the preparation of similar reports. The information and recommendations in this report are subject to the constraints and limitations in the Agreement and the qualifications in this report. This report must be read as a whole, and sections or parts should not be read out of context.

Parts of this report are based on information made available to KGS Group by NWMO. Unless stated otherwise, KGS Group has not verified the accuracy, completeness, or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith. KGS Group shall not be responsible for conditions/issues it was not authorized or able to investigate or which were beyond the scope of its work. The information provided in this report apply only as they existed at the time of KGS Group's work.

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1.0 INTRODUCTION

1.1 Overview

The Groundwater Monitoring of Shallow Well Networks project is part of the Phase 2 Geoscientific Preliminary Field Investigations of the NWMO's Adaptive Phased Management (APM) Site Selection Phase. As part of the Phase 2 Preliminary Field Investigations, NWMO has established a shallow groundwater monitoring network at the Wabigoon Lake Ojibway Nation (WLON)-Ignace Area in Northwestern Ontario, herein after referred to as the Revell Site. The objective of this project is to retrieve, on a quarterly basis, measurements of groundwater pressures and temperatures that are collected on installed dataloggers, and to collect groundwater samples for chemical analyses. The collection of this information is necessary to evaluate shallow groundwater system behavior and characteristics.

A test plan was prepared to plan for specific work at the site. The field groundwater monitoring started in the beginning of the third quarter (Q3) of year 2022, i.e., in the month of July, followed by two additional field events in September and December 2022. The first field event of 2023 for the Revell Site was completed during the second quarter (Q2) month of June, as there was no sampling event during Q1 of 2023 because the NWMO Geosciences team had planned to conduct a range of field studies. The remaining field events of the program were completed as planned in Q3, Q4 and Q1-2024.

Each groundwater monitoring and sampling program for the Revell Site involved the collection of groundwater pressure measurements and baseline groundwater samples from a selection of the 27 permanently installed monitoring well intervals for each of the 2022, 2023 and 2024 field sampling events. The groundwater pressure and temperature measurements were recorded with 27 permanently installed vibrating wire piezometers connected to dedicated four-channel dataloggers (one datalogger connected to three vibrating wire transducers per multilevel monitoring well) taking measurements at 6-hour intervals. The quarterly groundwater testing included the analysis of parameters including dissolved metals, routine parameters (see Table 2 for the complete list of parameters), nutrients, iodide, stable isotopes of oxygen and hydrogen ($\delta^{18}O$ and $\delta^{2}H$). Other specialized radioactive isotopes were sampled and analyzed once in 2022 and once in Q2-2023.

KGS Group prepared a separate annual chemistry report for the data collected in 2022 (KGS Group, 2024). This annual report presents the work completed and the data findings/analysis for the groundwater chemistry data collected in 2023 and during Q1 of 2024 from the shallow well network of the Revell Site.

1.2 Scope of Work

The overall objective of the groundwater monitoring and sampling program is to collect groundwater pressure measurements and baseline groundwater chemistry samples from each of the 27 permanently installed monitoring well intervals over two (2) years, starting in July 2022 until April 2024. While the data collected during the 2022 field events and its interpretations are included in the 2022 annual chemistry report, the current report includes the data and its analysis/interpretations for the three field events of 2023 and Q1 2024 for the Revell Site.

The four field events discussed in this report were each conducted during the months of June, September, and December of 2023, and in April 2024, and are referred to as the *current monitoring period.* A separate report will present the groundwater pressure results for the same period.

This data report presents the results of the field and laboratory measurements and groundwater physicochemical characteristics. The laboratory results of the groundwater samples collected during the *current monitoring period* were assessed and analysed to characterize groundwater chemistry at the Revell Site. A total of 26 groundwater samples (not including trip blank and trip field blank samples) were collected in 2023 while 9 groundwater samples were collected in Q1 of 2024, for a total of 35. All samples were analyzed for dissolved metals, routine parameters (see Table 2 for the complete list of parameters), nutrients, iodide and stable isotopes of oxygen and hydrogen ($\delta^{18}O$ and $\delta^{2}H$). Other specialized radioactive isotopes (gross alpha, gross beta, Strontium 87/86 ratio ($^{87}Sr/^{86}Sr$), Carbon-13 ($\delta^{13}C$ DIC), Chlorine-37 ($\delta^{37}Cl$) and Carbon-14 (^{14}C) and Tritium (^{3}H)) and dissolved ruthenium were analyzed only for the samples collected in Q2 of 2023. Of these 35 samples, 27 are considered to be high confidence samples as the purging criteria I was achieved and are discussed in detail in Section 4.0.

The characterization of groundwater was done based on the chemical composition of major ions. The software tool AquaChem (Build 19.22.0722.1), by Waterloo Hydrogeologic, was used to visualize and assess water chemistry. Groundwater laboratory results were plotted on Durov and Stiff diagrams to visualize physicochemical characteristics of groundwater and analyze trends for the *current monitoring period*. In addition to concentration of major ions in water, a discussion of trends of concentrations and ratios of stable and radio isotopes was completed.

2.0 PROJECT LOCATION

2.1 Land Acknowledgment

It is important to acknowledge that this project was completed on the traditional territory of the Anishinaabe people of Treaty Three. KGS Group and its subcontractors are grateful for being given the opportunity to complete work within the area and are thankful for the generations of people who have taken care of the land for thousands of years.

2.2 Study Area

The Revell Site is located on the Canadian Shield, at approximately 43 km northwest of the Town of Ignace, 21 km southeast of the Wabigoon Lake Ojibway Nation, and 260 km northwest of Lake Superior (NWMO, 2023), Figure 1.

The ground surface elevation at the western boundary of the Revell site where the Wabigoon River lies, is at 368 metres above sea level (masl), while it increases to 554 masl at the southeastern boundary of the site (NWMO, 2023). The site is comprised of rolling surfaces of Canadian Shield bedrock that is either covered with shallow glacial deposits or is exposed to the ground surface. This reflects an interplay between glacial action and rock resistance, with weaker rocks having been eroded to lower elevations while more resistant rocks forming the topographic highs (Renwick, 2009). The two major surface soils in the Ignace area are clay and sand of morainal, glaciofluvial or glaciolcustrial origin (Golder, 2013).

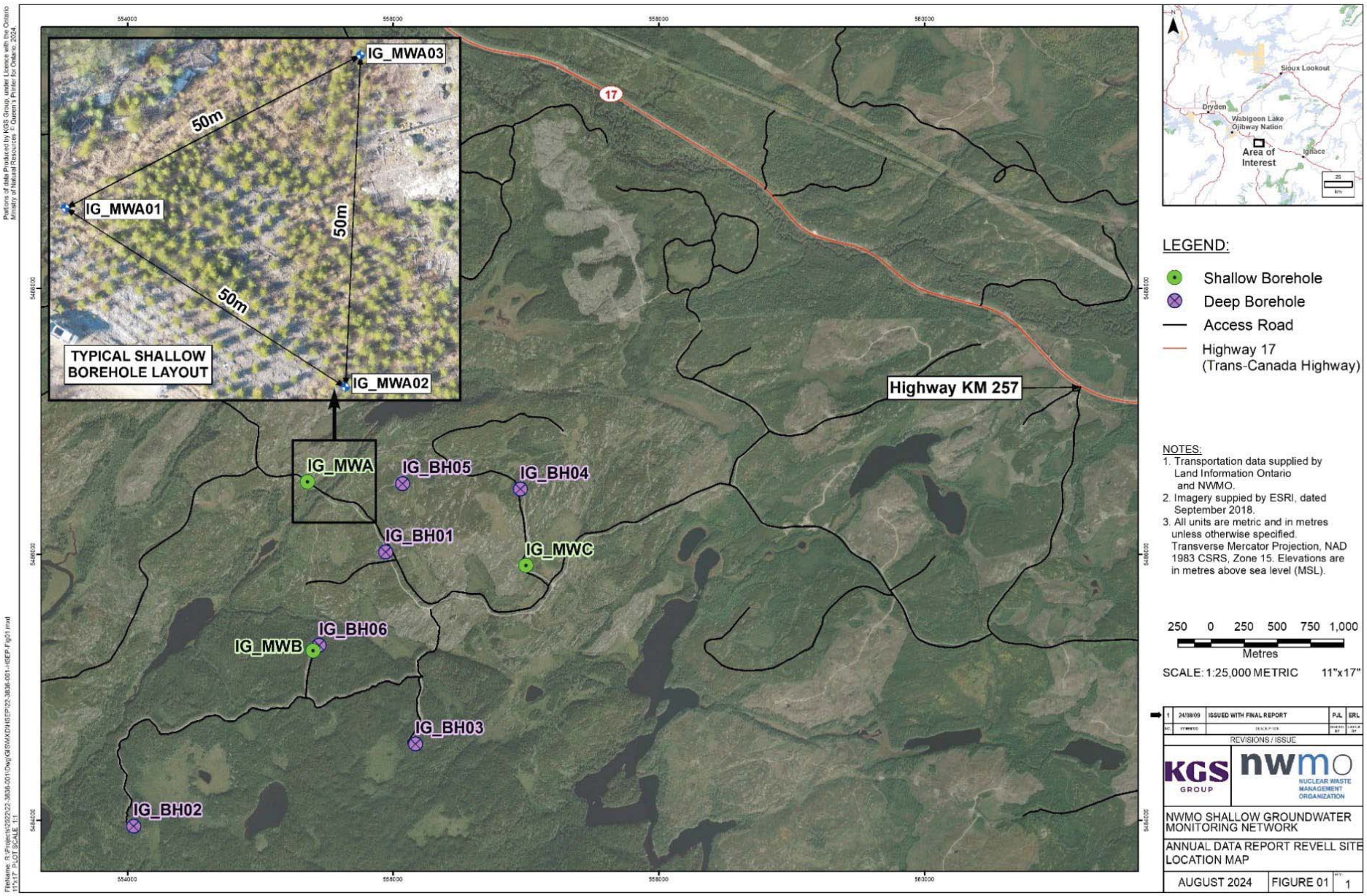
The Ignace area lies within the Superior Province of Canadian Shield and is underlain by Archean bedrock created from several ancient and tectonically stable plates and gradually accumulated juvenile arc terranes (Card and Ciesielski, 1986). Within the Superior Province, the area is situated in the central portion of Wabigoon Subprovince which is comprised of thin greenstone belts that are separated by large felsic plutonic rock masses (Stone, 2010a). A number of granite and granodioritic batholiths dominate the bedrock geology of the Ignace area (Stone, 2010a). The geological setting of the Ignace area is discussed in detail by Golder, 2013.

There are numerous lakes in the Ignace area which are interconnected by a network of rivers such as English, Wabigoon, and Turtle rivers. These rivers drain into the Nelson River which further flows into the Hudson Bay as its largest contributor of fresh water (JDMA, 2013). Details about the three tertiary-scale watersheds and several quaternary-scale watersheds in the Ignace area are provided in the Phase 1 Geoscientific Desktop Study by JDMA, (2013).

A total of nine (9) 100 m deep multilevel monitoring wells were drilled and installed in 2021 (KGS Group, 2023). Three multilevel monitoring wells were drilled and installed at three separate sites. Each multilevel monitoring well is comprised of three discrete depths/zones that have dedicated pressure monitoring instrumentation, to measure and record groundwater pressures and temperatures, thus, leading to a total of 27 separate monitoring well points. The three pressure monitoring instruments are connected to a datalogger on surface. Each multilevel well also has equipment for collecting groundwater samples. The three multilevel monitoring well sites include (Figure 1):

- IG_MWA
- IG_MWB
- IG_MWC

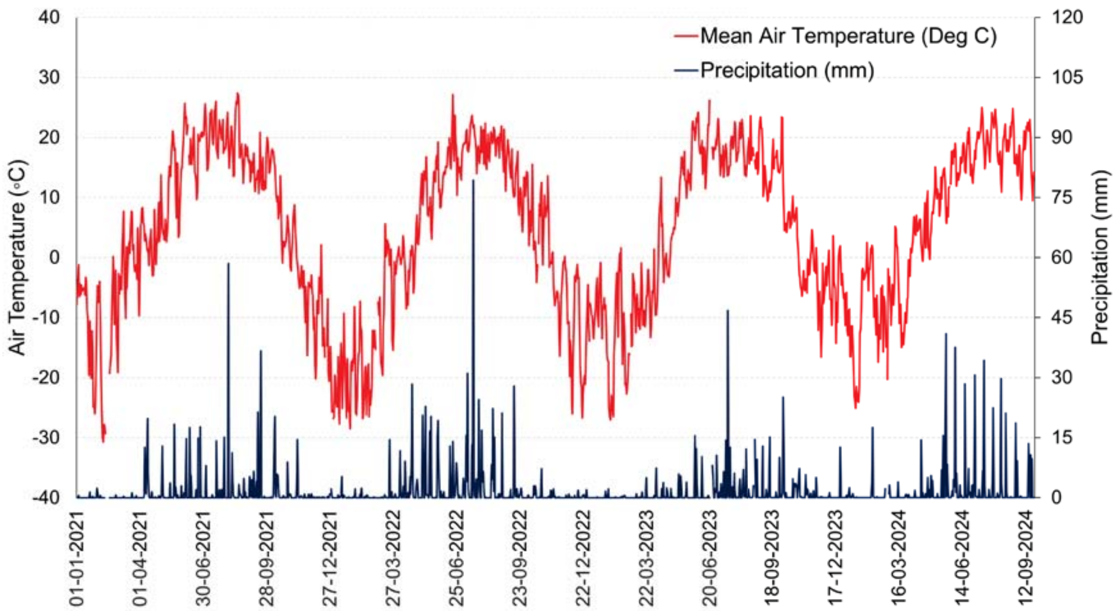
FIGURE 1: SITE LOCATION



2.3 Climate

The study area is subject to a humid continental climate of the warm summer subtype (Dfb under the Köppen climate classification defined by Kottek et al., (2006)). The closest weather station that exhibits the 1981-2010 Climate Normal Data is located in Dryden, ON, and is located approximately 49 kms Northwest of the Site (Environment and Climate Change Canada, 2017). The monthly average temperature varies from -16.8 ^{o}C in January to 18.9 ^{o}C in July as per the 1981 – 2010 Canadian Climate Normal. The area receives an average annual rainfall precipitation of 555.8 mm and 174.7 mm of snowfall precipitation, with a total annual precipitation of 719.7 mm. The wettest months are June and July (Environment and Climate Change Canada, 2017). The daily temperature and precipitation data for the period between January 1, 2022, and September 24, 2024, was available from the Dryden (Regional) weather station that is located at about 50 kms Northwest of the Ignace Site and is presented below on Figure 2:

FIGURE 2: SITE CLIMATE



2.4 Bedrock Geology

The site is located in the Revell batholith within the Wabigoon Subprovince of Canadian Shield. The Ignace area comprises a number of granitic to granodioritic batholiths as described by Stone, 2010a. Batholiths identified by Golder, 2011 in their initial screening report of the Ignace area include: Indian Lake Batholith, Revell Batholith, and the White Otter Lake Batholith. The Revell batholith was formed about 2.7 billion years (Percival & Easton, 2007) and is located in the western portion of the Wabigoon Sub-Province of the Superior Province. It is also surrounded by the older greenstone belts that are composed of old volcanic and meta-sedimentary rocks (Golder, 2013).

The lithology of the shallow bedrock (<101 m below ground surface) at the Revell Site was interpreted from the borehole drilling and geophysical logging of the shallow monitoring well drilling sites (IG_MWA, IG_MWB, and IG_MWC) (KGS Group, 2023).

There is minimal overburden material in the Revell Site area leading to high bedrock exposure at the surface. The three main suites of plutonic rock in the Revell batholith, include (oldest to youngest): a Biotite Tonalite to Granodiorite suite, Hornblende Tonalite to Granodiorite suite, and a Biotite Granite to Granodiorite suite. A detailed description of the bedrock geology of Ignace area has been provided by WSP (2023).

3.0 METHODOLOGY

3.1 Overview

Monitoring and sampling activities were scheduled to be completed by KGS Group on a quarterly basis. Each quarterly event consisted of checking and downloading pressure data from all 27 vibrating wire transducers, followed by purging select intervals, measuring water chemistry parameters and collecting groundwater samples and submitting them for laboratory analysis. A detailed Test Plan for the Revell site was prepared in advance of the first field event of 2022. The Test Plan outlines all the equipment, methodologies, criteria, and steps needed to achieve the desired outcomes of the project within the confines of the approved scope of work.

Wells to be sampled were pre-determined, together with the NWMO project team, in advance of the event. For each quarterly event, technical work followed the same general procedures as outline below, but were not limited to:

- Pre-mobilization equipment and material checks.
- Mobilization of all personnel.
- Checked and downloaded the data from all nine dataloggers (27 transducers), verified that the 4-channel dataloggers were functioning and were in good working order, perform maintenance on the datalogger(s) if required, field checked the data, and saved the data following the DMP (Data Management Plan) on the field laptop.
- Purged selected monitoring zones until purging criteria was met, collected and contained all purged water and disposed at the local wastewater treatment plant.
- Measured and recorded water quality parameters while purging.
- Collected one groundwater sample for the quarterly sample analysis package from each selected zone after purging criteria was met and after the well recovered to a minimum of 80% of the static pressure.
- Collected additional QA/QC samples (matrix blank and spike and a trip blank) as part of the 10% QA/QC requirements during each quarterly event.
- Submitted the samples for analysis to approved laboratories.
- Stored, processed, and prepared the analytical data for analysis and submission to NWMO.
- Prepared pressure data quarterly reports.

The steps outlined above are detailed further as pre-mobilization and mobilization activities, fluid pressure and temperature monitoring, purging and field parameters, groundwater sampling, data assessment and reporting activities.

3.2 Health, Safety and Environment Activities

While the field team was working on site, the Field Lead/Supervisor held daily tailgate meetings with the field crew at the beginning of their workday to review the planned work activities, the related health, safety and environmental issues related to the planned work and specific hazards associated with each task and mitigation and control measures related to the hazards. All Job Safety Analysis (JSA) forms were updated as needed and signed off by the field team. Completed JSAs have been provided with the data package. An example of some of the specific hazards identified during the field event included:

- Heavy lifting.
- Compressed gas.
- Water containment.
- Slips, trips, and falls.
- Hand Tool Safety.
- Use/handling of cleaning detergents, sample preservatives.
- Highway driving.
- Tire punctures from driving on gravel roads, narrow forest road access, and farm field access, etc.
- Wildlife crossings/encounters.
- Handling of preservatives when collecting samples.
- Weather (e.g., heavy rain, thunderstorms, lightning protocols).

No health and safety or environmental incidents occurred during any of the field events during the *current period*. The field lead conducted a daily environmental inspection at each of the sites using a prescribed checklist. The completed checklist was included in the data package.

3.3 Fluid Pressure and Temperature Monitoring

Fluid pressure and temperature monitoring was also completed during each monitoring event in 2023-24. The annual pressure data for the 2023-2024 period is addressed in a separate report.

3.4 Groundwater Sampling

The collection of groundwater samples comprises a significant portion of the scope of work of this project. The methodology for conducting the field work is described in the following sections.

3.4.1 SAMPLE LOCATION SELECTION

Monitoring well sample location selection was made in collaboration between the KGS Group project team and the NWMO project team several weeks prior to mobilizing to the field for each quarterly event. The rationale for selecting the monitoring wells to be sampled was documented on *DQCF01-Sample Location Rationale*, which provides the criteria and rationale for the sample location selection process. Completed DQCF01s were included with the data deliverable package for each quarterly event.

Well selection was done collaboratively and applying selection criteria such as: (i) even sample distribution over time, (ii) sufficient volume of water to be purged and sampled; some intervals did not have sufficient volume of water to reliably be purged and sampled based on previous work done on the wells in 2021 under a separate contract, and from the data collected in 2022.

3.4.2 GROUNDWATER FIELD CHEMISTRY EQUIPMENT CALIBRATION AND DECONTAMINATION

As per the Ignace Test Plan, KGS Group field staff did a field verification of each piece of equipment at the beginning of each day. If the instrument was not within manufacturer tolerance ranges when reading the calibration standards, then the instrument was re-calibrated in the field using valid National Institute of Standards and Technology (NIST) certified calibration standards and following the manufacturer's instructions. All field verifications and calibrations were recorded on *DQCF03-Equipment Calibration Log*. Completed DQCF03s have been provided with each of the Quarterly Data Delivery packages.

Certificates of calibration for each instrument used to measure a groundwater parameter in the field and Certificate of Analysis for all calibration standards have also been provided with each data deliverable package.

Decontamination and cleaning of each piece of equipment used to measure groundwater parameters was completed before purging was started as per the test plan. The decontamination process was recorded on *DQCF04-Equipment Decontamination Log* every time an interval was purged/pumped. Completed DQCF04s have been provided with each quarterly data deliverable package.

3.4.3 MONITORING WELL PURGING CRITERIA

The defined criteria agreed to by NWMO for when a groundwater sample can be collected is described in the Ignace Test Plan, which describes how purging activities would be completed and the criteria that should be used to determine when a groundwater sample can be collected. Due to the generally low hydraulic conductivities measured in the multilevel monitoring wells during the 2021 Shallow Groundwater Installation by KGS Group, well purging criteria was developed to guide the field purging activity and to try and ensure that a sample could be collected with high confidence in terms of sample integrity and more likely be representative of the groundwater at the Revell Site. The criteria used for determining when a sample would attempt to be collected must be one of three possible scenarios:

I. **Stabilization of Field Parameters:** Three consecutive readings that do not deviate more than the defined ranges as shown on Table 1 below for all field parameters (e.g., pH, electrical conductivity, temperature, total dissolved solids, turbidity, oxygen reduction potential, fluorescein, dissolved oxygen, density).
II. **Three well volumes purged:** Calculated total volume of water in each monitoring interval is purged three times before scenario I is observed.
III. **Well purged dry three times after 80% recovery each time:** Neither scenario I nor II as described above is achieved. Well is not able to be purged at steady-flow rates.

The groundwater chemistry stabilization criteria (Criteria I) are given on Table 1 below and are also provided on *DQCF05-Field Parameter Data Sheet* provided with each quarterly data deliverable package.

TABLE 1: FIELD PARAMETER STABILIZATION TARGETS

Field Parameters	Measurement Instrument	Units	Stabilization targets
Fluoresceine Dye	Pyxis Handheld Fluorometer, SP-380	ppb	<1 ppb Change
Hydraulic Density	Polycarbonate Buoyant Hydraulic Densometer	g/cm^3	N/A

Field Parameters	Measurement Instrument	Units	Stabilization targets
Total Dissolved Solids (TDS)	Hanna DiST1 Total Dissolved Solids Meter	mg/L	± 10% Change
Turbidity	Hach 2100Q	NTU	± 10% or ± 5 NTU, if initial NTU measurement is >50 NTU
Dissolved Oxygen (DO)	YSI 556 Water Chemistry Kit	mg/L	± 10% Change
Electrical Conductivity (EC)		mS/cm	± 10% Change
Temperature		Degrees Celsius	± 0.5 ºC Change
pH		pH unit	± 0.1 standard pH units Change
Oxidation-Reduction Potential (ORP)		mV	± 10% Change

3.4.4 PURGING METHODOLOGY

The Ignace Test Plan describes how purging of the monitoring well intervals at the Revell site was completed using the dedicated double valve pump installed as part of the Solinst Waterloo multilevel system with each pump having a dedicated drive and vent tube that extends to surface and is connected to the wellhead manifold. The pump was driven by compressed nitrogen gas controlled by a Solinst electronic control unit (ECU) that regulates and controls the pressure applied and duration of drive and vent cycles. Each monitoring interval required application of specific pressures with the main goal being to optimize the drive and vent times so that a low-flow steady flow rate was achieved. Steady flow stabilization allowed for collecting water quality field parameter measurements to track stabilization progress in each interval, and to ensure a representative groundwater sample was collected. The range of flow rates ranged between 7 and 380 mL/min.

KGS Group attempted to optimize the drive/vent cycles for each of the depth intervals to try and establish drive/vent timing that produced a steady low-flow rate. All purge water was diverted into pails and sealed with lids. Pails of purged water were disposed of at the City of Dryden Wastewater Plant.

A summary of the pump settings used in the field and the actual purge volumes is included in the *DQCF05-Field Parameter Data Sheets* provided with each Quarterly Data Deliverable packages.

3.4.5 GROUNDWATER PARAMETER MONITORING

As per the Ignace Test Plan, a flow-thru cell was used with the field verified YSI Pro multi-probe testing unit that allowed the measurement of water quality parameters every 5 minutes. Water quality parameters that were not measured using the YSI Pro multi-probe unit were measured with field verified/calibrated instruments from water collected from the discharge tubing of the flow-thru cell in a clean/decontaminated plastic cup or instrument-specific sample containers. Field measurements were recorded directly onto DQCF05. All completed DQCF05s and excel files were included with the Quarterly Data Deliverable packages.

3.4.6 QA/QC OF FIELD DATA

KGS Group completed the QA/QC of the field data that was recorded on Data Quality Confirmation Forms used to record datalogger readings at the time of downloading (DQCF02-*Transducer Download*), equipment calibration log (DQCF03), verify decontamination of field equipment (DQCF04), collect groundwater chemistry field measurements (DQCF05) and sample collection logs (DQCF06-*Sample Collection Log*).

This was completed as part of preparation for each of the quarterly data delivery packages. Each DQCF was reviewed by a senior reviewer for formatting, consistency of information being recorded, errors in the values and identification of values that were outside of the expected ranges. Where an error was found, that error was highlighted and a note was made of the correction. When a reading or value was outside of the expected range, that value was highlighted either by bolding or the cell was highlighted on the DQCF.

After the review was completed, the DQCF was signed off on by both the person who prepared the DQCF and the person who verified it.

3.5 Groundwater Analysis

During each of the field programs, KGS Group field staff presented the field parameter measurements recorded on DQCF05 to the KGS Group technical lead for verification that the purge criteria had been met and documented correctly before each sample was collected. Then groundwater sampling was completed by KGS Group field staff as described in Section 3.5.1 in the Ignace Test Plan.

The specifics and details for sample collection for all the field events are included on DQCF06 provided with the quarterly data deliverable packages.

QA/QC blanks were prepared as described in the Ignace Test Plan by ALS Laboratories LTD. All samples (including QA/QC samples) were analyzed for the Quarterly and Annual analytical packages as detailed on Table 2 below.

TABLE 2: SUMMARY OF LABORATORY PARAMETERS

Analysis Group	Parameters	Analysis Frequency
Dissolved Metals	Aluminum (Al), Antinomy (Sb), Arsenic (As), Barium (Ba), Beryllium (Be), Bismuth (Bi), Boron (B), Cadmium (Cd), Calcium (Ca), Cesium (Cs), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Lithium (Li), Magnesium (Mg), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Phosphorous (P), Potassium (K), Rubidium (Rb), Ruthenium (Ru), Selenium (Se), Silicon (Si), Silver (Ag), Sodium (Na), Strontium (Sr), Sulfur (S), Tellurium (Te), Thallium (Tl), Thorium (Th), Tin (Sn), Titanium (Ti), Tungsten (W), Uranium (U), Vanadium (V), Zinc (Zn), Zirconium (Zr)	Quarterly
Routine and Nutrients	Conductivity, pH, Alkalinity (Total, as CaCO3), Ammonia (Total, as N), Bicarbonate (HCO3), Bromide (Br), Carbonate (CO3), Chloride (Cl), Fluoride (F), Hydroxide (OH), Nitrate and Nitrite as N, Nitrate (as N), Nitrite (as N), Orthophosphate-Dissolved (as P), Phosphorus (P)-Total, Phosphorus (P)-Total Reactive, Silica	Quarterly

Analysis Group	Parameters	Analysis Frequency
	(SiO2)-Reactive, Sulfate (SO4), Total Kjeldahl Nitrogen, Total Nitrogen	
Dissolved Inorganic Carbon	Dissolved Inorganic Carbon (DIC)	Quarterly
Iodide	Iodide	Quarterly
$\delta^{18}O$, $\delta^{2}H$	Oxygen-18 ($\delta^{18}O$), Deuterium ($\delta^{2}H$)	Quarterly
Ruthenium – dissolved	Ruthenium – dissolved	Annually
$^{87}Sr/^{86}Sr$, $\delta^{13}C$ DIC, $\delta^{37}Cl$	Strontium 87/86 ratio ($^{87}Sr/^{86}Sr$), Carbon-13 ($\delta^{13}C$ DIC), Chlorine-37 ($\delta^{37}Cl$)	Annually
Gross Alpha/ Beta	Gross Alpha/ Beta	Annually
^{14}C and ^{3}H	Carbon-14 (^{14}C) and Tritium (^{3}H)	Annually

For all quarterly events, all the collected samples were submitted to ALS Laboratories located in Winnipeg, Manitoba by KGS Group.

All Certificates of Analysis (COA) (in both PDF and excel file formats), Sample Reception Confirmation (SRC) forms, Chain of Custody (CoC) forms, and electronic data deliverable (EDD) files have been provided with the data deliverable packages from each quarterly event.

3.5.1 QA/QC OF LABORATORY RESULTS

KGS Group completed a verification of the laboratory reports and data sets. Each set of reports and data have been identified and detailed on *DQCF07-Laboratory Data Quality Confirmation* forms and recorded per ALS work order #. These have been provided with each quarterly data deliverable package. The verification of the laboratory reports and data sets included the following checklist items:

- All results and data were received from the laboratory.
- All submitted samples requiring analysis were tested.
- Laboratory QA/QC procedures are outlined in the report.
- Laboratory results are in the proper format/unit.
- Laboratory results are in expected/reasonable ranges.
- Laboratory detection limits are correct.
- Chain-of-Custody contains the required information (dates, signatures, etc.).
- Hold time issues are identified.
- Additional notes (such as any other pertinent observations made by the reviewer of the lab reports).

Details regarding the results of the Quality Assurance/Quality Control checks and verifications done for the 2023-2024 analytical data are described below.

Results and Data Received from the Laboratory

There was no issue with any of the samples collected during the *current monitoring period* regarding missing analysis by the laboratory.

Laboratory Results are Reported in the Proper Format/Unit

The laboratory reported the concentration of nitrogen in both nitrate and nitrite ions for each sample throughout the *current monitoring period*. These concentrations are designated as Nitrate (as N) and Nitrite (as N), however, these concentrations were converted to nitrate (as NO_3) and nitrite (as NO_2) ion concentrations by KGS Group to meet the NWMO project objectives. Overall, the laboratory results for the *current monitoring period* data were analyzed and reported in units and detection limits that met the NWMO project objectives.

Hold Time Exceedances

Table 3 below summarizes the total number of samples, and parameters that exceeded the laboratory-recommended hold times for each of the quarterly sample events. It is important to note that the hold time for pH is 15 minutes and was exceeded for all samples submitted to the lab. This is an unavoidable exceedance, but is mitigated by collecting field measurements with a calibrated pH meter during purging. The field measured pH results are provided on Tables 7 and 8.

Possible reasons for a sample to exceed a hold time can be due to travel time to deliver the samples from the site to the lab, time of travel of a sample between laboratories for specific analysis (i.e. nitrate (as N), nitrite (as N), Total alkalinity (as $CaCO_3$) or some other issue at the lab, which is detailed on each of the quarterly DQCF07 and on Table 3.

TABLE 3: SAMPLE HOLD TIME EXCEEEDANCES

Analysis Group	Recommended Hold Times	Hold Time Exceedances			
		Q2 2023	Q3 2023	Q4 2023	Q1 2024
Dissolved Metals	180 days	None	None	None	None
Routine and Nutrients	Br, F, Cl, SiO_2, EC – 28 days ALK – 14 days ortho-PO_4^{3-} , NO_2^-, NO_3^- – 3 days All other nutrients – 28 days	6 samples for nitrite (as N) – samples received less than 24 hours prior to expiry.	4 samples for dissolved inorganic carbon.	3 samples for total reactive phosphorus (1). 3 samples for dissolved orthophosphate.	None
Dissolved Inorganic Carbon	14 days	None	None	None	None
Iodide	28 days	None	None	None	None
$\delta^{18}O$, $\delta^{2}H$	Unlimited if no headspace and chilled	None	None	None	None
Ruthenium – dissolved	180 days	None	None	None	None
$^{87}Sr/^{86}Sr$, $\delta^{13}C$ DIC, $\delta^{37}Cl$	Unlimited if no headspace and chilled	None	None	None	None
Gross Alpha/ Beta	Unlimited	None	None	None	None
^{14}C and ^{3}H	Unlimited	None	None	None	None

Note: (1) Freezing of the reactive phosphorus samples by the laboratory was done in accordance with ISO-5667-3 (2012) and does not affect the validity of the analysis.

3.5.2 ASSESSMENT OF LABORATORY RESULTS

Assessment of the laboratory data for this annual report by KGS Group was principally done by preparation of two distinct geochemistry plots, Durov and Stiff Diagrams. These plots were generated using AquaChem 11.0.

AquaChem 11.0 is a commercially available software developed by Waterloo Hydrogeologic. The version 11.0 and build 19.22.0516.1 of AquaChem was used to generate the Durov and Stiff Diagrams for the 2023-2024 shallow groundwater quality data for each quarterly sampling event. The Durov and Stiff plots were used for making interpretations of the groundwater types and trend analysis.

Data Processing: KGS Group received the laboratory data from ALS Laboratories LTD as an Electronic Data Deliverable file format (.EDD) which was imported into an environmental database management system called ESdat. The file generated by the lab reporting system consists of three files (a header file in a .xml format, a sample file in a .csv format, and a chemistry file in a .csv format) compressed in a zip folder. Within ESdat, the chemistry data was then arranged to be exported into the excel based acQuire import templates and as the primary data input into AquaChem to generate the geochemical plots.

Durov Plots: Multiple water types can be compared using a Durov plot. AquaChem 11.0 calculates the milliequivalents per litre (meq/L) of each cation and anion from the laboratory water quality data. The total cations and the total anions are expected to balance each other, however, there were inequalities in the sum totals of cations and anions as measured by the laboratory within the accepted margin of error of +/= 10% difference for majority of the samples. A total of three samples of the forty-three total samples (including field duplicate, trip blank, and field blank samples) analyzed by the lab had charge balance error greater than +/- 10%.

On the Durov plots, the cations and anions are plotted on adjacent ternary plots. The ternary diagram on the left (Y-axis) represents the cations: Magnesium, Calcium, and Sodium + Potassium, while the ternary diagram on the top (X-axis) represents the anions: sulfate, chloride, and carbonate + bicarbonate. The intersection of the data is shown on a central rectangular plot which is a projection of anions (X axis, SO_4, HCO_3+CO_3 and Cl) and cations (Y axis, Na+K, Mg and Ca) ternary plots. Side plots show the actual pH and conductivity values for each point. Durov plots can be used to differentiate between different water types, which plot in different sections of the graph. Similar water types tend to cluster within the same region of the central rectangular plot. The plot can also be used to infer the origin of the water or mixing processes between water types. Durov plots can also be used to plot changes in water quality data with time, which could be applied at this site in the future. A Durov Plot for all water types for high confidence samples are shown on Figure 3. Additional Durov plots are provided in Appendix A for each monitoring well site sampled (sites IG_MWA01 to IG_MWC03, Figures A1 to A6) and then by depth interval (i.e., C, B and A, Figures A7 to A9) and finally by sample event (Figures A10 to A13). Only high confidence samples are shown on the Durov plots.

Stiff Diagrams: Individual water types can be compared using Stiff diagrams that display the relative concentrations of major ions expressed in milliequivalents per litre (meq/L). The lengths of the polygon sides illustrate the major ion concentrations, and plots of different shapes indicate different “fingerprints” of water qualities. Waters of similar type have a similar plot shape and would be generally expected to originate from the same source. Water can be named using the major cations and anions found on a percentage basis in the laboratory water analysis, see Table 9. Stiff diagrams for all samples collected in the current monitoring period are provided in Appendix B, Figures B1 to B7. Stiff diagrams were prepared for high confidence samples only.

4.0 RESULTS

4.1 Sample Selection

4.1.1 SAMPLE LOCATION SELECTION

As indicated previously, the team selected all intervals from multilevel monitoring wells except IG_MWB02 and IG_MWC02 to be sampled in the Q2 2023 and Q3 2023 events, while in addition to IG_MWB02 and IG_MWC02, IG_MWB03 was also not sampled during Q4 2023 and Q1 2024 monitoring events. Table 4 below shows the number of samples collected during each quarterly event.

TABLE 4: 2023-2024 MULTILEVEL INTERVALS SAMPLED

Field Event	Q2 2023	Q3 2023	Q4 2023	Q1 2024
Dates of Event	June 19 to 25, 2023	September 25 to 29, 2023	December 4 to 6, 2023	April 3 to 6, 2024
Multilevel Interval Sampled	IG_MWA01_C IG_MWA02_C IG_MWA03_B IG_MWB01_C IG_MWB03_A IG_MWC01_A IG_MWC01_C IG_MWC03_C	IG_MWA01_C IG_MWA02_C IG_MWA03_B IG_MWB01_C IG_MWB03_A IG_MWC01_A IG_MWC01_C IG_MWC03_C	IG_MWA01_C IG_MWA02_C IG_MWA03_B IG_MWB01_C IG_MWC01_A IG_MWC01_C IG_MWC03_C	IG_MWA01_C IG_MWA02_C IG_MWA03_B IG_MWB01_C IG_MWB03_A IG_MWC01_A IG_MWC01_C IG_MWC03_C
Multilevel Monitoring Well Not Sampled	IG_MWB02 and IG_MWC02	IG_MWB02 and IG_MWC02	IG_MWB02, IG_MWB03 and IG_MWC02	IG_MWB02 and IG_MWC02
Total Samples Collected	8 groundwater samples + 3 QA/QC samples	8 groundwater samples + 3 QA/QC samples	7 groundwater samples + 3 QA/QC samples	8 groundwater samples + 3 QA/QC samples

Each multilevel monitoring well comprised three depth intervals (e.g. IG_MWA01_A, IG_MWA01_B, IG_MWA01_C), where "A" represents the deep interval, "B" represents the intermediate depth interval, and "C" is the shallowest within the multilevel). Purging of the multilevel monitoring wells during each quarterly events was completed as per the Test Plan.

4.2 Purging and Field Chemistry

The sections below present the results and a discussion of the purging and field chemistry results from 2023-24 field events.

4.2.1 FIELD PURGING RESULTS

4.2.1.1 Purge Volumes

Summaries of purge volumes corresponding to each quarterly event for high and low confidence samples, respectively, are presented in Tables 5 and 6 below, these measurements are also included on DQCF05 provided with the data deliverable package of each quarterly event.

TABLE 5: PURGING RESULTS OF HIGH CONFIDENCE SAMPLES

Multilevel Monitoring Well	Purging Results			Field Event
	Total Purge Volume (L)	Purge Method	Purge Criteria Achieved (I, II or III)	
IG_MWB01_C	34	Double Valve Pump	I – stabilized field chemistry	Q2 2023
IG_MWB03_A	14	Double Valve Pump	I – stabilized field chemistry	
IG_MWA01_C	10	Double Valve Pump	I – stabilized field chemistry	
IG_MWA03_B	17	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_C	6	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_A	16	Double Valve Pump	I – stabilized field chemistry	
IG_MWC03_C	5	Double Valve Pump	I – stabilized field chemistry	
IG_MWB01_C	19	Double Valve Pump	I – stabilized field chemistry	Q3 2023
IG_MWB03_A	22	Double Valve Pump	I – stabilized field chemistry	
IG_MWA01_C	7	Double Valve Pump	I – stabilized field chemistry	
IG_MWA03_B	14	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_C	3	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_A	11	Double Valve Pump	I – stabilized field chemistry	
IG_MWC03_C	13	Double Valve Pump	I – stabilized field chemistry	
IG_MWA01_C	9	Double Valve Pump	I – stabilized field chemistry	Q4 2023
IG_MWA03_B	15	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_C	3	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_A	10	Double Valve Pump	I – stabilized field chemistry	

Multilevel Monitoring Well	Purging Results			Field Event
	Total Purge Volume (L)	Purge Method	Purge Criteria Achieved (I, II or III)	
IG_MWC03_C	13	Double Valve Pump	I – stabilized field chemistry	
IG_MWB01_C	13	Double Valve Pump	I – stabilized field chemistry	
IG_MWA01_C	7	Double Valve Pump	I – stabilized field chemistry	Q1 2024
IG_MWA03_B	12	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_C	3	Double Valve Pump	I – stabilized field chemistry	
IG_MWC01_A	10	Double Valve Pump	I – stabilized field chemistry	
IG_MWC03_C	11	Double Valve Pump	I – stabilized field chemistry	
IG_MWB01_C	10	Double Valve Pump	I – stabilized field chemistry	
IG_MWB03_A	7	Double Valve Pump	I – stabilized field chemistry	

The samples collected from monitoring well interval IG_MWA02_C are considered of low confidence. None of the samples collected satisfied the purge criteria I (stabilized field chemistry) during each quarterly events of *current monitoring period.* Therefore, the chemistry results for these four samples are not discussed in the upcoming sections. This interval was purged dry three times (purging criteria III) and resulted in field parameters (TDS, EC, DO) and analytical results that are notably elevated compared to the results from intervals that were able to reach groundwater field parameter stabilization. The purging results for this one monitoring interval are shown on Table 6.

TABLE 6: PURGING RESULTS OF LOW CONFIDENCE SAMPLES

Multilevel Monitoring Well	Purging Results			Field Event
	Total Purge Volume (L)	Purge Method	Purge Criteria Achieved (I, II or III)	
IG_MWA02_C	1.32	Double Valve Pump	III – Purged dry 3x	Q2 2023
IG_MWA02_C	0.31	Double Valve Pump	III – Purged dry 3x	Q3 2023
IG_MWA02_C	1.12	Double Valve Pump	III – Purged dry 3x	Q4 2023
IG_MWA02_C	0.32	Double Valve Pump	III – Purged dry 3x	Q1 2024

4.2.2 FIELD CHEMISTRY RESULTS

KGS Group has reviewed the field chemistry results from all the field events of *current monitoring period* which included a detailed assessment of the hydrogeochemical characteristics of groundwater at the Ignace Site. The results of the field chemistry monitoring are presented in Tables 7 and 8 below for the high and low confidence samples, respectively. These field measurements were recorded during the purging of each of the multilevel monitoring well intervals in preparation for collecting a representative groundwater sample for laboratory analysis and are discussed below for the high confidence samples only.

4.2.2.1 Field Parameters Data Discussion

The groundwater temperature values during the field work ranged between 4.9 and 13.7 °C. The values of pH in groundwater of the area of study vary from 5.42 to 8.06, revealing the slightly acidic to slightly alkaline nature of the groundwater.

The values of field EC in samples varied between 40 and 2850 µS/cm at field groundwater temperatures, whereas the field TDS values ranged between 30 mg/L and 1630 mg/L. To understand the accuracy of field EC and field TDS measurements, the field EC values were compared against the EC values reported by the laboratory, whereas the field TDS measurements were compared with the calculated TDS values using the expression:

$TDS = k.EC_{field}$

Where, TDS is represented in mg/L, “k” is a unitless conversion factor, and EC is represented in µS/cm (Rusydi, 2018). The value of “k” is derived from the literature to be in the range 0.55 – 0.75 (Hem & Survey, 1985). During the Q2 2023 field event, it was noted that the field TDS values appeared to be slightly lower than calculated TDS values using a conversion factor of 0.55 (as noted by KGS Group on the acQuire Importers IG_IMP-29_SH included with the Q2 2023 Chemistry Data Deliverables). Although it should be noted that a Low Range TDS meter was used during the 2023 and 2024 field events, the maximum difference between the calculated and field TDS was 275 mg/L for IG_MWA03_B_GW0003 collected in Q2 2023. It should also be noted that the TDS values for samples collected from monitoring well interval IG_MWA03_B and IG_MWC01_C remained elevated throughout the *current monitoring period*, a possible indication that further well development is required, and because of this, these samples are most likely not representative of groundwater at the Site.

There were other instances where dissolved oxygen (DO) and turbidity of the samples were higher than expected or remained elevated after purging three well volumes. Elevated DO and turbidity readings in field samples that are noted in Tables 7 and 8 below where applicable.

TABLE 7: FIELD CHEMISTRY PARAMETERS OF HIGH CONFIDENCE SAMPLES

Multilevel Monitoring Well	Sample Event	Field DO (Multimeter) [mg/L]	Field EC [mS/cm]	Field ORP [mV]	Field Turbidity (NTU)	Field Fluorescein [ppb]	Field pH	Field TDS [mg/L]	Field Temp [°C]	Field Density (g/cm^3)	Comments
IG_MWA01_C	Q2 2023	7.0	40	30.7	**79**	0	**5.87**	30	9.2	1	Field turbidity was higher than expected. pH was lower than expected
	Q3 2023	0.9	54	11.2	19.2	0	**5.45**	40	8.9	1	pH was lower than expected
	Q4 2023	1.2	68	-30	32.5	0	**5.42**	30	7.5	1	pH was lower than expected
	Q1 2024	1.6	60	198.7	14.4	0	6.08	30	8.5	0.995	-
IG_MWA03_B	Q2 2023	0.4	1415	-194.8	0.6	0	7.75	**1160**	7.7	1	Elevated TDS value
	Q3 2023	0.6	1765	-235.4	0.7	0	7.65	**1340**	7.5	1.02	Elevated TDS value
	Q4 2023	0.6	2850	-216.4	0.5	0	7.28	**1350**	6.5	0.998	Elevated TDS value
	Q1 2024	0.8	2250	-193.6	0.7	0	7.35	**1630**	6.5	1	Elevated TDS value
IG_MWB01_C	Q2 2023	**3.9**	56	40.1	2	0	**5.96**	40	8.3	1.002	pH was lower than expected
	Q3 2023	1.5	119	59.6	0.5	0	**5.6**	70	8.3	1.01	pH was lower than expected
	Q4 2023	**3.2**	154	-66.7	0.4	0	**5.51**	60	8.3	1	Field DO was higher than expected while the pH was lower than expected
	Q1 2024	**2.1**	91	82.3	0.9	0	**5.94**	50	6.0	0.98	Field DO was higher than expected while the pH was lower than expected
IG_MWB03_A	Q2 2023	0.1	358	-143.6	**996**	0	7.96	220	4.9	Not enough water	Field turbidity was higher than expected
	Q3 2023	0.5	232	-182.4	**643**	0	7.89	190	**13.8**	1.01	Field turbidity and temperature was higher than expected
	Q1 2024	0.4	390	-118.1	150	0	8.06	220	7.5	Not enough water	-

Multilevel Monitoring Well	Sample Event	Field DO (Multimeter) [mg/L]	Field EC [mS/cm]	Field ORP [mV]	Field Turbidity (NTU)	Field Fluorescein [ppb]	Field pH	Field TDS [mg/L]	Field Temp [°C]	Field Density (g/cm³)	Comments
IG_MWC01_A	Q2 2023	0.4	531	-149.9	0.4	0	7.22	430	7.3	1	-
	Q3 2023	0.4	733	-214.2	0.5	0	7.3	490	7.6	1	-
	Q4 2023	0.3	1360	-192.2	0.3	0	7.17	510	7.1	1	-
	Q1 2024	0.3	940	-149.9	0.5	0	7.25	560	6.3	1	-
IG_MWC01_C	Q2 2023	1.7	1223	-131	6.6	0	6.81	**860**	**10.8**	1	Field temperature and TDS were higher than expected
	Q3 2023	1.2	2301	-160.9	3.3	0	7.17	**1350**	**12.3**	Not enough water	Field temperature and TDS were higher than expected
	Q4 2023	1.8	2616	-167.8	2.3	0	7.03	**970**	9.6	Not enough water	Elevated TDS value
	Q1 2024	1.6	1377	-56.7	1.8	0	7.04	**760**	8.4	1	Elevated TDS value
IG_MWC03_C	Q2 2023	1.3	566	-136.9	1.6	0	7.9	380	**12.7**	1	Field temperature was higher than expected
	Q3 2023	0.4	242	-105.8	0.4	0	7.62	150	8.9	1	-
	Q4 2023	0.3	467	-180.8	0.6	0	7.55	150	7.6	1	-
	Q1 2024	0.3	277	-82.5	0.3	0	7.71	150	6.8	1	-

Notes: **Bolded** values indicate a reading/measurement is flagged as likely not representative or erroneous and should be treated with caution, see comments.

TABLE 8: FIELD CHEMISTRY PARAMETERS FOR LOW CONFIDENCE SAMPLES

Multilevel Monitoring Well	Sample Event	Field DO (Multimeter) [mg/L]	Field EC [mS/cm]	Field ORP [mV]	Field Turbidity (NTU)	Field Fluorescein [ppb]	Field pH	Field TDS [mg/L]	Field Temp [°C]	Field Density (g/cm^3)	Comments
IG_MWA02_C	Q2 2023	1.7	1078	-162.5	20	0	7.68	**1150**	6.6	1	Elevated TDS value
	Q3 2023	1.5	1551	-137.2	20.4	0	7.76	**1000**	**13.5**	Not enough water	Field temperature and TDS were higher than expected
	Q4 2023	1.5	1944	-137.2	18.5	0	7.76	**910**	**11.3**	Not enough water	Field temperature and TDS were higher than expected
	Q1 2024	1.5	1944	-137.2	18.5	0	7.76	**910**	**11.3**	Not enough water	Field temperature and TDS were higher than expected

Notes: **Bolded** values indicate a reading/measurement is flagged as likely not representative or erroneous and should be treated with caution, see comments.

4.3 Groundwater Sampling Results

The Q2/Q3 2023 and Q1 2024 monitoring events, comprised collecting eight groundwater samples, one field duplicate, one trip blank, and one field blank, for a total of eleven samples. The Q4 2023 event was comprised of collecting seven groundwater samples, one field duplicate, one trip blank and one field blank samples, for a total of ten samples.

All samples were submitted for analysis at ALS Laboratories LTD. All sample IDs were provided by the NWMO Geoscientific Data Management (GDMS) Administrator prior to mobilizing to the field. Table 4 provides a summary of the total number of samples collected each quarterly sample event and the location of the samples.

As discussed in the previous sections, samples collected from the monitoring well interval IG_MWA02_C were considered of low confidence as this well did not meet the stabilization criteria during each purging attempt. Therefore, the chemistry results for all samples collected from this monitoring well during the *current monitoring period* are not discussed in this section. In contrast to that, the samples collected from monitoring well intervals IG_MWA03_B and IG_MWC01_C did satisfy the purge criteria I, however groundwater purged from these wells had high levels of TDS, and hence the chemistry results for these wells are also suspected to be unrepresentative of the groundwater and are discussed separately from the high confidence samples.

4.3.1 LABORATORY RESULTS

KGS Group has reviewed the laboratory results from all the field events of *current monitoring period* and included an assessment of the hydrogeochemical characteristics of groundwater at the Revell Site.

4.3.1.1 Concentrations of Major Ions

There are many natural factors that can affect the groundwater quality of an area. The primary factors include the chemical composition and the source of recharge water, the lithological and hydrological properties of the water-bearing geological unit and the groundwater residence time in a geological unit.

Major ions, both positively (cations) and negatively (anions) charged, are the most abundant dissolved constituents in the groundwater, and are found at equal concentrations for electroneutrality. The most abundant cations present in water are calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K). The most abundant anions are bicarbonate (HCO_3), chloride (Cl), and sulfate (SO_4). Durov plots were prepared for all samples based on the concentration of these ions and are provided in Appendix A. Durov plots were also prepared for each quarterly sample event seen on Figures 3 to 6 below. The concentration of major ions listed above are also shown for reference on all stiff diagrams presented in Appendix B.

The groundwater water type is based on the dominant dissolved cation and anion, expressed in milliequivalents per liter (meq/L). The dominant dissolved ion must be greater than 50% of the total. For example, the sodium-bicarbonate ($Na\text{-}HCO_3$) type water contains greater than 50% of total cation milliequivalents as sodium and more than 50% of total anion milliequivalents in water as bicarbonate. If no cation or anion is dominant, the water is classified as mixed, and the two most common anions (or anions in decreasing order of their composition) are used to describe the water type.

The water type of each sample is provided below on Table 9 grouped by sample location and excludes the trip blank, field blank and field duplicate samples:

TABLE 9: WATER TYPES AT THE REVELL SITE FOR HIGH CONFIDENCE SAMPLES

Multilevel Monitoring Well	Sample ID	Sample Event	Sample Date (dd-mm-yyyy)	Na (mg/L)	Ca (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	SO_4 (mg/L)	Water Type	Comments
IG_MWA01_C	**IG_MWA01_C_GW0003**	Q2 2023	22-06-2023	3.78	3.6	0.51	17.1	3.95	Na-Ca-HCO_3	-
	IG_MWA01_C_GW0004	Q3 2023	27-09-2023	5.73	6.74	0.61	30.7	3.38	Ca-Na-HCO_3	-
	IG_MWA01_C_GW0005	Q4 2023	04-12-2023	4.18	4.36	0.5	18.8	4.24	Ca-Na-HCO_3	-
	IG_MWA01_C_GW0006	Q1 2024	03-04-2024	3.56	3.55	0.54	15.7	3.66	Ca-Na-HCO_3	-
IG_MWA03_B	**IG_MWA03_B_GW0003**	Q2 2023	22-06-2023	293	60.3	83	194	470	Na-SO_4	High TDS
	IG_MWA03_B_GW0005	Q3 2023	27-09-2023	432	64.2	124	264	684	Na-SO_4	High TDS
	IG_MWA03_B_GW0006	Q4 2023	04-12-2023	447	64.5	113	255	677	Na-SO_4	High TDS
	IG_MWA03_B_GW0007	Q1 2024	03-04-2024	517	94.4	150	350	898	Na-SO_4-HCO_3	High TDS
IG_MWB01_C	**IG_MWB01_C_GW0002**	Q2 2023	19-06-2023	2.57	9.87	0.51	23.3	5.78	Ca-HCO_3	-
	IG_MWB01_C_GW0004	Q3 2023	25-09-2023	4.66	18	2.39	28.7	31.6	Ca-SO_4-HCO_3	-
	IG_MWB01_C_GW0006	Q4 2023	06-12-2023	4.35	15.7	1.05	26.5	26	Ca-SO_4-HCO_3	-
	IG_MWB01_C_GW0008	Q1 2024	05-04-2024	2.48	11.1	0.87	25.1	13.7	Ca-HCO_3-SO_4	-
IG_MWB03_A	**IG_MWB03_A_GW0003**	Q2 2023	25-06-2023	79	82.2	9.02	265	46.9	Ca-Na-HCO_3	-
	IG_MWB03_A_GW0004	Q3 2023	25-09-2023	48.2	25.6	7.38	178	29.1	Na-Ca-HCO_3	-
	IG_MWB03_A_GW0006	Q1 2024	06-04-2024	57.1	18.1	7.86	172	38.9	Na-Ca-HCO_3-SO_4	-
IG_MWC01_A	**IG_MWC01_A_GW0001**	Q2 2023	24-06-2023	138	22.7	19.2	152	169	Na- SO_4-HCO_3	-
	IG_MWC01_A_GW0005	Q3 2023	28-09-2023	150	26	28.2	162	224	Na- SO_4-HCO_3	-
	IG_MWC01_A_GW0006	Q4 2023	05-12-2023	181	28.3	30.3	163	242	Na- SO_4-HCO_3	-
	IG_MWC01_A_GW0007	Q1 2024	04-04-2024	162	26	32.6	170	234	Na- SO_4-HCO_3	-
IG_MWC01_C	**IG_MWC01_C_GW0003**	Q2 2023	24-06-2023	160	70.2	59	208	315	Na-Ca-SO_4-HCO_3	High TDS
	IG_MWC01_C_GW0004	Q3 2023	28-09-2023	358	117	125	435	631	Na-Ca-SO_4-HCO_3	High TDS
	IG_MWC01_C_GW0005	Q4 2023	05-12-2023	285	89.6	84.3	296	446	Na-Ca-SO_4-HCO_3	High TDS
	IG_MWC01_C_GW0007	Q1 2024	04-04-2024	207	69.6	62.3	270	314	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C	**IG_MWC03_C_GW0002**	Q2 2023	24-06-2023	77.8	22.4	19.8	171	50.2	Na-Ca-HCO_3-SO_4	-
	IG_MWC03_C_GW0004	Q3 2023	28-09-2023	25.1	25.5	12.2	177	63.8	Ca-Na-HCO_3-SO_4	-
	IG_MWC03_C_GW0006	Q4 2023	05-12-2023	26.2	26.3	3.41	143	7.43	Ca-Na-HCO_3	-
	IG_MWC03_C_GW0007	Q1 2024	04-04-2024	23.1	25.6	2.78	147	5.41	Ca-Na-HCO_3	-

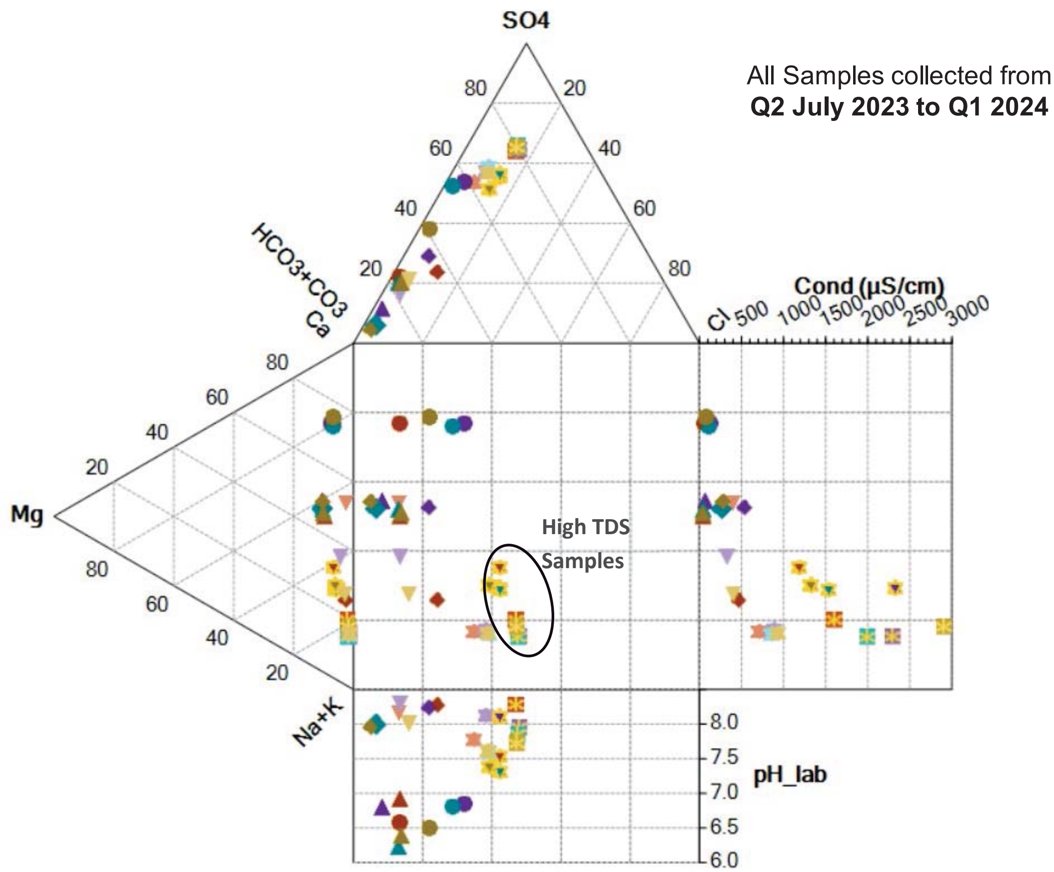
The most common groundwater type is **Ca-Na-HCO_3**, which was observed at two monitoring well locations, IG_MWA01_C and IG_MWC03_C, both being the shallowest interval C. Various other water types were observed at all other sites and depths throughout the monitoring period. The second most common water type observed was **Na-SO_4-HCO_3** (five samples, two locations IG_MWC01_A and IG_MWA03_B). All other water types observed are **Na-Ca-SO_4-HCO_3** (four samples), **Na-SO_4** (three samples)**, Ca-SO_4-HCO_3** (two samples), **Na-Ca-HCO_3-SO_4** (two samples), **Na-Ca-HCO_3** (two samples), **Ca-HCO_3** (one sample), **Ca-HCO_3-SO_4** (one sample), and **Ca-Na-HCO_3-SO_4** (one sample).

Overall, it is evident that sodium is the most abundant cation in the shallow bedrock groundwater at the Revell site followed by calcium, while sulphate and bicarbonate are the primary anions found in the groundwater. The results are plotted together on a Durov plot in Figure 3.

Generally, the chemistry of groundwaters in crystalline rocks of the Canadian Shield are found to show a strong relationship to depths primarily in terms of bicarbonate, sulfate, and chloride concentrations (Drever, 2005). The bicarbonate concentrations are typically higher in shallow groundwaters (<300 m depth) but tend to decrease with depth (>300 m depth). An opposite trend is seen for chloride and sulfate concentrations that have been found to increase with depth (Drevor, 2005). The groundwater collected from the Revell Site is from shallow depths (less than 100 m below ground surface) and is expected to have low concentrations of chloride in the groundwater and not be a dominant anion in the water type at these shallow depths (<300 m). The most common water types observed (Ca-Na-HCO_3 and Na-SO_4-HCO_3) at the Revell site do show some correlation with the typical shallow groundwater types found in the crystalline rocks in the Canadian Shield (Fritz et al, 1994).

The Durov plots were used to characterize the samples collected from Revell Site according to the sample water types shown on Figure 3. Figures 4, 5 and 6 show the concentrations of chloride, sodium and sulphate respectively with depth and are discussed further in the section below. All other Durov plots are included in Appendix A (Figures A1 to A13).

FIGURE 3: DUROV PLOT OF ALL WATER TYPES FOR HIGH CONFIDENCE SAMPLES



Sample ID	Water Type
IG_MWA01_C_GW0003	Na-Ca-HCO_3
IG_MWB01_C_GW0002	Ca-HCO_3
IG_MWB03_A_GW0003	Ca-Na-HCO_3
IG_MWC01_A_GW0004	Na-SO_4-HCO_3
IG_MWC03_C_GW0002	Na-Ca-HCO_3-SO_4
IG_MWA01_C_GW0004	Ca-Na-HCO_3
IG_MWB01_C_GW0004	Ca-SO_4-HCO_3
IG_MWB03_A_GW0004	Na-Ca-HCO_3
IG_MWC01_A_GW0005	Na-SO_4-HCO_3
IG_MWC03_C_GW0004	Ca-Na-HCO_3-SO_4
IG_MWA01_C_GW0005	Ca-Na-HCO_3
IG_MWB01_C_GW0006	Ca-SO_4-HCO_3
IG_MWC01_A_GW0006	Na-SO_4-HCO_3
IG_MWC03_C_GW0006	Ca-Na-HCO_3
IG_MWA01_C_GW0006	Ca-Na-HCO_3
IG_MWC01_A_GW0007	Na-SO_4-HCO_3
IG_MWC03_C_GW0007	Ca-Na-HCO_3
IG_MWB01_C_GW0008	Ca-HCO_3-SO_4
IG_MWB03_A_GW0006	Na-Ca-HCO_3-SO_4

Samples with high TDS concentration (between 760 and 1630 mg/L)

Sample ID	Water Type
IG_MWA03_B_GW0003	Na-SO_4
IG_MWA03_B_GW0005	Na-SO_4
IG_MWA03_B_GW0006	Na-SO_4
IG_MWA03_B_GW0007	Na-SO_4-HCO_3
IG_MWC01_C_GW0003	Na-Ca-SO_4-HCO_3
IG_MWC01_C_GW0004	Na-Ca-SO_4-HCO_3
IG_MWC01_C_GW0005	Na-Ca-SO_4-HCO_3
IG_MWC01_C_GW0007	Na-Ca-SO_4-HCO_3

Water Type	Number of Samples
Ca-Na-HCO_3	6
Na-SO_4-HCO_3	5
Na-Ca-SO_4-HCO_3	4
Na-SO_4	3
Ca-SO_4-HCO_3	2
Na-Ca-HCO_3-SO_4	2

Water Type	Number of Samples
Na-Ca-HCO_3	2
Ca-HCO_3	1
Ca-HCO_3-SO_4	1
Ca-Na-HCO_3-SO_4	1
Total Samples	**27**

Na – Major Cation in 16 Samples
Ca – Major Cation in 11 Samples

HCO_3 - Major Anion in 13 Samples
SO_4 – Major Anion in 14 Samples

Additional Durov plots were prepared for each well site IG_MWA01, IG_MWA03, IG_MWB01, IG_MWB03, IG_MWC01, and IG_MWC03 on Figures A1 through A6, respectively in Appendix A. The data was then grouped by monitoring zone type (i.e., Bedrock zones C, B and A) on Figures A7, A8 and A9, respectively in Appendix A. Each sample has a unique symbol, allowing comparisons over time as well as location. Finally, the Durov plots for each quarterly event during the *current monitoring period* are included in Figures A10 through A13.

The specific well site plots can be used to look for any variations in groundwater quality with depth at a single location and for changes over time. The monitoring zone plots can be used to look at variations with a single depth zone over the project area. The composite plot (Figure 3) can be used to summarize the characteristics of the site, as a whole, for the period.

The major ion concentrations of individual water samples collected from the Revell Site were also compared using Stiff diagrams that displayed the relative concentrations of major ions expressed in milliequivalents per liter (meq). Stiff diagrams for the Revell Site are included in Appendix B of this report. The plots are organized by well and then by monitoring interval from overburden to bedrock intervals C, B and A in order of depth. Each diagram can be “read” by reading down the page and noting the differences in the plots. A uniform scale was used for all plots for comparison.

To understand the overall groundwater chemistry of the samples collected from the Revell Site, it is crucial to understand the bedrock mineralogy and the potential rock-water interactions that the groundwater may have gone through. In general, the groundwaters found in the crystalline bedrocks have varying concentrations of cations such as calcium and sodium (occasionally enriched with magnesium), and anions such as chloride, sulphate, and bicarbonate (Jacks, 1978). The crystalline rocks are composed of various igneous and metamorphic rock types, e.g. the BGT (Biotite Granodiorite-Tonalite) bedrock at the Revell Site. The groundwaters from the crystalline and sedimentary environments are classified by chemical type (dominant cations and anions), e.g., Ca-Na-HCO_3 type water. As mentioned earlier, the most common water types observed in the shallow groundwater at the Revell site are Ca-Na-HCO_3 and Na-SO_4-HCO_3. This observation also aligns with the findings outlined by Frape et. al.(1984) in their study done on the rock-water interactions of groundwaters in Canadian Shield. Frape et al. (1984) mentioned that the groundwater found in the felsic-granite rocks have the chemistry of fresh and brackish waters and is dominated by Na>Ca>Mg>K ions with HCO_3.

4.3.2 PARAMETERS OF INTEREST

Nitrate: KGS Group observed elevated concentrations of nitrate (as NO_3) in groundwater for the samples listed in Table 10 below. Generally, elevated concentrations of nitrate are associated with groundwater that may be impacted by agricultural activities such as manure and fertilizer applications to the land. The area around the Revell Site is boreal forest with lakes, wetland, and areas of exposed bedrock, and there is no evidence of any agricultural activities in the area. Nitrate is not typically found in the Canadian Shield bedrock groundwaters. The elevated nitrate concentrations have been observed in the samples collected from monitoring well interval IG_MWC01_C that showed high TDS levels during each quarterly event of *current monitoring period*. Hence, the chemistry results from this monitoring well are likely not representative of groundwater at the Site.

TABLE 10: ELEVATED NITRATE CONCENTRATIONS

Sample ID	Quarter Sample Collected	Nitrate (as NO3)
		mg/L
IG_MWC01_C_GW0004	Q3 2023	**2.9**
IG_MWC01_C_GW0005	Q4 2023	**2.1**

Chloride: The chloride concentration for all samples collected within the *current monitoring period* (excluding samples collected from intervals IG_MWA03_B and IG_MWC01_C, which had high TDS measurements) was below 32.6 mg/L. The highest concentration observed (32.6 mg/L) was from sample IG_MWC01_A_GW0007, collected in Q1 2024.

Considering the set of samples collected from high TDS wells (IG_MWA03_B and IG_MWC01_C), the chloride concentration was between 19.2 mg/L for IG_MWC01_A_GW0001, and 150 mg/L for IG_MWA03_B_GW0007, however these samples are most likely not representative of the groundwater at the Revell Site.

Figure 4 shows a concentration versus depth plot for chloride in all samples collected during the *current monitoring period*. For the set of high confidence samples at the Revell Site (excluding samples collected from high TDS intervals IG_MWA03_B and IG_MWC01_C), an increasing trend of chloride concentrations with depth is observed on Figure 4.

Sodium: Sodium has been found to be the dominant cation in the shallow bedrock groundwater (<100 m) at the Revell Site. For all samples, the sodium concentrations were above the laboratory detection limits of 0.05mg/L. The sodium concentration for all samples collected within the *current monitoring period* (excluding samples collected from high TDS intervals IG_MWA03_B and IG_MWC01_C) was between 2.48 mg/L and 181 mg/L. The highest observed concentration (181 mg/L) was from sample IG_MWC01_A_GW0006, collected in Q4 2023.

For the eight samples collected from the high TDS intervals (IG_MWA03_B and IG_MWC01_C), the sodium concentration was between 138 mg/L and 517 mg/L.

Figure 5 shows a concentration versus depth plot for sodium for all samples collected during the current monitoring period. An increasing trend in the concentration of sodium can be observed with depth for the high confidence samples and are most likely representative for the reasons previously discussed.

FIGURE 4: CHLORIDE CONCENTRATIONS WITH DEPTH

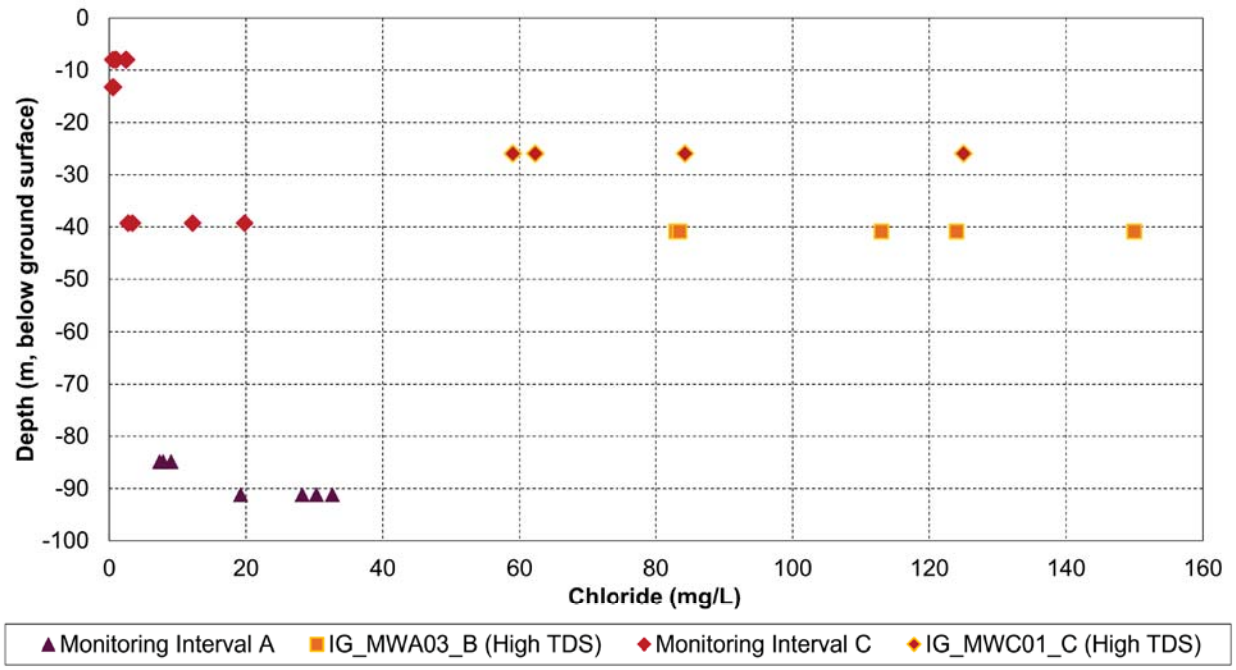
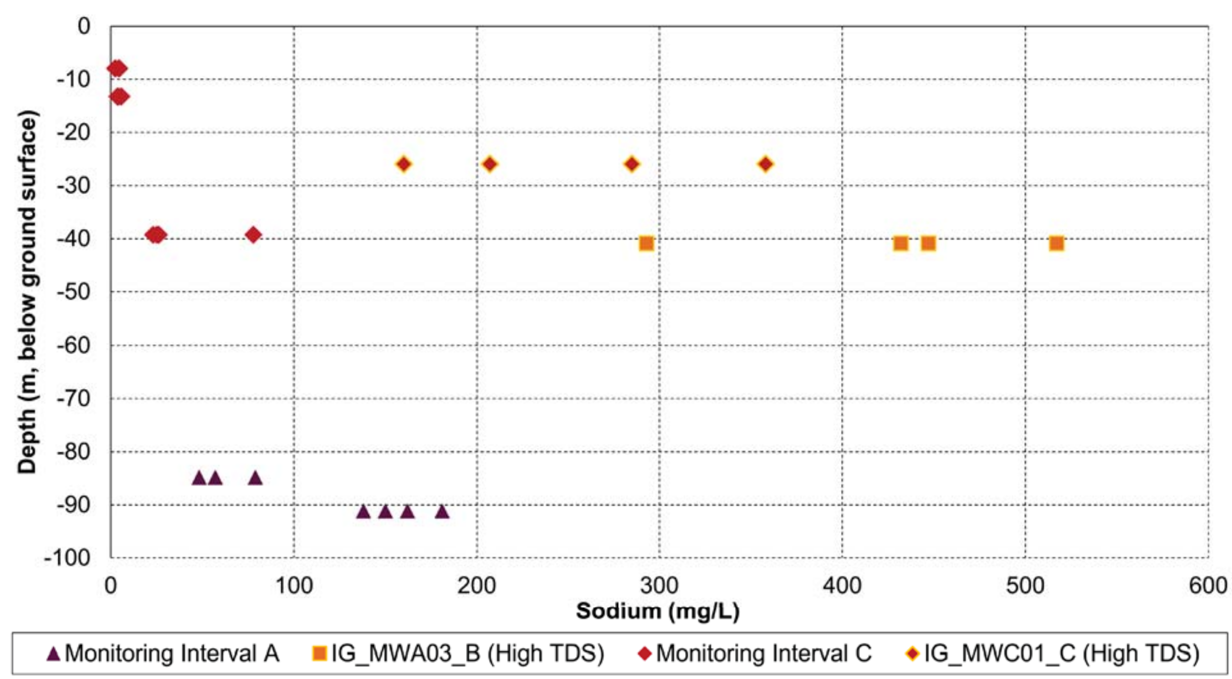


FIGURE 5: SODIUM CONCENTRATIONS WITH DEPTH

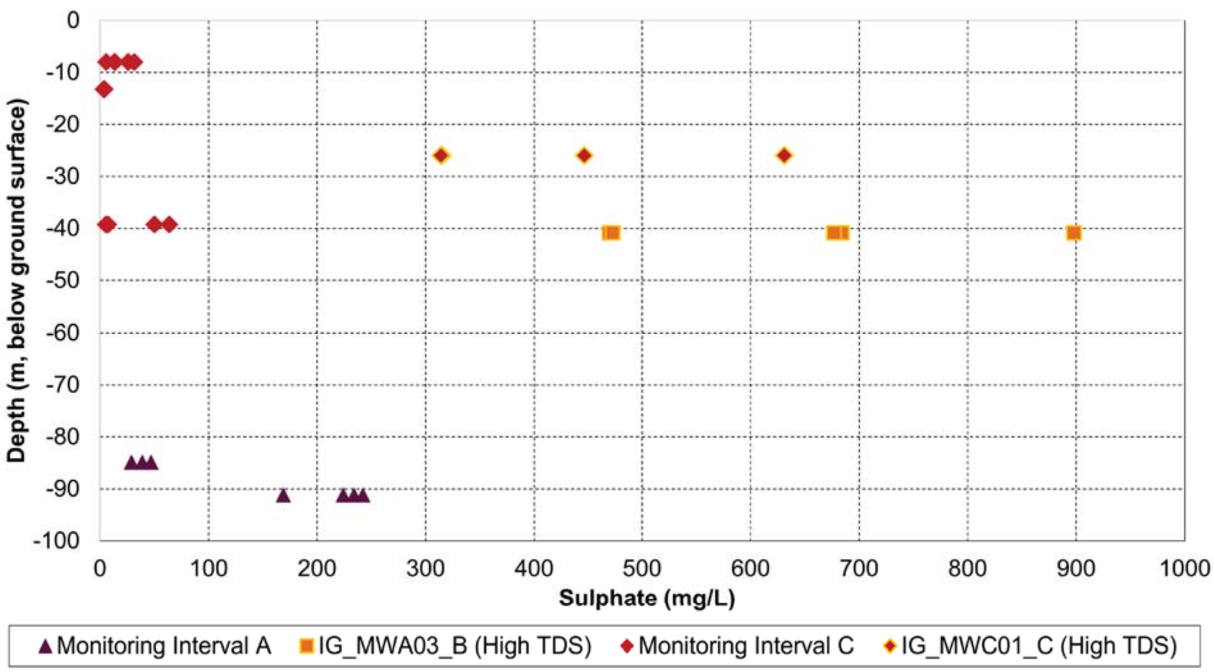


Sulphate: Sulphate has been found to be the dominant anion in the shallow bedrock groundwater at the Revell Site. Its concentration for all samples collected within the *current monitoring period* (excluding samples collected from high TDS wells IG_MWA03_B and IG_MWC01_C) was between 3.38 mg/L and 242 mg/L. The highest concentration observed (242 mg/L) was from sample IG_MWC01_A_GW0006, collected in Q4 2023.

Considering the set of samples collected from high TDS wells (IG_MWA03_B and IG_MWC01_C), the sulphate concentration was between 169 mg/L for IG_MWC01_A_GW0001, and 898 mg/L for IG_MWA03_B_GW0007, however these samples are most likely not representative of the groundwater at the Revell Site.

Figure 6 shows a concentration versus depth plot for sulphate in all samples collected during the *current monitoring period*. For the set of samples that are representative of groundwater at the Revell Site (excluding samples collected from high TDS wells IG_MWA03_B and IG_MWC01_C), an increasing trend of sulphate concentrations with depth can be noted in Figure 6.

FIGURE 6: SULPHATE CONCENTRATIONS WITH DEPTH



Calcium and Magnesium: No specific trends of concentrations with depth were observed for calcium and magnesium concentrations at the Revell Site. The calcium (3.5 mg/L to 117 mg/L) and magnesium concentrations (0.9 mg/L to 26 mg/L) are typical for the Canadian Shield groundwater. The concentrations of both calcium and magnesium remained consistent for observations across all the field events during the *current monitoring period*.

Alkalinity: The alkalinity of water is a measure of its acid-naturalizing capacity that maintains a stable pH level of the water. It is a function of bicarbonate, carbonate and hydroxide concentration levels of the water, and is expressed in terms of an equivalent quantity of calcium carbonate. The Total Alkalinity of groundwater at the Revell site is in the range of 15 mg/L (as $CaCO_3$) to 435 mg/L (as $CaCO_3$) for all samples collected from the Site during the *current monitoring period* (excluding the samples collected from wells IG_MWA02_C, IG_MWA03_B, and IG_MWC01_C.

Eight samples collected during the *current monitoring period* had Total Alkalinity (as $CaCO_3$) concentrations below 50 mg/L (as $CaCO_3$) while the remaining samples were above 100 mg/L (as $CaCO_3$). The primary contributing parameter of these concentrations of Total Alkalinity in all samples was bicarbonate. The bicarbonate-alkalinity was also in the range of 15 mg/L (as $CaCO_3$) to 435 mg/L (as $CaCO_3$) while the carbonate-alkalinity remained below the laboratory detection limit of 1 mg/L (as $CaCO_3$) for all samples. The hydroxide-alkalinity in each sample was also below the laboratory detection limit of 1 mg/L (as $CaCO_3$).

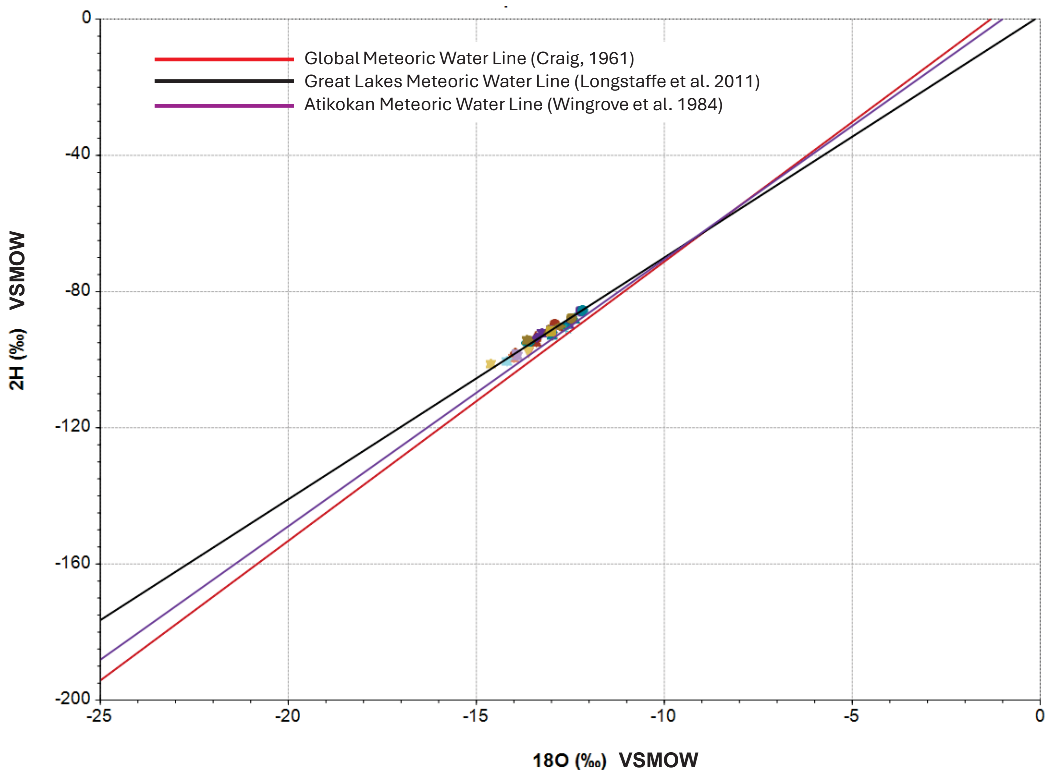
4.3.3 QUARTERLY ISOTOPE ANALYSIS

Oxygen-18 ($\delta^{18}O$) and Deuterium (δ^2D)

Isotope parameters Oxygen-18 ($\delta^{18}O$) and Deuterium (δ^2D), O-18 and 2-H isotopes in water serve as valuable indicators in hydrology. The $\delta^{18}O$ and δ^2D can provide insights into temperature variations during precipitation and can indicate the water origin. Analyzing these isotopes aids in understanding hydrological cycles, climate patterns, and tracing water movement. O-18 and 2-H samples were collected during quarterly sample events from all the wells for a total of 31 samples collected during the *current monitoring period*, not including any QA/QC samples (i.e. duplicates or blanks).

The $\delta^{18}O$ - δ^2D data is presented on Figure 7 relative to the Great Lakes Meteoric Water Line (GLMWL) ($\delta^2H=7.1*\delta^{18}O+1.0$; (Longstaffe et al., 2011)), the Global Meteoric Water Line (GMWL, $\delta^2H=8.13*\delta^{18}O+10.8$; (Craig, 1961)), and Atikokan Meteoric Water Line ($\delta^2H=7.84*\delta^{18}O + 7.88$); Wingrove et al., 1984) for comparison purposes. The GLMWL comprises samples collected from the region of Great Lakes on a more frequent basis, and is informative in terms of local water movements, water sources, and any precipitation/evaporation processes that these waters may have undergone, in comparison to coarser resolution of information that GMWL provides. The Revell site is located up-wind from the predominant precipitation that occurs nearest the Great Lakes and as such, the Revell site isotopic signature is likely to be subject to precipitation that occurs more locally (e.g. the Atikokan MWL) and from the west, originating from the prairies.

FIGURE 7: SHALLOW GROUNDWATER δ²H VS δ¹⁸O OF HIGH CONFIDENCE SAMPLES



Generally, the isotope data plots clustered together somewhat local to the GLMWL and in particular, closest to the local Atikokan Meteoric Water Line (AMWL), which suggests the formation water from these samples share a local and common origin, namely meteoric water. Local precipitation (e.g. the Atikokan MWL) and precipitation originating upwind and to the west on the prairies would be expected to dominate the isotopic signature at the Revell site, versus precipitation related to the Great Lakes, originating to the east and downwind of the Revell site. These results are comparable to the 2022 results.

4.3.4 ANNUAL ISOTOPE ANALYSIS

A summary of annual isotope analytical results for the *current monitoring period* is provided on Table 11 below. Environmental isotope analysis was planned to be completed once in 2022 and for the second time in 2023 from the monitoring intervals selected for the respective quarterly sampling events. The environmental isotope analysis is considered useful for baselining the shallow groundwater geochemistry at the Revell Site. However, there were a few points highlighted in the 2022 Annual Groundwater Chemistry Report for the Revell Site (KGS Group, 2024) regarding the completeness of the 2022 dataset and changes that were made late in 2022 were applied in the second year of environmental isotope sampling in Q2 2023. Table 11 below shows the results of isotope analysis for the samples collected during the *current monitoring period.*

TABLE 11: ANNUALLY COLLECTED ISOTOPE RESULTS FOR HIGH CONFIDENCE SAMPLES

Sample ID	Quarter Sample Collected	Gross Alpha (Bq/L)	Gross Beta (Bq/L)	Tritium (^3H) Bq/L	Tritium (^3H) +/-0.8 T.U.	Carbon-13 of DIC (d13C-DIC) per mil VPDB	Carbon-14 of DIC (^{14}C-DIC) pmC	Chlorine-37 (d37Cl) per mil SMOC	Strontium Isotope Ratio ($^{87}Sr/^{86}Sr$)
IG_MWA01_C_GW0003	Q2 2023	0.122	0.237	1.01	8.6	-11.89	98.48	-1.49	0.7143
IG_MWA03_B_GW0003	Q2 2023	**0.611**	0.309	0. 39	3.3	-17.46	67.62	3.51	0.7109
IG_MWB01_C_GW0002	Q2 2023	<0.111	< 0.148	1.09	9.2	-7.39	88.53	0.56	0.7173
IG_MWB03_A_GW0003	Q2 2023	**3.47**	**2.32**	<0.094	<0.8	-16.13	36.81	3.2	0.7087
IG_MWC01_A_GW0004	Q2 2023	0.14	0.0995	0.143	1.2	-15.77	61.29	3.52	0.7140
IG_MWC01_C_GW0003	Q2 2023	0.386	0.319	0.45	3.8	-15.89	63.12	3.77	0.7136
IG_MWC03_C_GW0002	Q2 2023	0.454	0.193	<0.094	<0.8	-16.9	41.33	2.17	0.7155

(1) pmC = percent modern carbon, (2) Tritium is reported in Tritium Units, 1TU= 0.11919 Bq/L per IAEA, 2000 report, (3) **BOLD** indicates guideline exceedance

Gross Alpha/Beta

Radionuclides are found in the environment as naturally occurring elements and as products or by-products of nuclear technologies. Gross alpha and gross beta determination is an initial screening for the presence of radioactivity, and the procedures used to analyze the samples are not the same procedures used to determine the identity of the contributing radionuclides. To help with a relative comparison of the presence of radionuclides in groundwater at the study site, it is important to know that the recommended screening values for gross alpha and gross beta activity have been set at 0.5 Bq/L and 1 Bq/L, respectively by Health Canada Canadian Drinking Water Quality Guidelines (HC-CDWQG). Using the HC-CDWQG, the samples that had gross alpha activity greater than the screening level of 0.5 Bq/L include IG_MWA03_B_GW0003 (0.611 Bq/L) and IG_MWB03_A_GW0003 (3.47 Bq/L), which are consistent with the 2022 results from these two intervals.

Only one sample, IG_MWB03_A_GW0003 (2.32 Bq/L) had gross beta activity measurements above the HC-CDWQG recommended screening level of 1.0 Bq/L, which is an increase compared to the 2022 concentration of 0.22 Bq/L.

Tritium (^3H) and Carbon-14 (^{14}C)

Tritium and Carbon-14 are naturally occurring radionuclides at very low levels and contribute to natural radioactivity exposure to Canadians. However, these radionuclides have been introduced in greater concentrations into the global environment via the use and expansion of nuclear technologies over the past 60 years, and in particular due to nuclear weapon testing prior to 1963. Therefore, tritium as an example is an important parameter to measure and baseline, because its presence and concentration provides insight to the relative “age” or atmospheric interconnection/origin of a groundwater sample, depending on its origin and exposure within the hydrological system prior to, or during activities that occurred globally related to the nuclear industry.

Health Canada has a recommended Maximum Allowable Concentration (MAC) in water for Tritium of 7000 Bq/L or 834.33 T.U. All of the samples submitted for analysis had reported concentrations that were far below the HC-CDWQG MAC.

For Carbon-14 results, as mentioned earlier in section 3.5.1, Carbon-14 was analyzed by Accelerator Mass Spectrometry (AMS), and the results of Carbon-14 for all samples collected during the *current monitoring period* were reported in the pmC (Percent Modern Carbon) units and were in the range between 36.81 and 98.48 pmC.

Chlorine Isotope ($\delta^{37}Cl$)

The stable isotope of Chlorine (Cl) has been used to estimate the origin of salts and fluids which help in characterization of groundwater. The $\delta^{37}Cl$ results ranged from a low of -1.49‰ in IG_MWA01_C_GW0003 to a high of 3.‰ in IG_MWC01_C_GW0003 for high confidence and acceptable TDS measured samples collected during Q2 2023 for isotope analysis. However, the high TDS samples from IG_MWA03_B and IG_MWC01_C had $\delta^{37}Cl$ results of 3.51‰ and 3.77‰, respectively.

Based on a limited dataset, Drever (2005) mentioned in their study that groundwaters in the crystalline bedrock environments have a very narrow range (-1.0 ‰ to +2.0‰) of $\delta^{37}Cl$ signatures, however, Frape et al. (2004) in their study about deep fluids in continental crystalline rocks stated that rocks containing Cl-rich minerals such as apatite, or biotite can have enriched $\delta^{37}Cl$ signatures as high as 4.0 ‰.

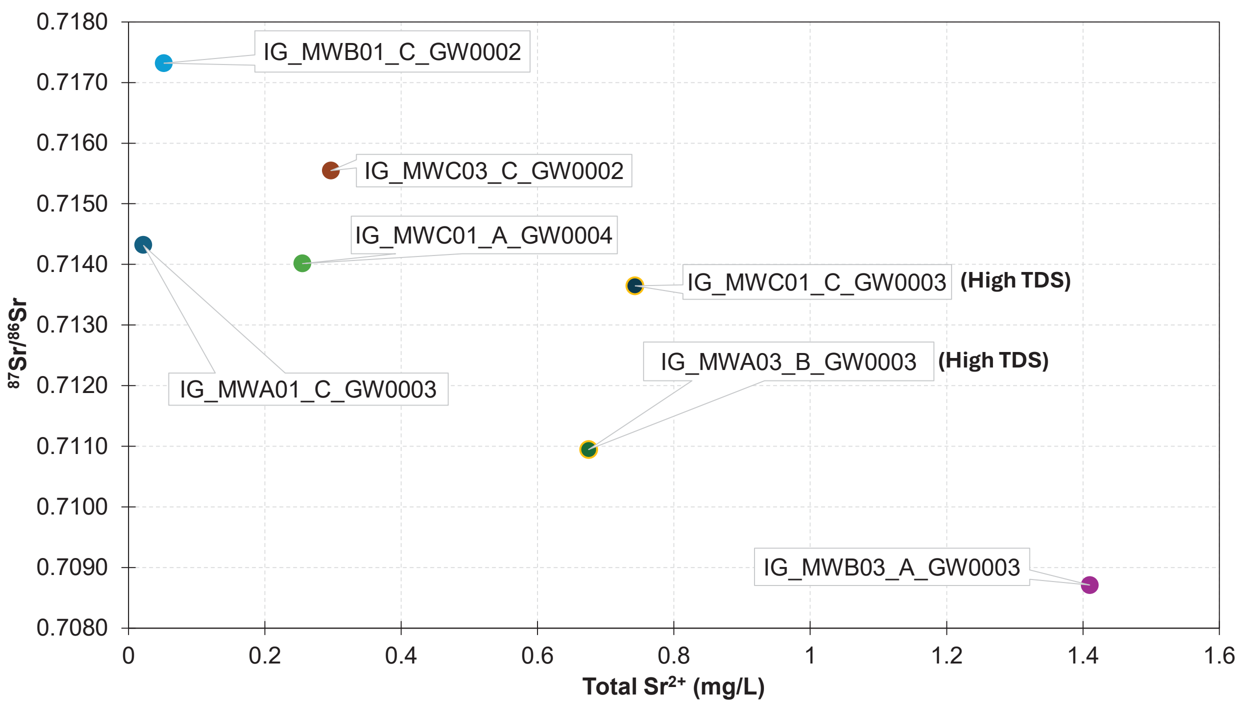
As the groundwater in crystalline bedrock environments flows from a recharge to a fairly complex discharge environment, it goes through water-rock interaction processes as well as a series of redox reactions. These chemical processes result in changing the chemical composition of groundwater (Gascoyne, 1996). A significant change that happens in groundwater chemical composition is when the salinity increases due to the uptake of Na, Cl, and Ca ions from various sources such as fluids that remain in the fracture zones from a past low-temperature alteration, or from the presence of chloride bearing minerals such as biotite in the rocks (Gascoyne, 1996). For the Revell Site, the $\delta^{37}Cl$ results are between -1.49‰ and 3.52 ‰ and thus fall within the ranges noted within the studies mentioned above.

Strontium Isotope Ratio $^{87}Sr/^{86}Sr$

The $^{87}Sr/^{86}Sr$ ratio reflects the source of Sr in the rock and water. The present $^{87}Sr/^{86}Sr$ ratio in seawater is a relatively constant value of 0.709. The $^{87}Sr/^{86}Sr$ ratio for the former Selco Mine that was located in the Uchi Belt of Ontario within the Canadian Shield (about 200 kms North of the Revell Site) is between 0.7100 and 0.7210 (McNutt et. al., 1990). The Selco Mine Site consisted of brine samples (collected from depths between 0 and 300 m) of the Rhyolite rocks (igneous) with a predominant water type of Ca-Na-$HC0_3$-SO_4, similar to the Revell Site, and hence was used as a reference Site to compare the $^{87}Sr/^{86}Sr$ ratios.

The 2023 samples collected have an overall variation in $^{87}Sr/^{86}Sr$ with a low of 0.7087 in the monitoring well IG_MWB03_A and a high of 0.7173 in the monitoring well IG_MWB01_C. Only one of the eight samples was outside the range of $^{87}Sr/^{86}Sr$ ratio provided by McNutt et. al., (1990) (0.7087 for IG_MWB03_A_GW0003). However, all Strontium isotope ratios are within the typical range for groundwaters found in crystalline environments (Drever, 2005).

FIGURE 8: STRONTIUM ISOTOPIC RATIOS VS. TOTAL SR^{2+} CONCENTRATIONS



5.0 SUMMARY

The NWMO Groundwater Monitoring of Shallow Well Networks study objective at the Revell site was to measure groundwater pressures and temperatures on a quarterly basis, from the installed dataloggers, and to collect groundwater samples for their chemical analyses. This information is collected to allow NWMO to evaluate the shallow groundwater system behavior and geochemical characteristics.

The first field event of 2023 for the Revell Site was completed during the second quarter (Q2) month of June 2023 followed by the fields events in Q3 (September) and Q4 (December) of 2023, with the final field event in Q1 of 2024. Each groundwater monitoring and sampling event involved the collection of groundwater pressure measurements and baseline groundwater samples from a selection of the 27 permanently installed shallow groundwater monitoring wells. The quarterly groundwater quality testing included the analysis of parameters including dissolved metals, routine parameters (see Table 2 for the detailed list) nutrients, iodide, stable isotopes of oxygen and hydrogen ($\delta^{18}O$ and $\delta^{2}H$). Groundwater samples from several monitoring well sites were also collected annually and analyzed for specialized radioactive isotopes such as oxygen-18, deuterium, tritium, carbon-14, chlorine-37 and strontium ratio Sr^{87}/Sr^{86}.

A total of thirty-one groundwater samples were collected during the *current monitoring period* (excluding the QA/QC samples). Four out of these thirty-one samples were collected from the monitoring well interval IG_MWA02_C that did not satisfy the purge criteria I (stabilized field chemistry), and hence these four samples were treated as low confidence in being representative and their corresponding chemistry analysis results were not discussed in this report. In addition to this, samples collected from monitoring well intervals IG_MWA03_B and IG_MWC01_C (eight samples in total) had elevated levels of field measured total dissolved solids (TDS), and it is because of this parameter that the chemistry results for these eight samples are most likely not representative of the bedrock groundwater and are recommended to be considered as such in any future analysis of the data from these intervals.

The most common groundwater types of the shallow bedrock aquifer at the Revell Site is Ca-Na-HCO_3 and Na-SO_4-HCO_3 based on all high confidence samples collected during the *current monitoring period* (between Q2 2023 and Q1 2024). The samples with this water type are primarily collected from the Biotite Granodiorite-Tonalite (BGT) Formation. The other water types observed at the Revell site are Na-Ca-SO_4-HCO_3 (four samples), Na-SO_4 (three samples), Ca-SO_4-HCO_3 (two samples), Na-Ca-HCO_3-SO_4 (two samples), Na-Ca-HCO_3 (two samples), Ca-HCO_3 (one sample), Ca-HCO_3-SO_4 (one sample), and Ca-Na-HCO_3-SO_4 (one sample).

Sodium is found to be the most abundant cation in the shallow bedrock groundwater at the Revell site followed by calcium, while sulphate and bicarbonate are the primary anions found in the groundwater. Generally, the chemistry of groundwaters in crystalline rocks of the Canadian Shield are found to show a strong relationship to depths primarily in terms of bicarbonate, sulfate, and chloride concentrations (Drever, 2005). The bicarbonate-alkalinity is typically higher in shallow groundwaters (<300 m depth) but tends to decrease with depth (>300 m depth). An opposite trend is seen for chloride and sulfate concentrations that have been found to increase with depth (Drevor, 2005). The groundwater collected from the Revell Site is from shallow depths (less than 100 m below ground surface) and is expected to have low concentrations of chloride in the groundwater and not be a dominant anion in the water type at these shallow depths (<300 m). The calculation of water types confirmed that chloride was not a major anion in any of the high confidence groundwater samples.

Generally, the $\delta^{18}O$ and $\delta^{2}H$ isotope data plots clustered together very close to the GLMWL and to the local Atikokan Meteoric Water Line which suggests the water from these samples share a common origin, namely meteoric water. Local precipitation (e.g. the Atikokan MWL) and precipitation originating upwind and to the west on the prairies would be expected to dominate the isotopic signature at the Revell site, versus precipitation related to the Great Lakes, originating to the east and downwind of the Revell site.

Other isotopes and radiochemical parameters measured including tritium (^{3}H), carbon-14 (^{14}C), chlorine-37 $\delta^{37}Cl$, and strontium isotope ratio $^{87}Sr/^{86}Sr$, were all within the expected values of the Canadian Shield groundwaters for all high confidence samples, however, gross alpha and gross beta values were above the Health Canada Drinking Water Guidelines and were outside the expected range of values for two samples.

The field plan focussed on collecting samples from well intervals that could be purged to satisfy the sample collection criteria, that being the stabilization of groundwater field parameters (e.g., Criteria I). This resulted in generally consistent chemistry results where TDS field measurements were not exceedingly high as measured at two monitoring intervals. Overall, the groundwater chemistry data collected during the *current monitoring period* was within the expected concentration ranges and water types for shallow crystalline bedrock groundwaters.

6.0 REFERENCES

Craig, H. (1961). Isotopic Variations in Meteoric Waters. *Science*, *133*(3465), 1702–1703. https://doi.org/10.1126/science.133.3465.1702

Card, K.D. and A. Ciesielski, (1986). Subdivisions of the Superior Province of the Canadian Shield. Geoscience Canada, 13, 5-13.

Drever J.I., (2005). Surface and Ground Water, Weathering, and Soils: Treatise on Geochemistry, Second Edition, Volume 5. Vol 1st ed. Elsevier Science; 2005. Accessed January 12, 2024. https://search-ebscohost-com.uml.idm.oclc.org/login.aspx?direct=true&db=e000xna&AN=199275&site=ehost-live

Environment and Climate Change Canada. (2017). Canadian Climate Normals.1981-2010 Station Data. . *Environment and Climate Change Canada*.

Frape S. K., Fritz P., and McNutt R. G. (1984) Water-Rock interactions and chemistry of groundwaters from the Canadian Shield. Geochim. Cosmochim. Acta 48, 1617-1627

Frape, S.K., A. Blyth, R. Blomqvist, R.H. McNutt and M. Gascoyne, (2004). Deep fluids in the continents: II. Crystalline rocks, pp. 541-579. In Surface and Ground Water, Weathering, and Soils (ed. J.I. Drever) Vol. 5 Treatise on Geochemistry (eds. H.D. Holland and K.K. Turekian), Elsevier-Pergamon, Oxford.

Fritz P., Frape S. K., Drimmie R.J., Appleyard E.C., Hattori K. (1994). Sulfate in brines in the crystalline rocks of the Canadian shield. Geochimica et Cosmochimica Acta. Volume 58, Issue 1, January 1994, Pages 57-65.

Gascoyne, M. (1996). The evolution of redox conditions and groundwater geochemistry in recharge-discharge environments on the Canadian Shield. Report Number: AECL-11682; COG-96-500. Atomic Energy of Canada Ltd., Pinawa, Manitoba (Canada).

Golder (Golder Associates Ltd.), (2011). Initial Screening for Siting a Deep Geological Repository for Canada's Used Nuclear Fuel. The Corporation of the Township of Ignace, Ontario. Nuclear Waste Management Organization, March 2011.

Golder (Golder Associates Ltd.), (2013). Phase 1 Geoscientific Desktop Preliminary Assessment of Potential Suitability for Siting a Deep Geological Repository for Canada's Used Nuclear Fuel. Township of Ignace, Ontario. Prepared for Nuclear Waste Management Organization (NWMO). Report Number: APM-REP- 06144-0011.

Hem, J. D., & Survey, U. S. G. (1985). Study and interpretation of the chemical characteristics of natural water. In *Water Supply Paper* (3rd ed.). https://doi.org/10.3133/wsp2254Higgins, Patrick, (2021). Dissolved Oxygen Measurement Issues, Top Tips. https://www.ysi.com/ysi-blog/water-blogged-blog/2021/06/do-meter-measurement-problems-check-out-these-top-tips

Jacks G. (1978). Ground Water Chemistry at Depth in Granites and Gneisses. Technical Report 88, Swedish Nuclear Fuel and Waste Management Company (SKBF/KBS), 28p.

JDMA (2013). Phase 1 Geoscientific Desktop Preliminary Assessment, Terrain and Remote Sensing Study. Township of Ignace, Ontario. APM-REP-06144-0012.

KGS Group, (2023). Shallow Groundwater Monitoring Network, Ignace Area-Data Report-APM-REP-01332-0362, Rev 1, April 27, 2023.

KGS Group In. (2024). Groundwater Monitoring of Shallow Well Network – Ignace Chemistry Data Annual Report 2023. APM-REP-01332-0448.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). World Map of the Köppen-Geiger Climate Classification Updated. *Meteorologische Zeitschrift*, *15*, 259–263. https://doi.org/10.1127/0941-2948/2006/0130

Longstaffe, F. J., Ayalon, A., Bumstead, N. L., Crowe, A. S., Hladyniuk, R., & Huddart, P. A. (2011). The oxygen-isotope evolution of the North American Great Lakes. *Northeastern (46th Annual) and North-Central (45th Annual) Joint Meeting (20–22 March 2011)*. https://gsa.confex.com/gsa/2011NE/webprogram/Paper184287.html

McNutt R, Frape S, Fritz P, Jones M, MacDonald I, (1990). The 87Sr86Sr values of Canadian Shield brines and fracture minerals with applications to groundwater mixing, fracture history, and geochronology. ISSN: 0016-7037.

NWMO (2023). Confidence in Safety – Revell Site – 2023 Update. NWMO-TR-2023-07.

Percival, J.A. and Easton, R.M. (2007). Geology of the Canadian Shield in Ontario: an update; Ontario Geological Survey, Open File Report 6196, Geological Survey of Canada, Open File 5511, Ontario Power Generation, Report 06819-REP-01200-10158-R00, 65p.

Qing, H., Christopher R. Barnes, Dieter Buhl, and Jan Veizer (1998), The strontium isotopic composition of Ordovician and Silurian brachiopods and conodonts: Relationships to geological events and implications for coeval seawater. Geochimica et Cosmochimica Acta, Vol. 62, No. 10, pp. 1721–1733, 1998

Renwick, W.H. (2009). Lakes and Reservoirs of North America. Encyclopedia of Inland Waters. Pages 524-532.

Rusydi, A. F. (2018). Correlation between conductivity and total dissolved solid in various type of water: A review. *IOP Conference Series: Earth and Environmental Science*, *118*(1), 012019. https://doi.org/10.1088/1755-1315/118/1/012019

Stone, D., (2010a). Precambrian geology of the central Wabigoon Subprovince area, northwestern Ontario. Ontario Geological Survey, Open File Report 5422, 130p.

Wingrove, T.R., Rudloph, D.L., Farvolden, R.N., (1984) Field Evidence For Groundwater Flow Systems in Precambrian Terrain Near Atikokan, Ontario, in Proceedings of the International Groundwater Symposium on Groundwater Resource Utilization and Contaminant Hydrogeology: International Association of Hydrogeologists (Canadian chapter), v. 2, p. 580-593.

YSI, (2019). Dissolved Oxygen Tables, Calibration and Oxygen Solubility Tables. https://www.ysi.com/file%20library/documents/technical%20notes/do-oxygen-solubility-table.pdf

WSP (2023). Phase 2 Initial Borehole Drilling and Testing, Ignace Area – WP03 Data Report-Geological and Geotechnical Core Logging, Photography and Sampling for IG_BH06. APM-REP-01332-0383

APPENDIX A

Durov Plots

REVELL SITE DUROV PLOTS – Q2 2023 to Q1 2024

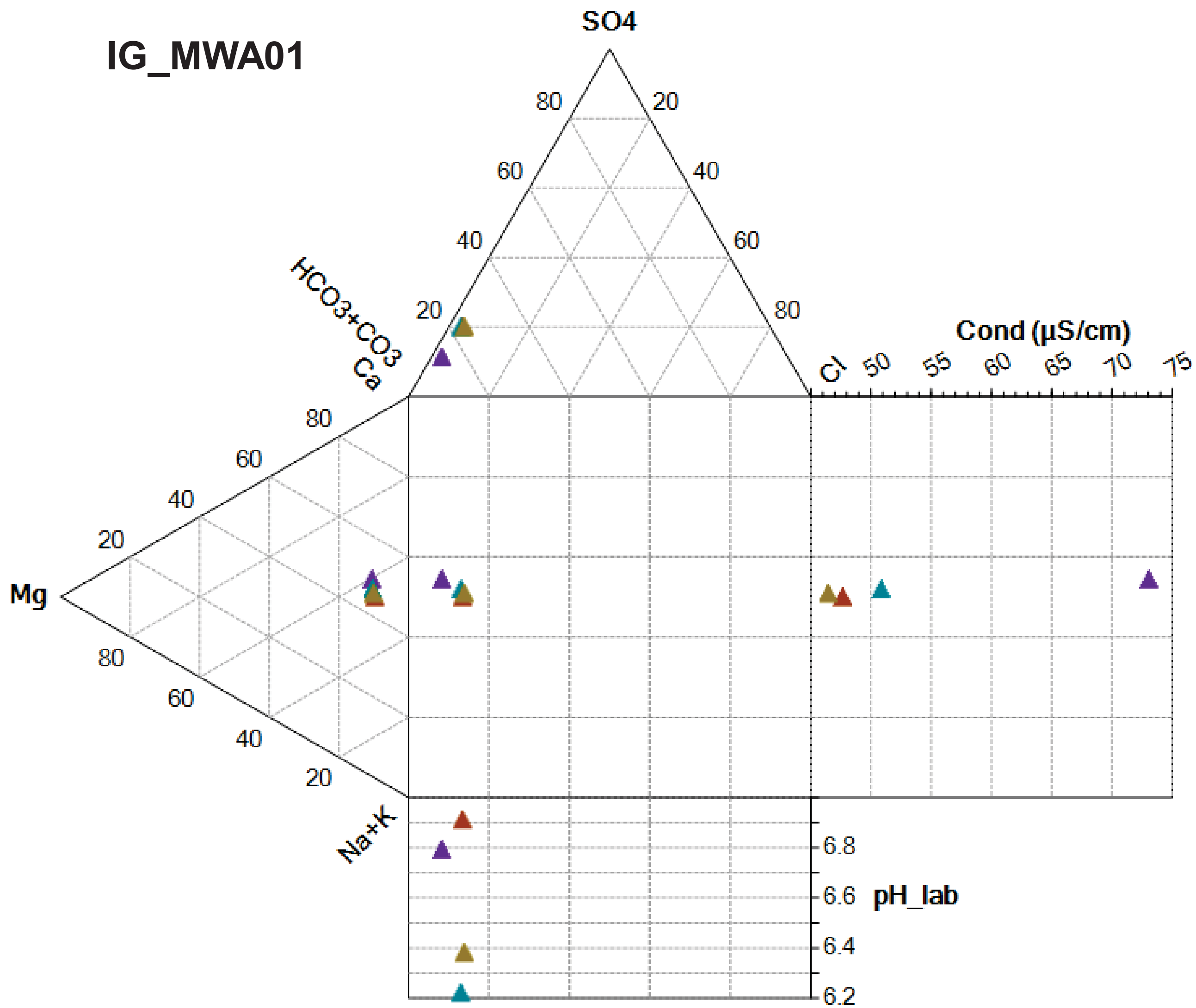
Q2 2023 samples			
Overburden	Interval C	Interval B	Interval A

Q3 2023 samples			
Overburden	Interval C	Interval B	Interval A

Q4 2023 samples			
Overburden	Interval C	Interval B	Interval A

Q1 2024 samples			
Overburden	Interval C	Interval B	Interval A

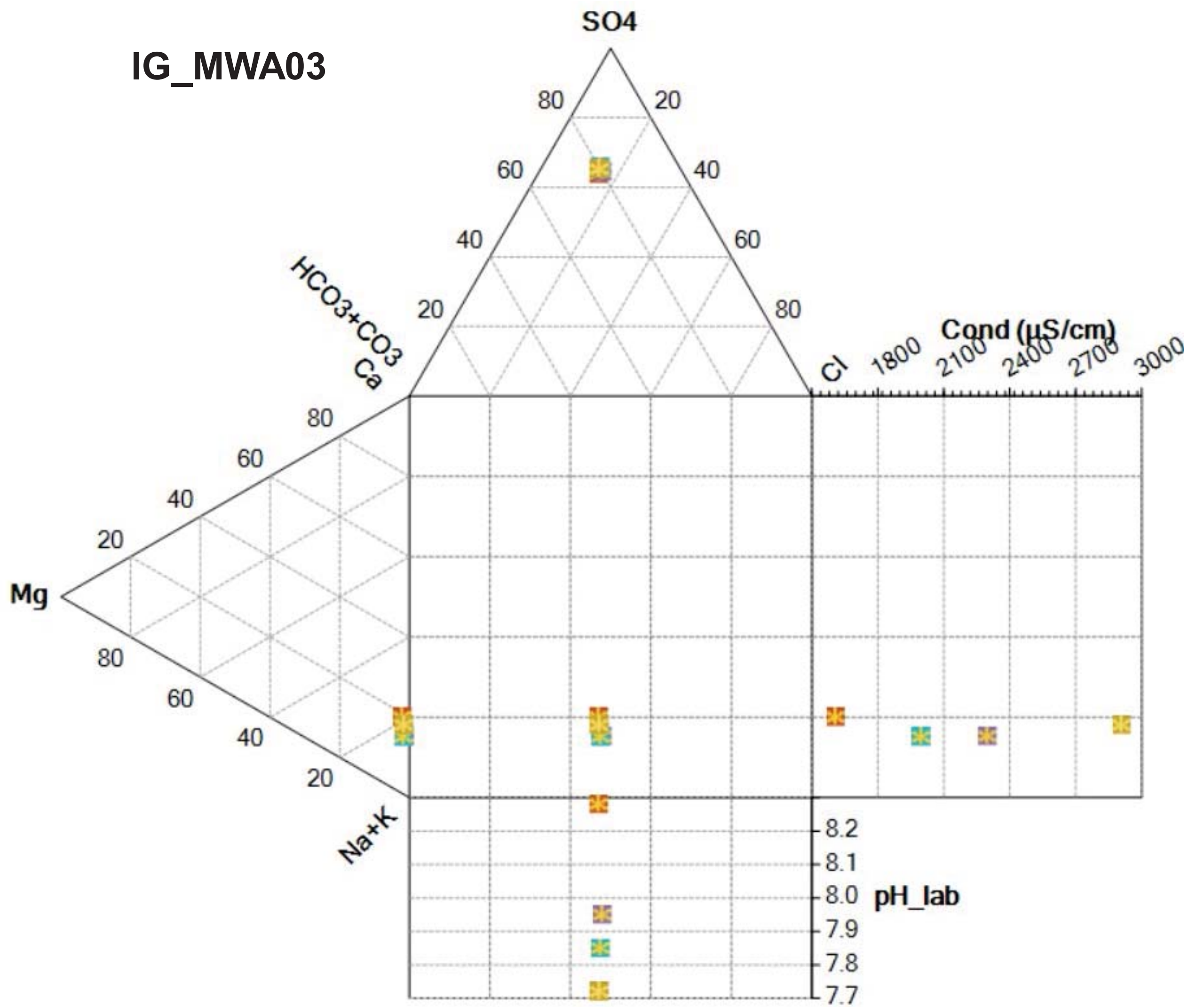
FIGURE A1: DUROV PLOT FOR IG_MWA01



Samples collected between:
Q2 2023 and Q1 2024

Sample ID	Water Type
IG_MWA01_C_GW0003	Ca-Na-HCO_3
IG_MWA01_C_GW0004	Ca-Na-HCO_3
IG_MWA01_C_GW0005	Ca-Na-HCO_3
IG_MWA01_C_GW0006	Ca-Na-HCO_3

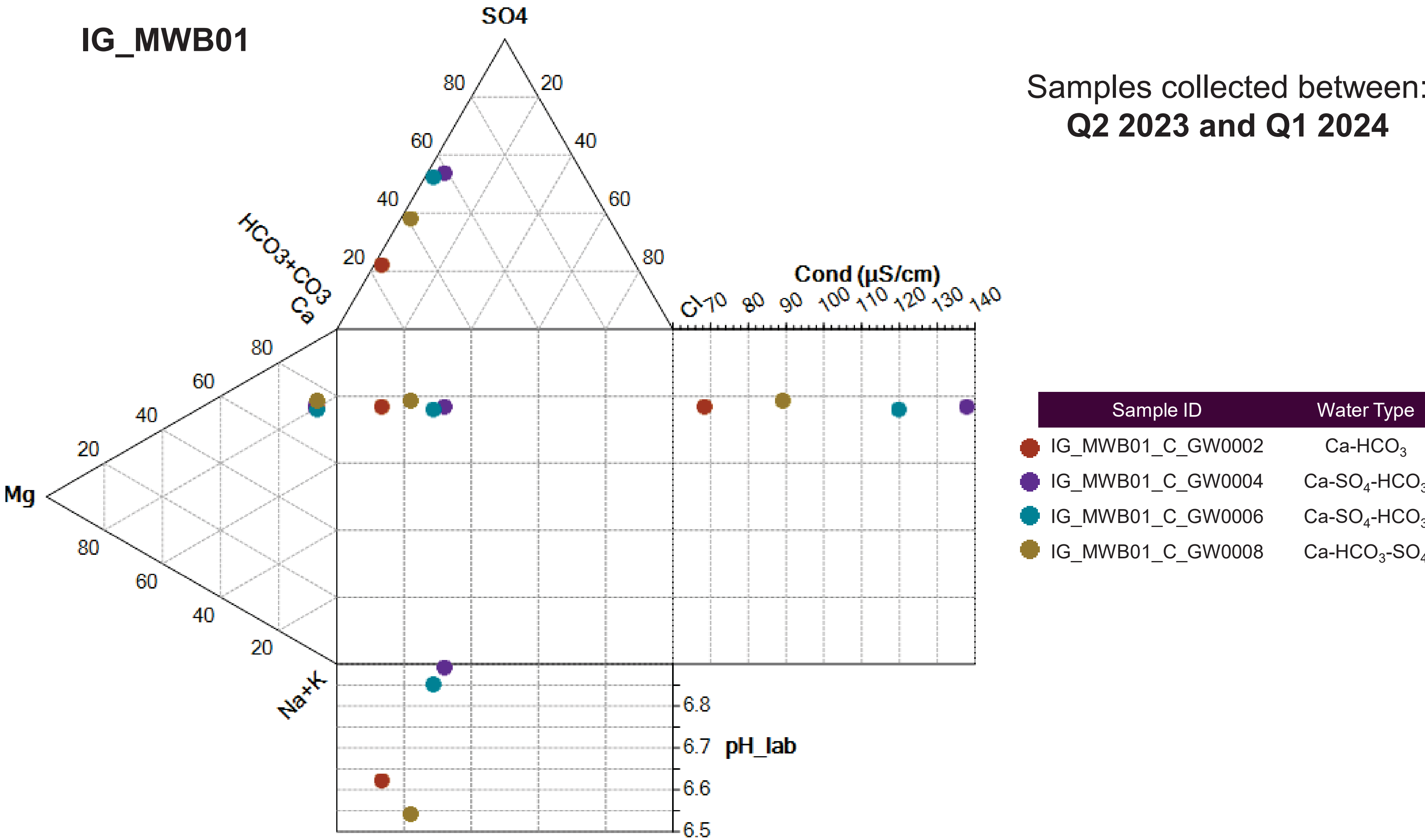
FIGURE A2: DUROV PLOT FOR IG_MWA03



Samples collected between:
Q2 2023 and Q1 2024

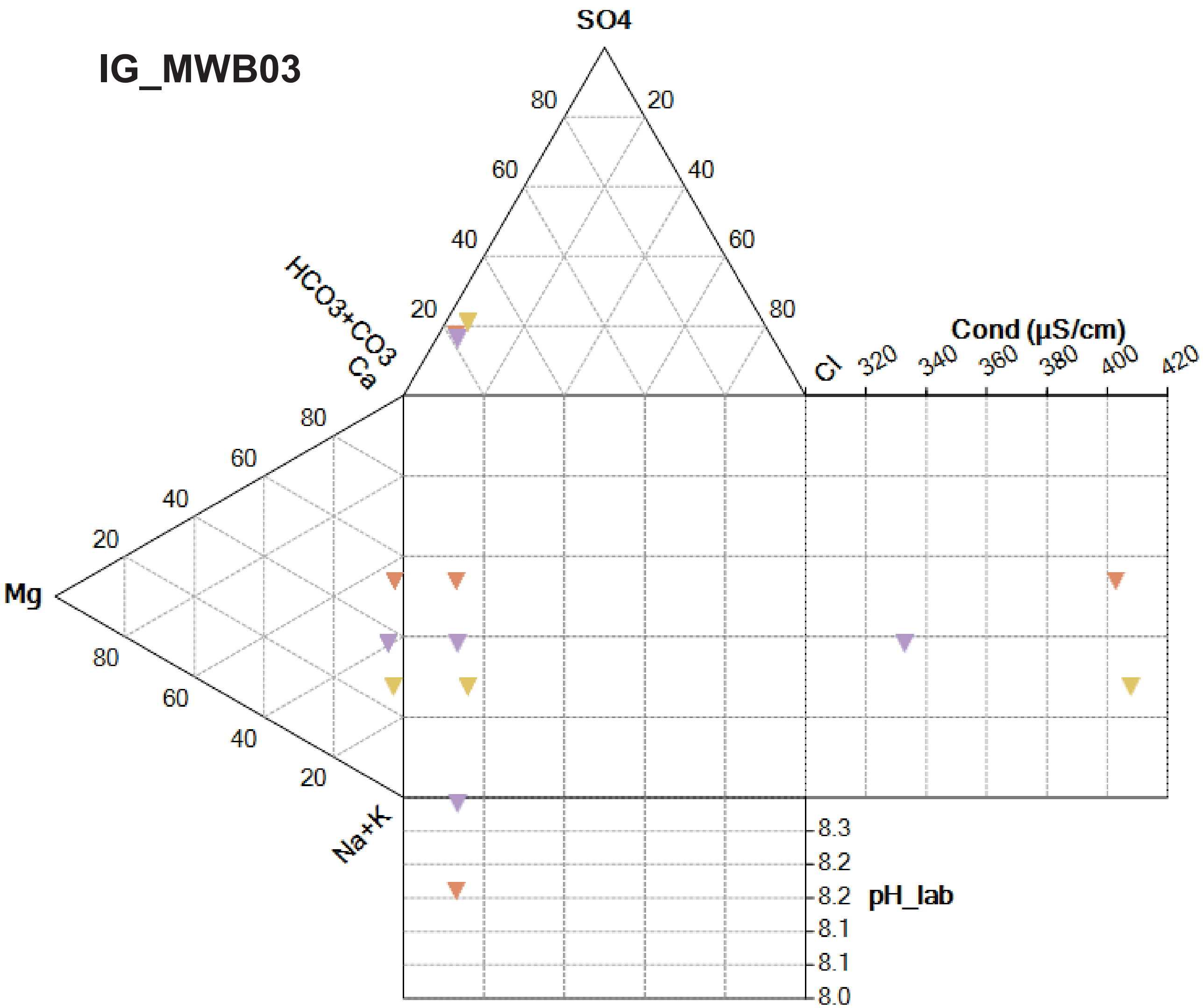
Sample ID	Water Type
IG_MWA03_B_GW0003	Na-SO_4
IG_MWA03_B_GW0005	Na-SO_4
IG_MWA03_B_GW0006	Na-SO_4
IG_MWA03_B_GW0007	Na-SO_4-HCO_3

FIGURE A3: DUROV PLOT FOR IG_MWB01



Sample ID	Water Type
IG_MWB01_C_GW0002	Ca-HCO_3
IG_MWB01_C_GW0004	Ca-SO_4-HCO_3
IG_MWB01_C_GW0006	Ca-SO_4-HCO_3
IG_MWB01_C_GW0008	Ca-HCO_3-SO_4

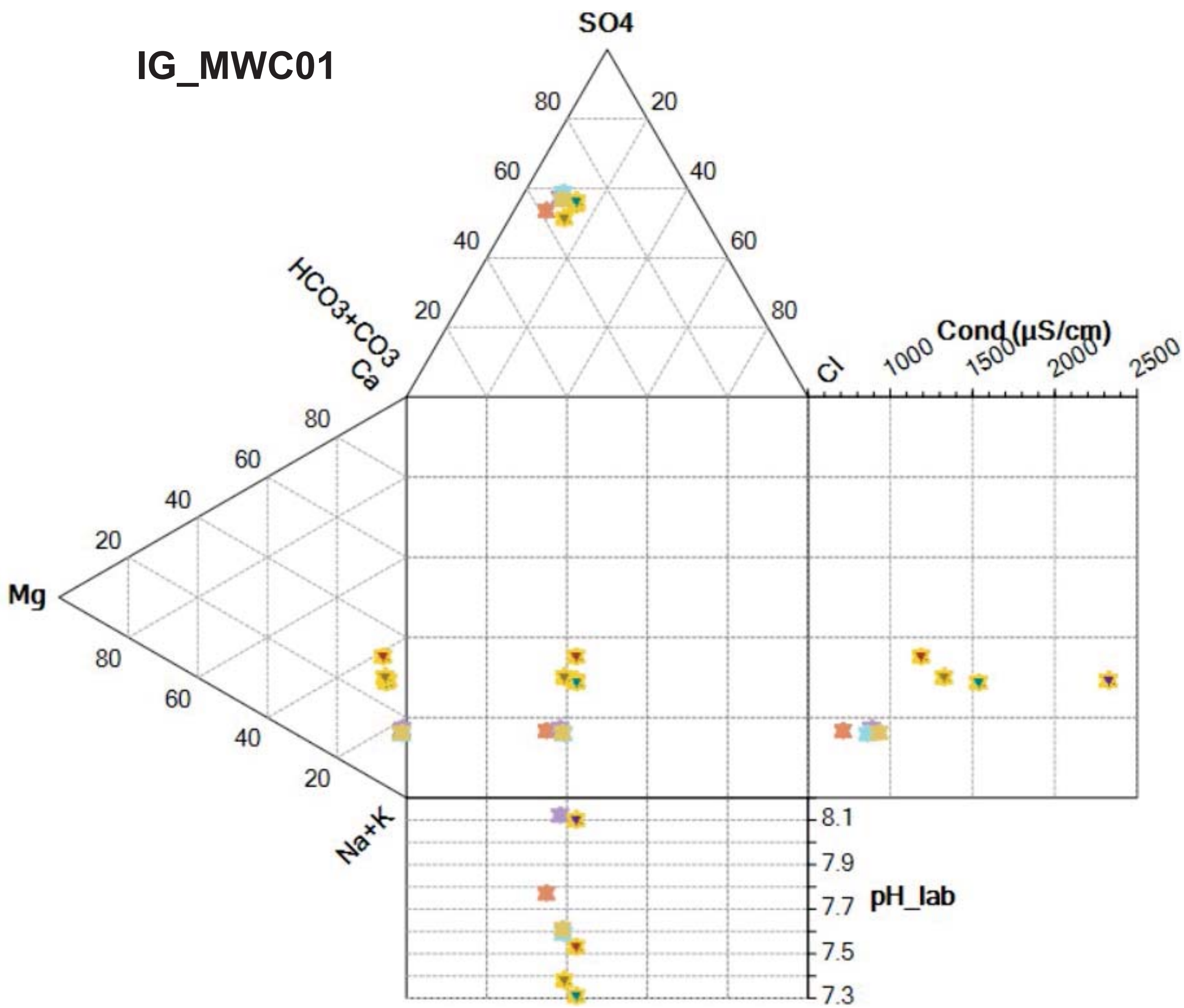
FIGURE A4: DUROV PLOT FOR IG_MWB03



Samples collected between:
Q2 2023 and Q1 2024

Sample ID	Water Type
IG_MWB03_A_GW0003	Ca-Na-HCO_3
IG_MWB03_A_GW0004	Na-Ca-HCO_3
IG_MWB03_A_GW0006	Na-Ca-HCO_3-SO_4

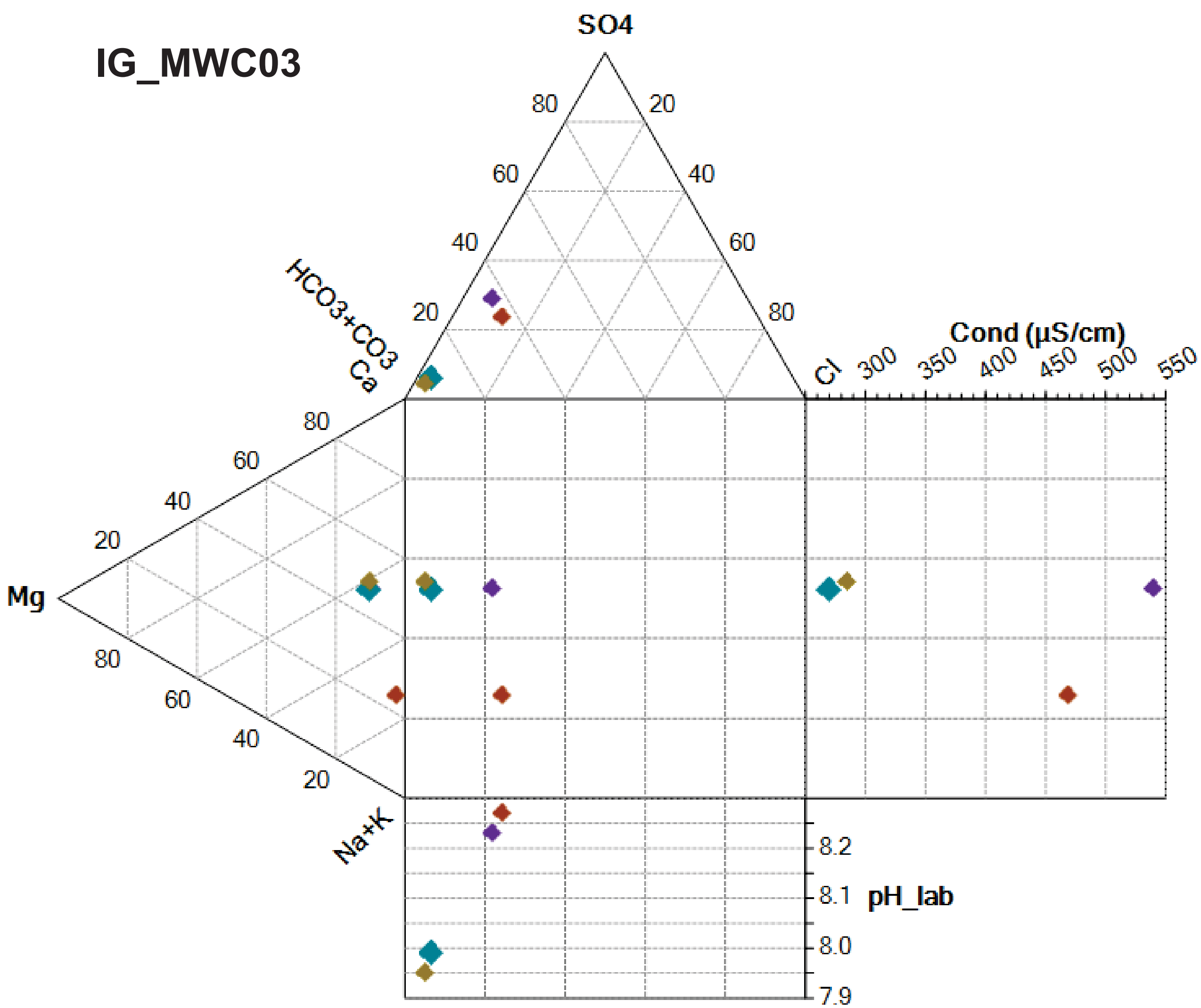
FIGURE A5: DUROV PLOT FOR IG_MWC01



Samples collected between:
Q2 2023 and Q1 2024

Sample ID	Water Type
IG_MWC01_A_GW0004	Na-SO_4-HCO_3
IG_MWC01_C_GW0003	Na-Ca-SO_4-HCO_3
IG_MWC01_A_GW0005	Na-SO_4-HCO_3
IG_MWC01_C_GW0004	Na-Ca-SO_4-HCO_3
IG_MWC01_A_GW0006	Na-SO_4-HCO_3
IG_MWC01_C_GW0005	Na-Ca-SO_4-HCO_3
IG_MWC01_C_GW0007	Na-Ca-SO_4-HCO_3
IG_MWC01_A_GW0007	Na-SO_4-HCO_3

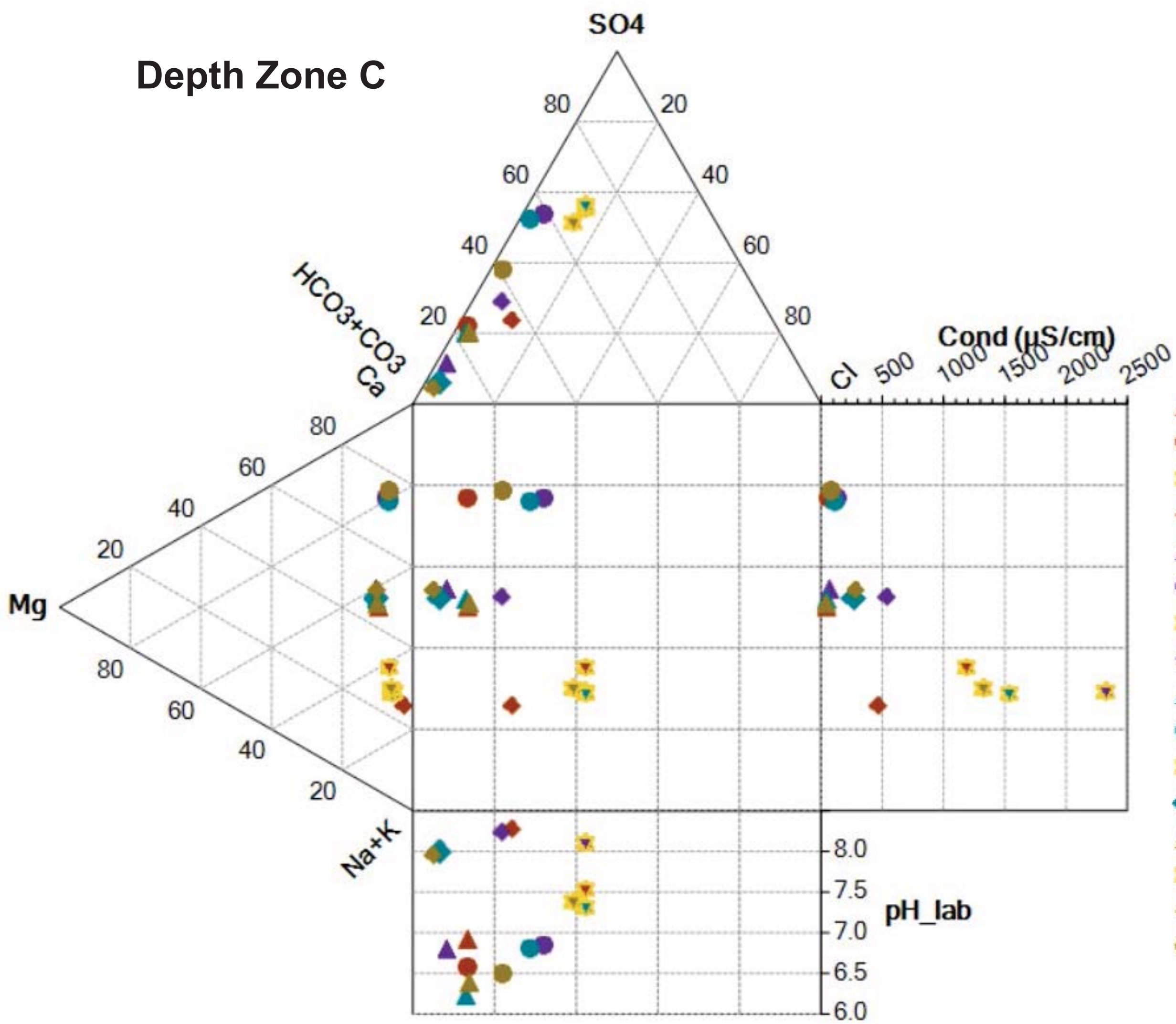
FIGURE A6: DUROV PLOT FOR IG_MWC03



Samples collected between:
Q2 2023 and Q1 2024

Sample ID	Water Type
IG_MWC03_C_GW0002	Na-Ca-HCO_3-SO_4
IG_MWC03_C_GW0004	Ca-Na-HCO_3-SO_4
IG_MWC03_C_GW0006	Ca-Na-HCO_3
IG_MWC03_C_GW0007	Ca-Na-HCO_3

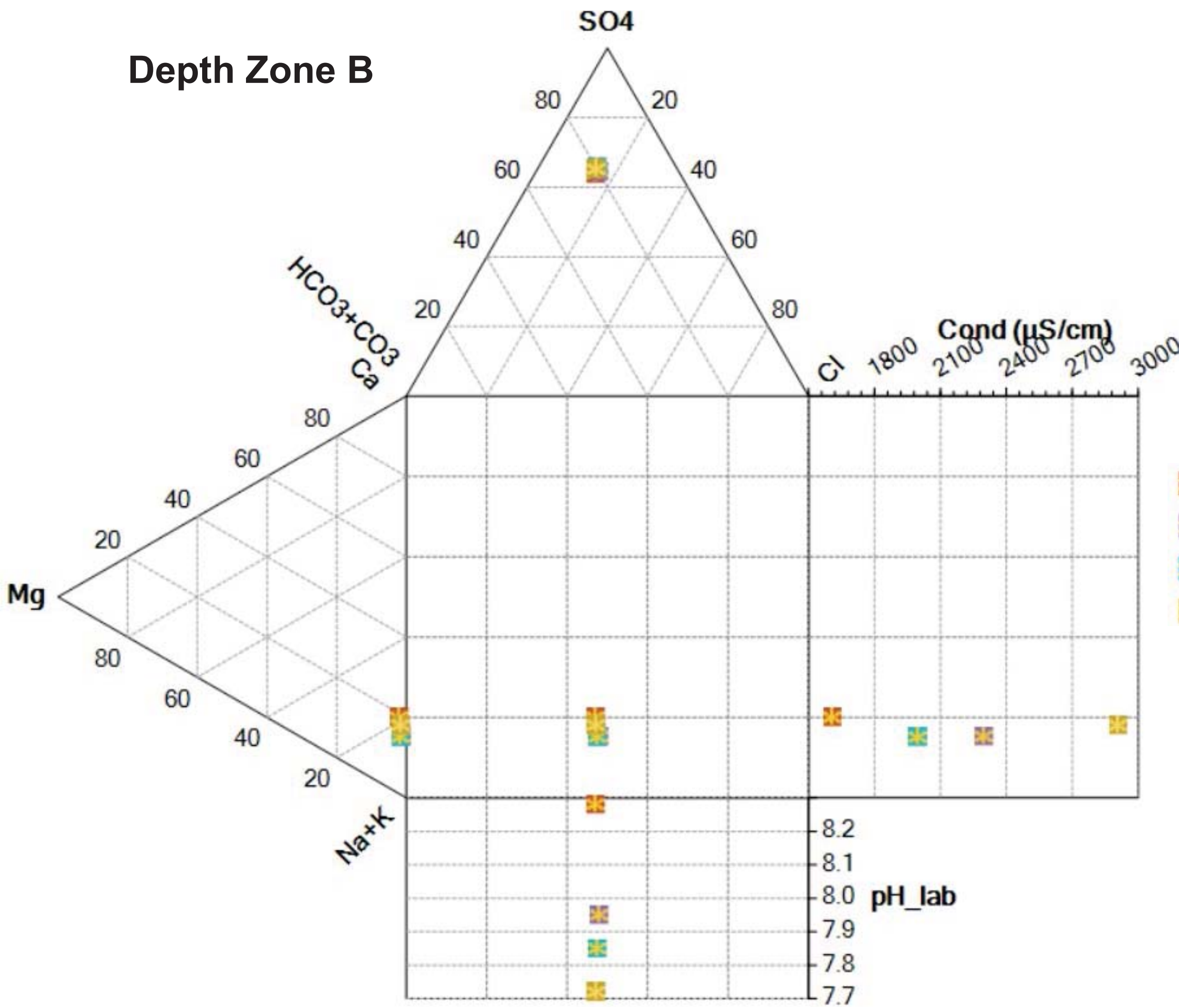
FIGURE A7: DUROV PLOT FOR DEPTH ZONE-C INTERVALS



Samples collected between:
Q2 2023 and Q1 2024

Name	WaterType	
IG_MWA01_C_GW0003	Ca-Na-HCO_3	
IG_MWB01_C_GW0002	Ca-HCO_3	
IG_MWC01_C_GW0003	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C_GW0002	Na-Ca-HCO_3-SO_4	
IG_MWA01_C_GW0004	Ca-Na-HCO_3	
IG_MWB01_C_GW0004	Ca-SO_4-HCO_3	
IG_MWC01_C_GW0004	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C_GW0004	Ca-Na-HCO_3-SO_4	
IG_MWA01_C_GW0005	Ca-Na-HCO_3	
IG_MWB01_C_GW0006	Ca-SO_4-HCO_3	
IG_MWC01_C_GW0005	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C_GW0006	Ca-Na-HCO_3	
IG_MWA01_C_GW0006	Ca-Na-HCO_3	
IG_MWC01_C_GW0007	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C_GW0007	Ca-Na-HCO_3	
IG_MWB01_C_GW0008	Ca-HCO_3-SO_4	

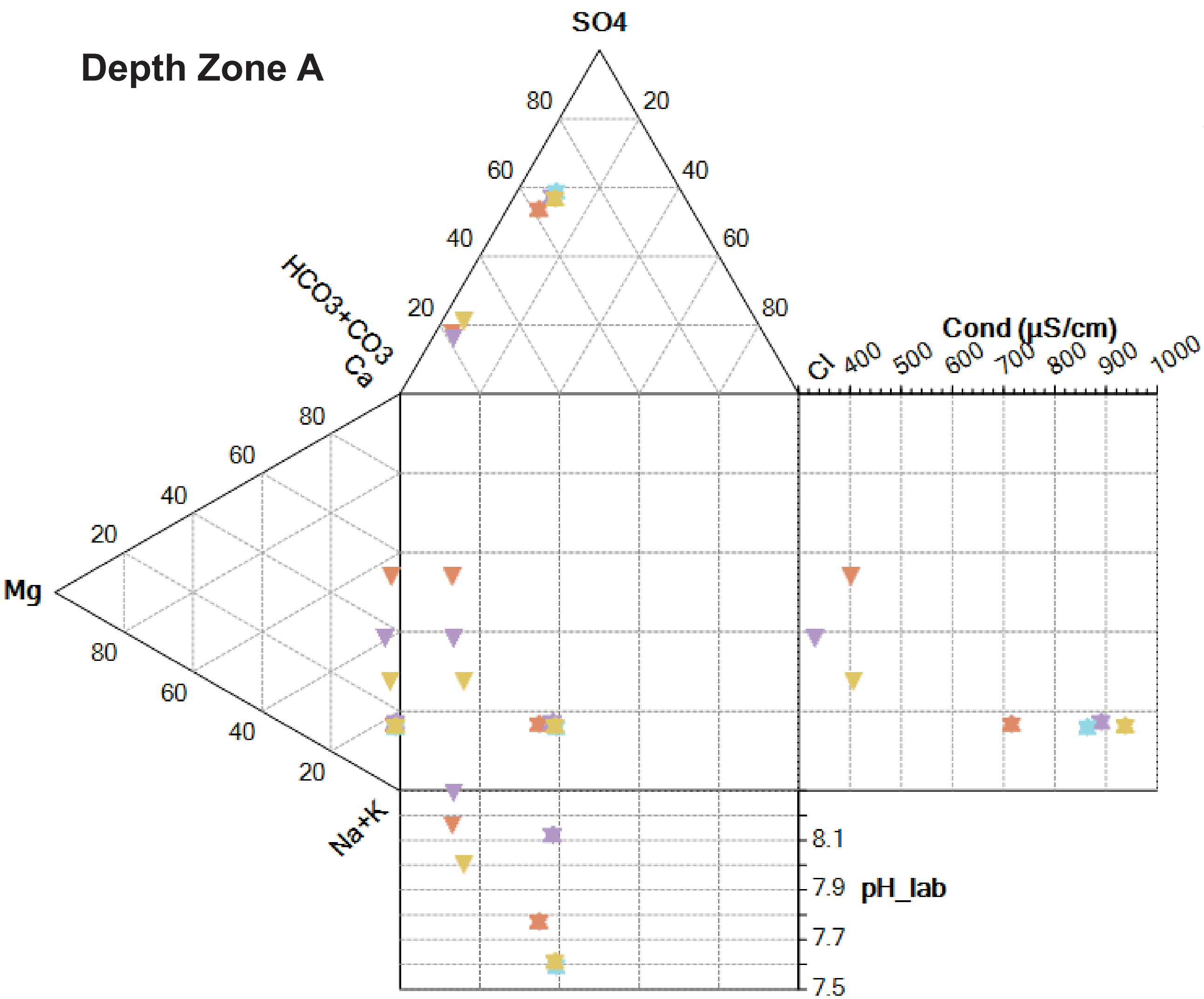
FIGURE A8: DUROV PLOT FOR DEPTH ZONE-B INTERVALS



Samples collected between:
Q2 2023 and Q1 2024

Sample ID	Water Type	
IG_MWA03_B_GW0003	Na-SO_4	High TDS
IG_MWA03_B_GW0005	Na-SO_4	High TDS
IG_MWA03_B_GW0006	Na-SO_4	High TDS
IG_MWA03_B_GW0007	Na-SO_4-HCO_3	High TDS

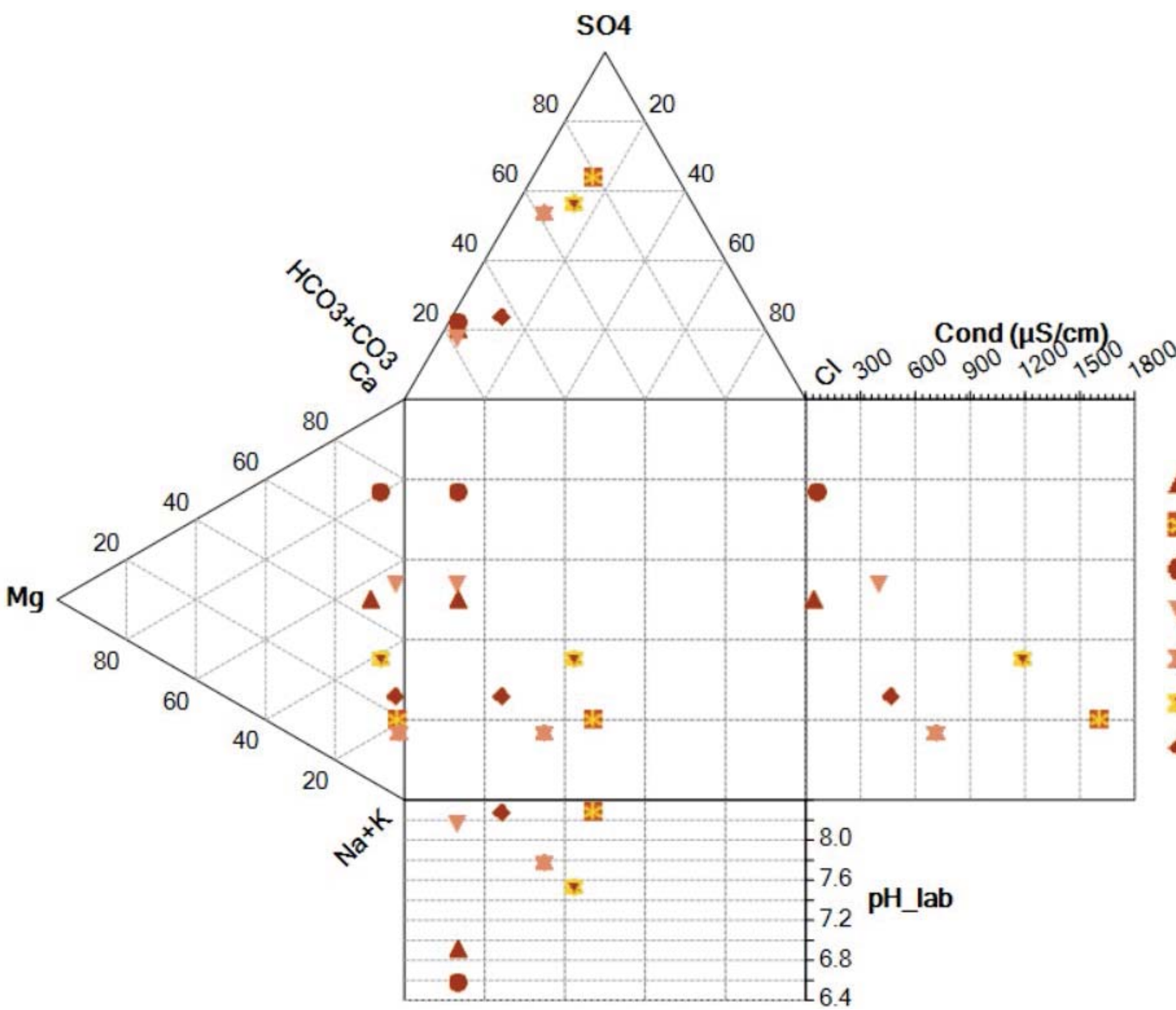
FIGURE A9: DUROV PLOT FOR DEPTH ZONE-A INTERVALS



Samples collected between:
Q2 2023 and Q1 2024

Sample ID	Water Type
IG_MWB03_A_GW0003	Ca-Na-HCO_3
IG_MWC01_A_GW0004	Na-SO_4-HCO_3
IG_MWB03_A_GW0004	Na-Ca-HCO_3
IG_MWC01_A_GW0005	Na-SO_4-HCO_3
IG_MWC01_A_GW0006	Na-SO_4-HCO_3
IG_MWC01_A_GW0007	Na-SO_4-HCO_3
IG_MWB03_A_GW0006	Na-Ca-HCO_3-SO_4

FIGURE A10: DUROV PLOT FOR Q2 2023 SAMPLES



Monitoring Event:
Q2 2023

Sample ID	Water Type	
IG_MWA01_C_GW0003	Ca-Na-HCO_3	
IG_MWA03_B_GW0003	Na-SO_4	High TDS
IG_MWB01_C_GW0002	Ca-HCO_3	
IG_MWB03_A_GW0003	Ca-Na-HCO_3	
IG_MWC01_A_GW0004	Na-SO_4-HCO_3	
IG_MWC01_C_GW0003	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C_GW0002	Na-Ca-HCO_3-SO_4	

FIGURE A11: DUROV PLOT FOR Q3 2023 SAMPLES

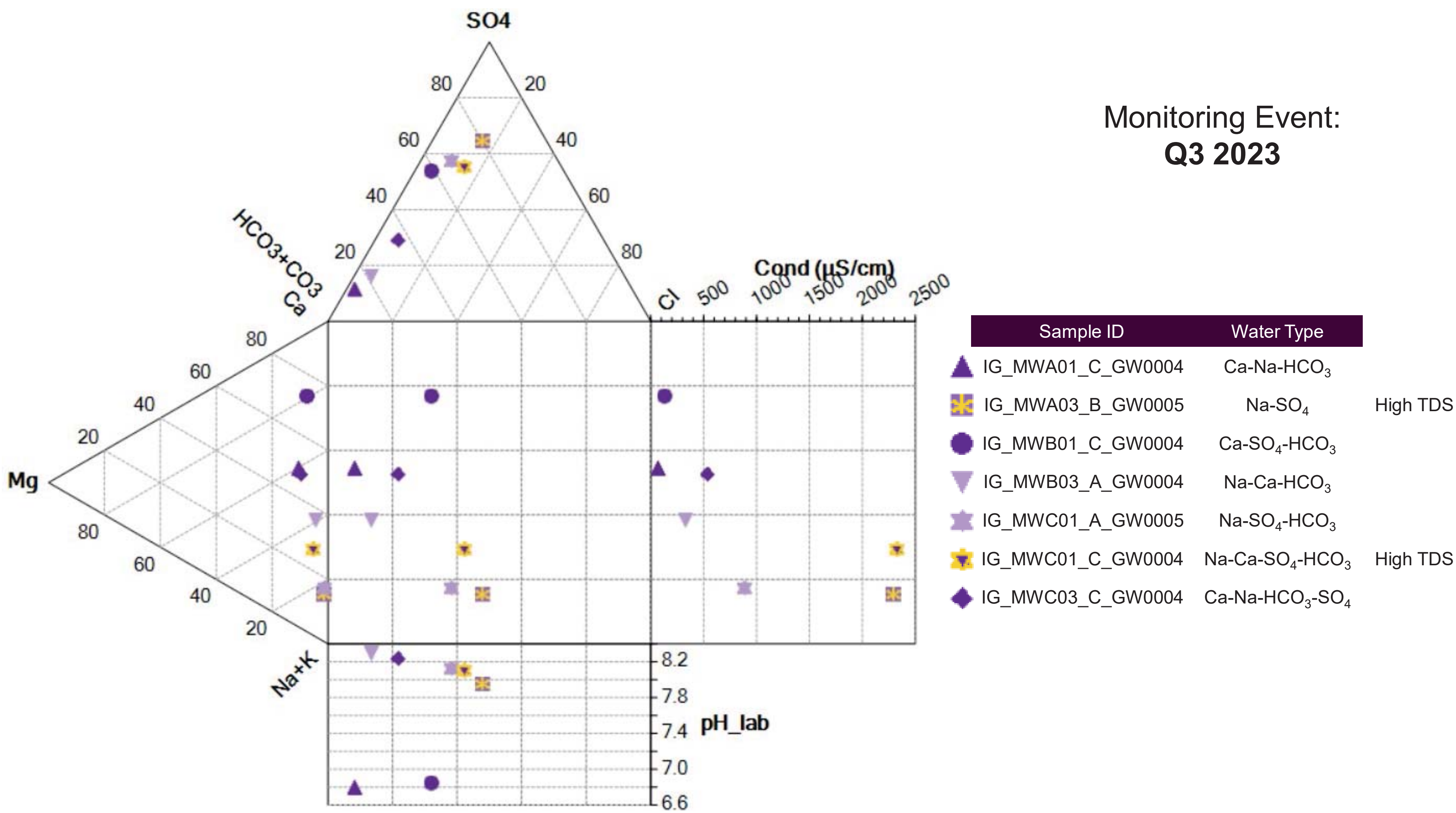
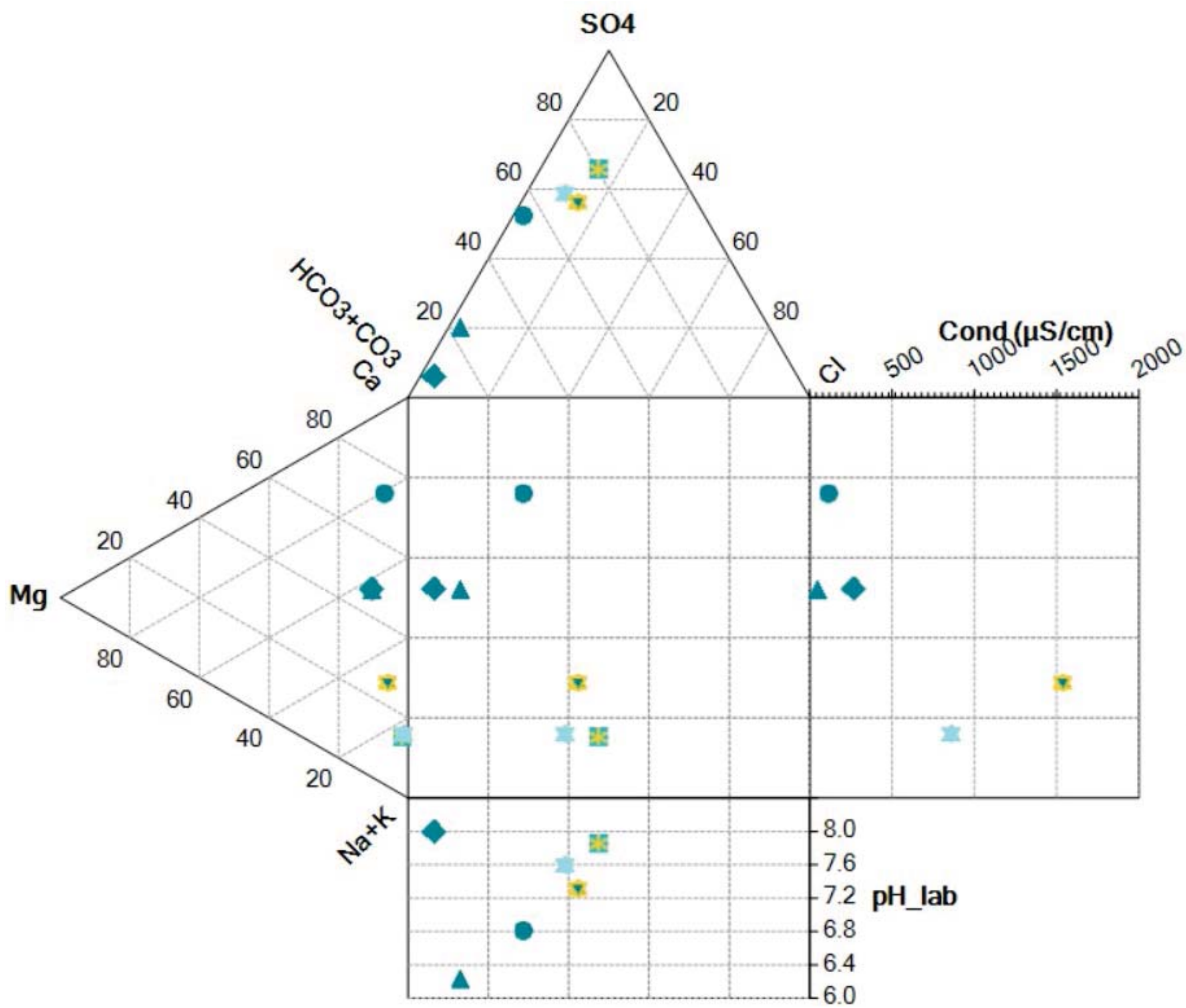


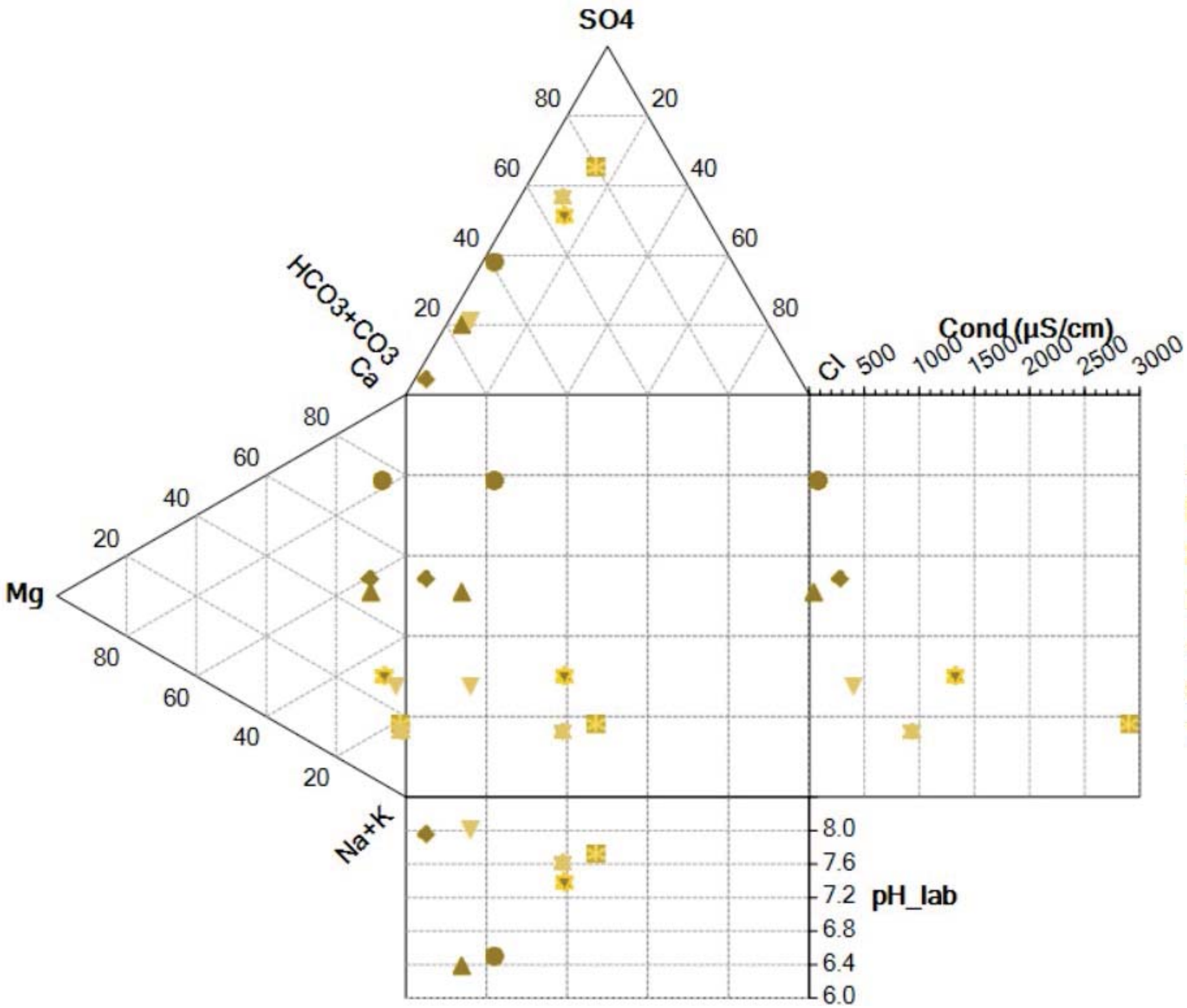
FIGURE A12: DUROV PLOT FOR Q3 2023 SAMPLES



Monitoring Event:
Q4 2023

Sample ID	Water Type	
IG_MWA01_C_GW0005	Ca-Na-HCO_3	
IG_MWA03_B_GW0006	Na-SO_4	High TDS
IG_MWB01_C_GW0006	Ca-SO_4-HCO_3	
IG_MWC01_A_GW0006	Na-SO_4-HCO_3	
IG_MWC01_C_GW0005	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC03_C_GW0006	Ca-Na-HCO_3	

FIGURE A13: DUROV PLOT FOR Q3 2023 SAMPLES

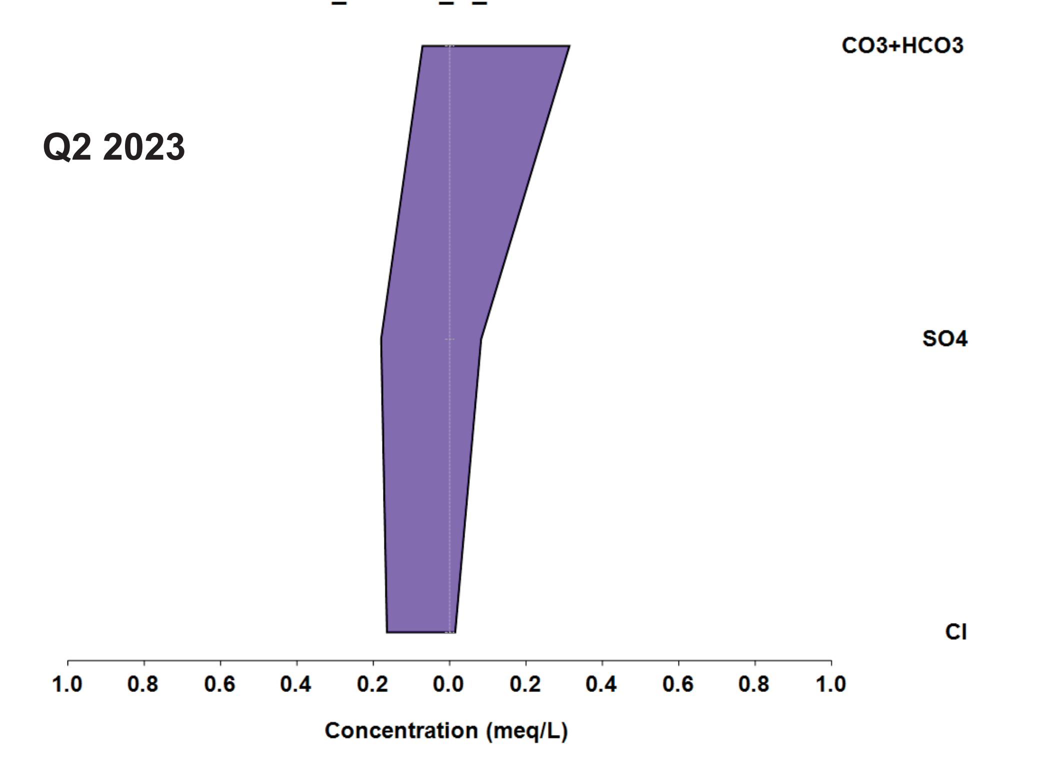


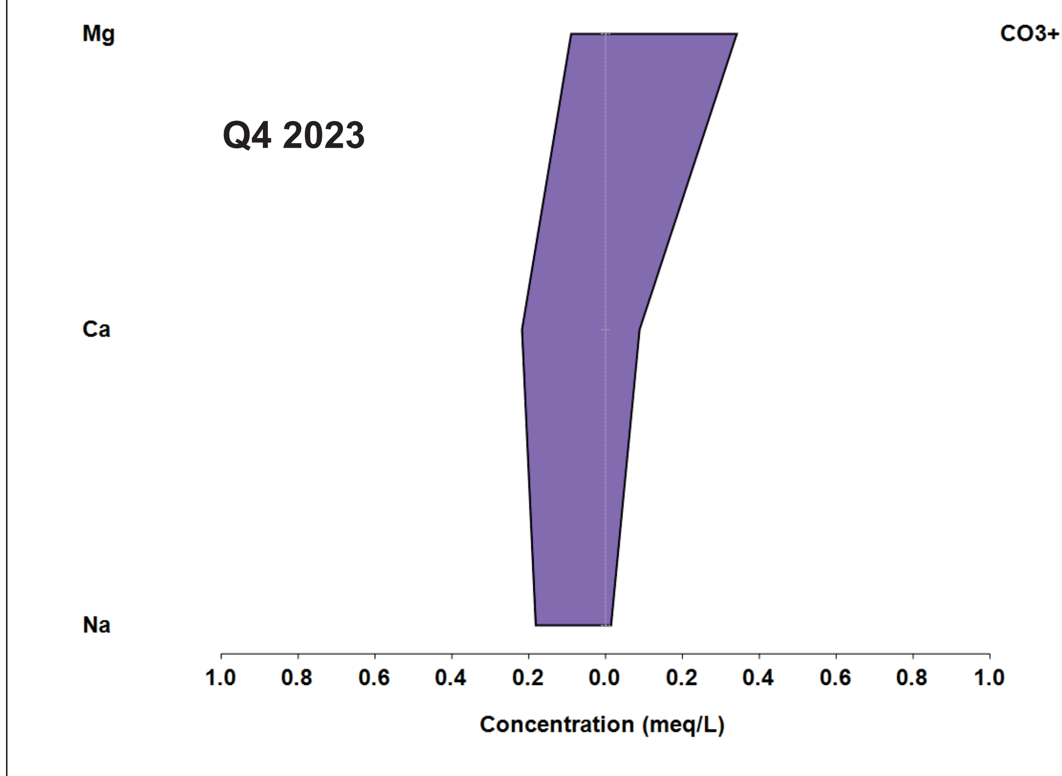
Monitoring Event:
Q1 2024

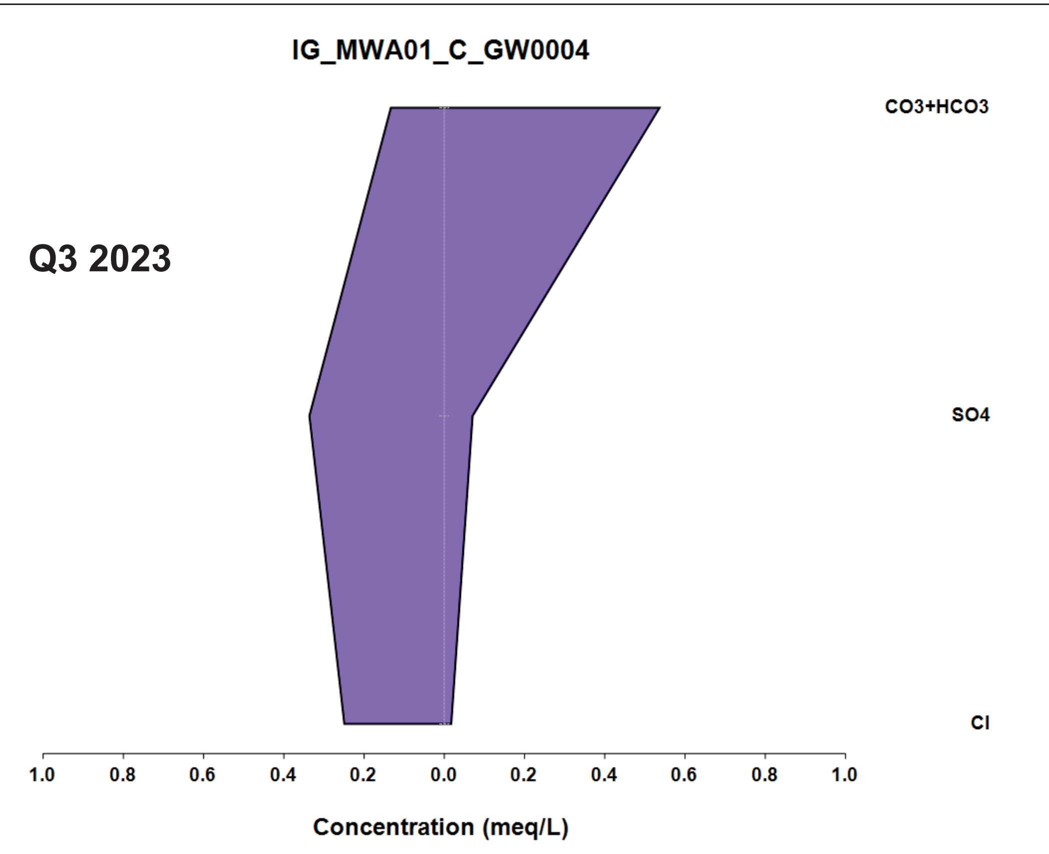
Sample ID	Water Type	
IG_MWA01_C_GW0006	Ca-Na-HCO_3	
IG_MWA03_B_GW0007	Na-SO_4-HCO_3	High TDS
IG_MWC01_C_GW0007	Na-Ca-SO_4-HCO_3	High TDS
IG_MWC01_A_GW0007	Na-SO_4-HCO_3	
IG_MWC03_C_GW0007	Ca-Na-HCO_3	
IG_MWB01_C_GW0008	Ca-HCO_3-SO_4	
IG_MWB03_A_GW0006	Na-Ca-HCO_3-SO_4	

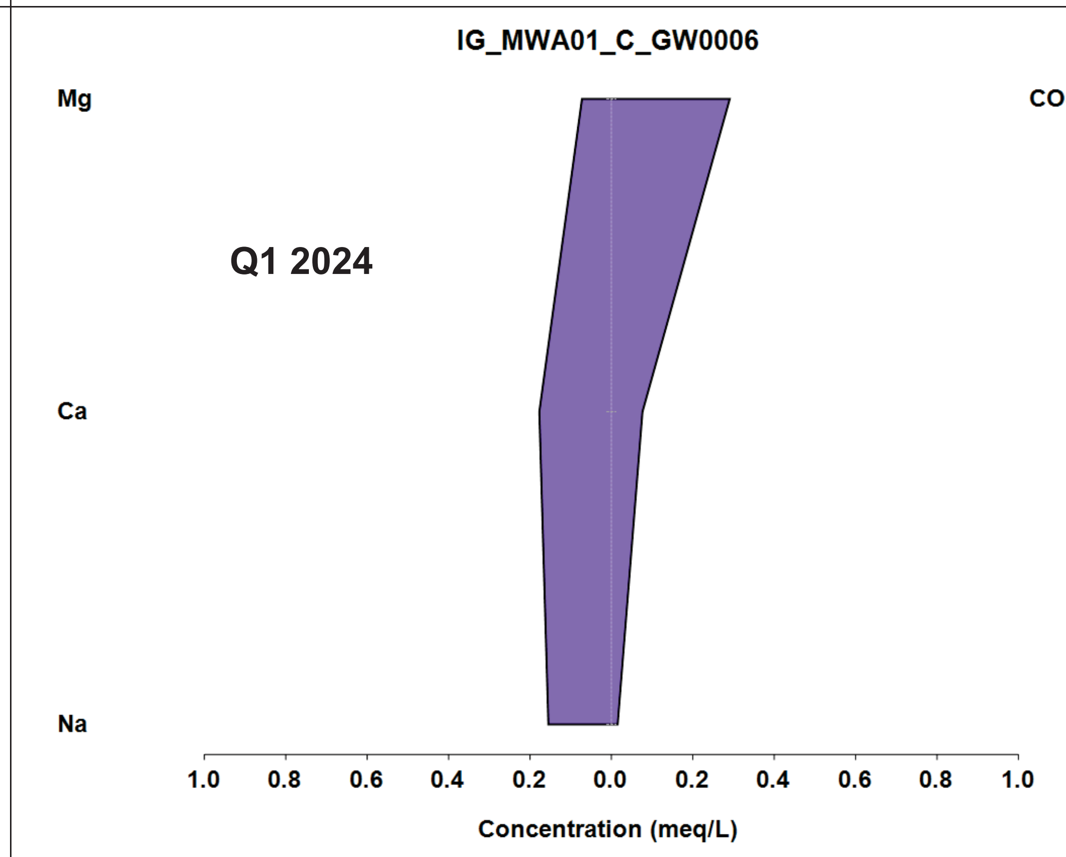
APPENDIX B

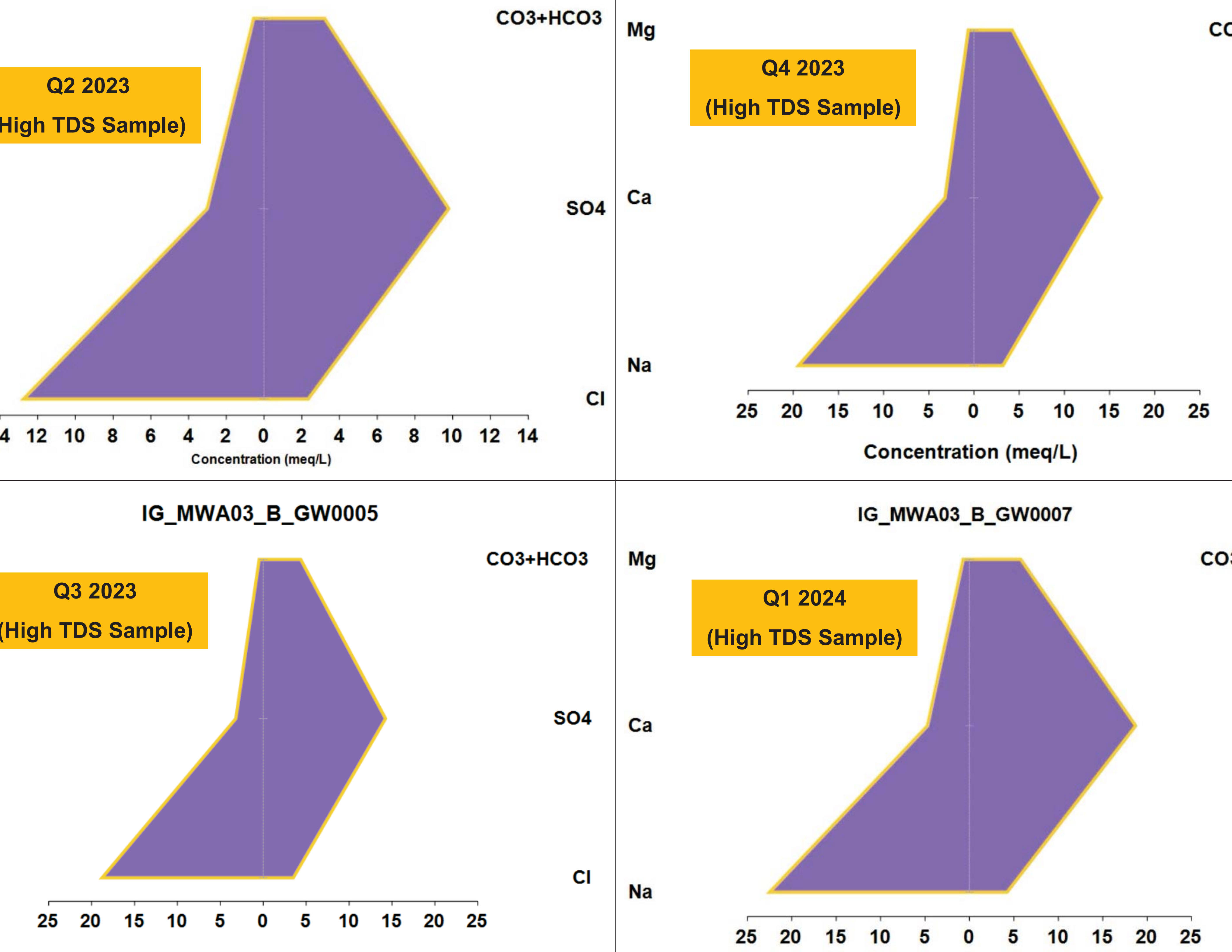
Stiff Diagrams


Q2 2023
CO3+HCO3
SO4
Cl
1.0 0.8 0.6 0.4 0.2 0.0 0.2 0.4 0.6 0.8 1.0
Concentration (meq/L)

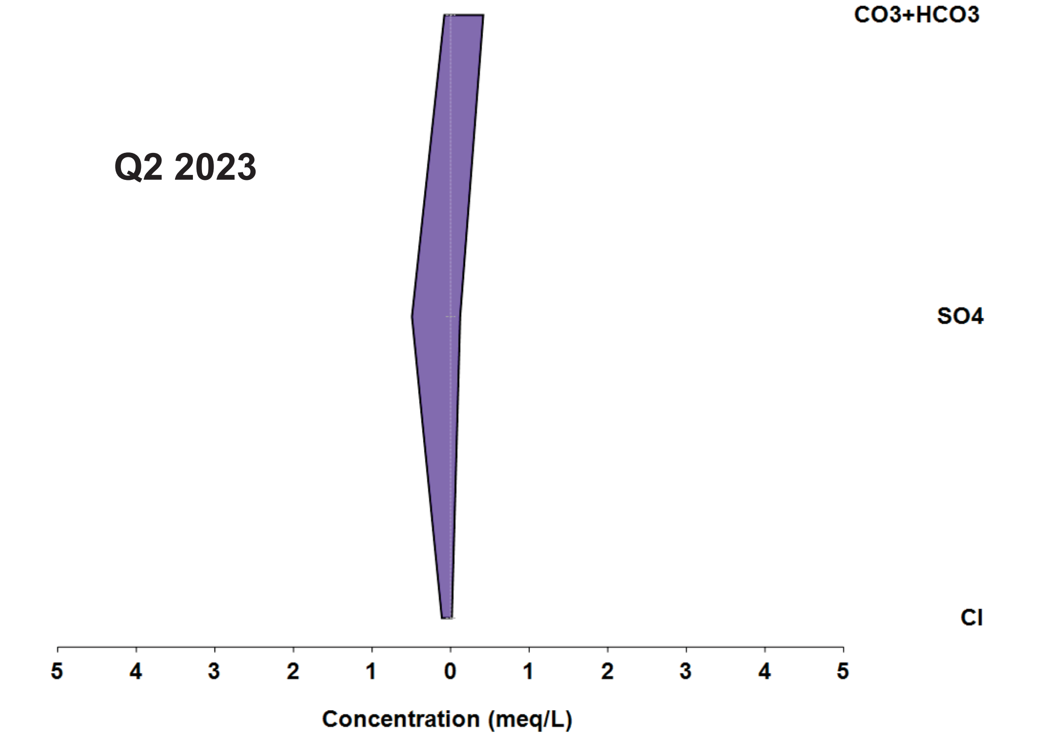

Q4 2023
Mg
Ca
Na
CO3+
1.0 0.8 0.6 0.4 0.2 0.0 0.2 0.4 0.6 0.8 1.0
Concentration (meq/L)

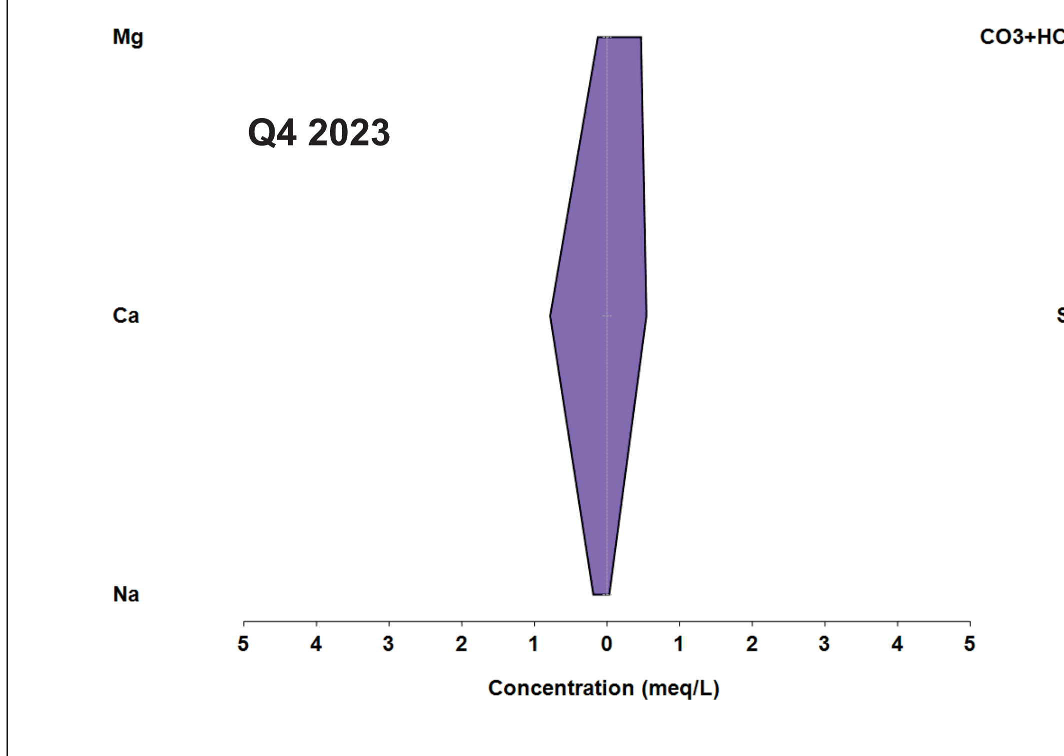

IG_MWA01_C_GW0004
Q3 2023
CO3+HCO3
SO4
Cl
1.0 0.8 0.6 0.4 0.2 0.0 0.2 0.4 0.6 0.8 1.0
Concentration (meq/L)

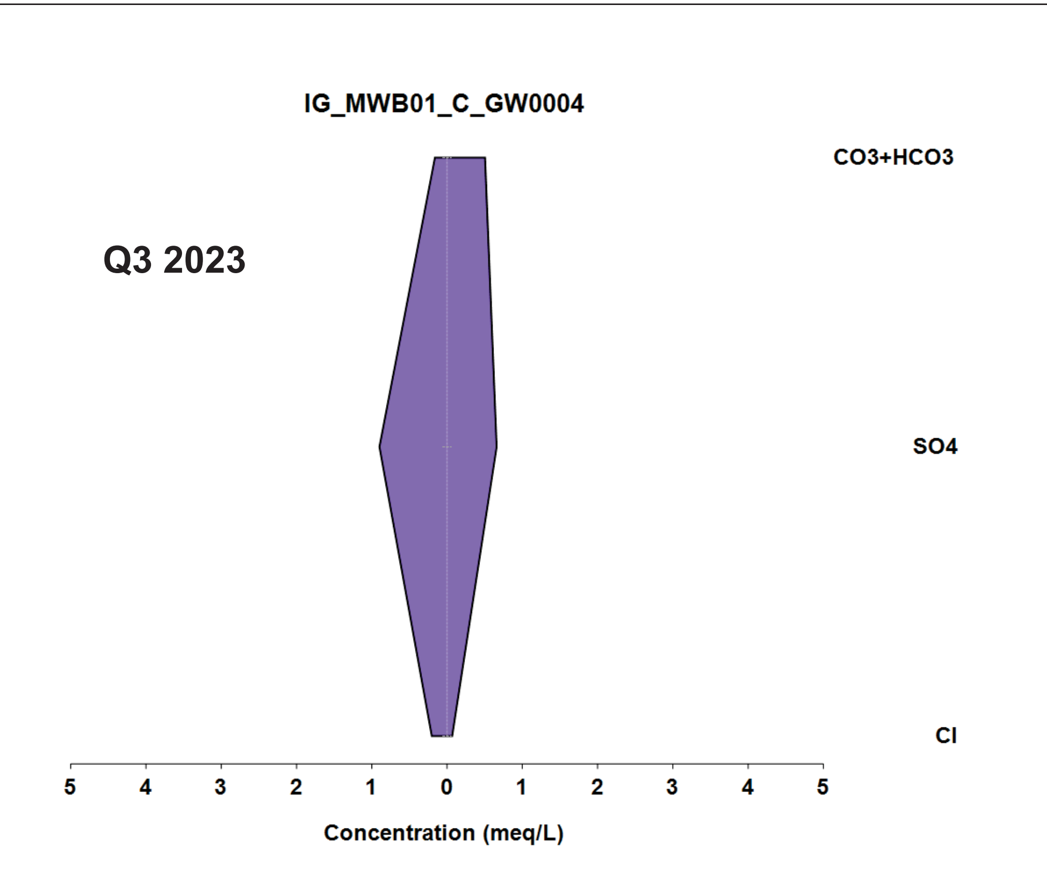

IG_MWA01_C_GW0006
Q1 2024
Mg
Ca
Na
CO
1.0 0.8 0.6 0.4 0.2 0.0 0.2 0.4 0.6 0.8 1.0
Concentration (meq/L)

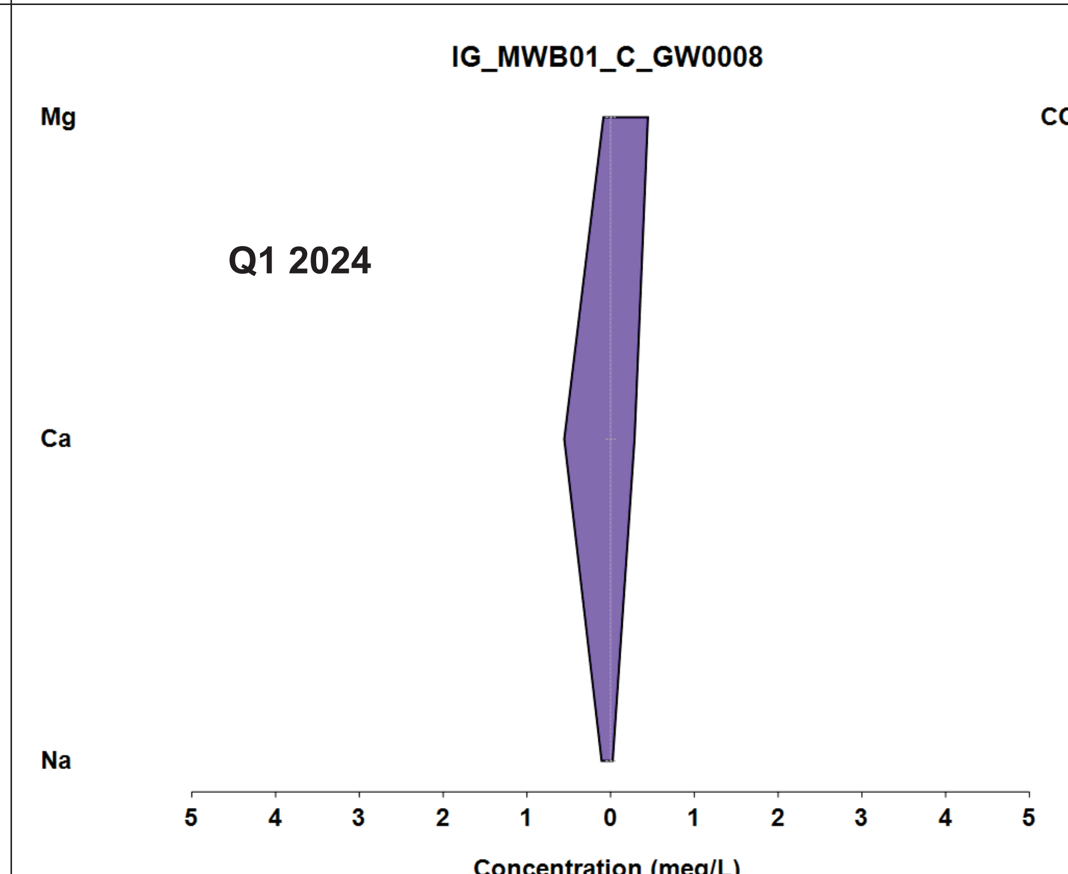


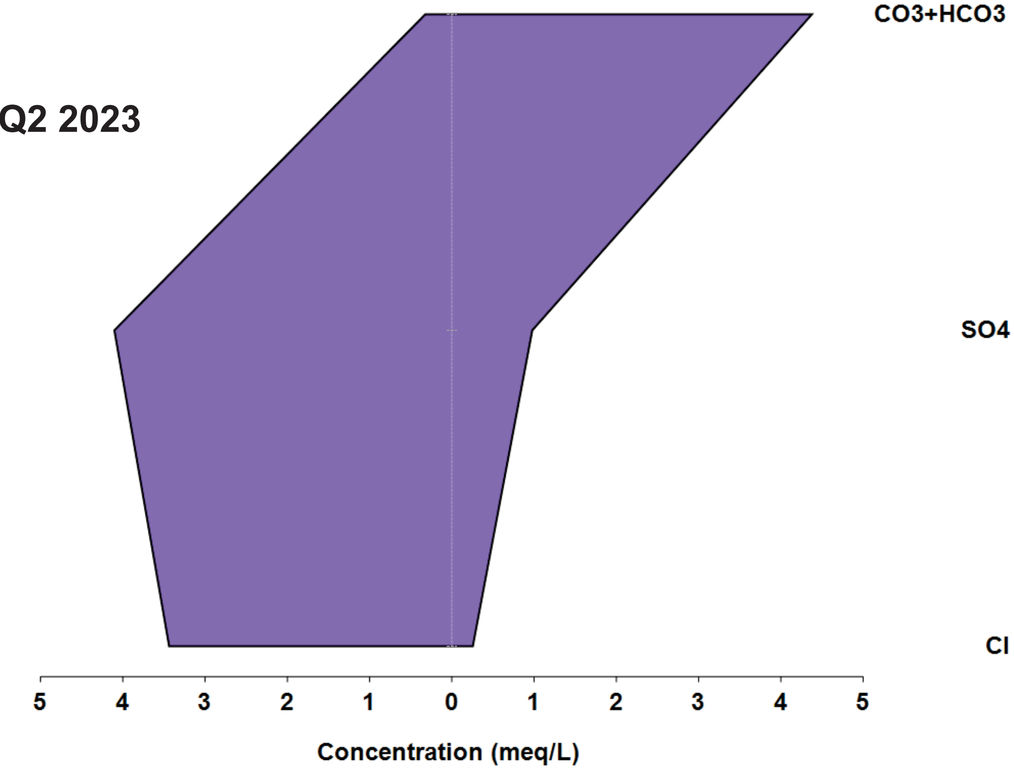
Q2 2023
High TDS Sample)
CO3+HCO3
SO4
Cl
4 12 10 8 6 4 2 0 2 4 6 8 10 12 14
Concentration (meq/L)
Mg
Ca
Na
Q4 2023
(High TDS Sample)
25 20 15 10 5 0 5 10 15 20 25
Concentration (meq/L)
IG_MWA03_B_GW0005
Q3 2023
(High TDS Sample)
CO3+HCO3
SO4
Cl
25 20 15 10 5 0 5 10 15 20 25
IG_MWA03_B_GW0007
Mg
Ca
Na
Q1 2024
(High TDS Sample)
25 20 15 10 5 0 5 10 15 20 25

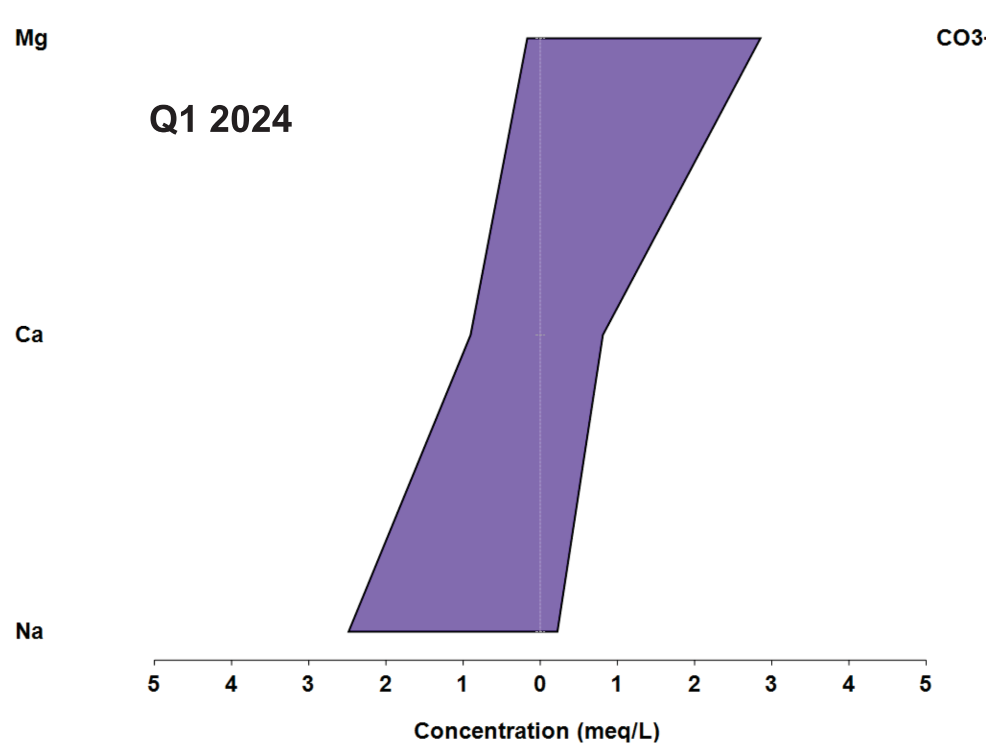

Q2 2023
CO3+HCO3
SO4
Cl
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)


Q4 2023
Mg
Ca
Na
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)

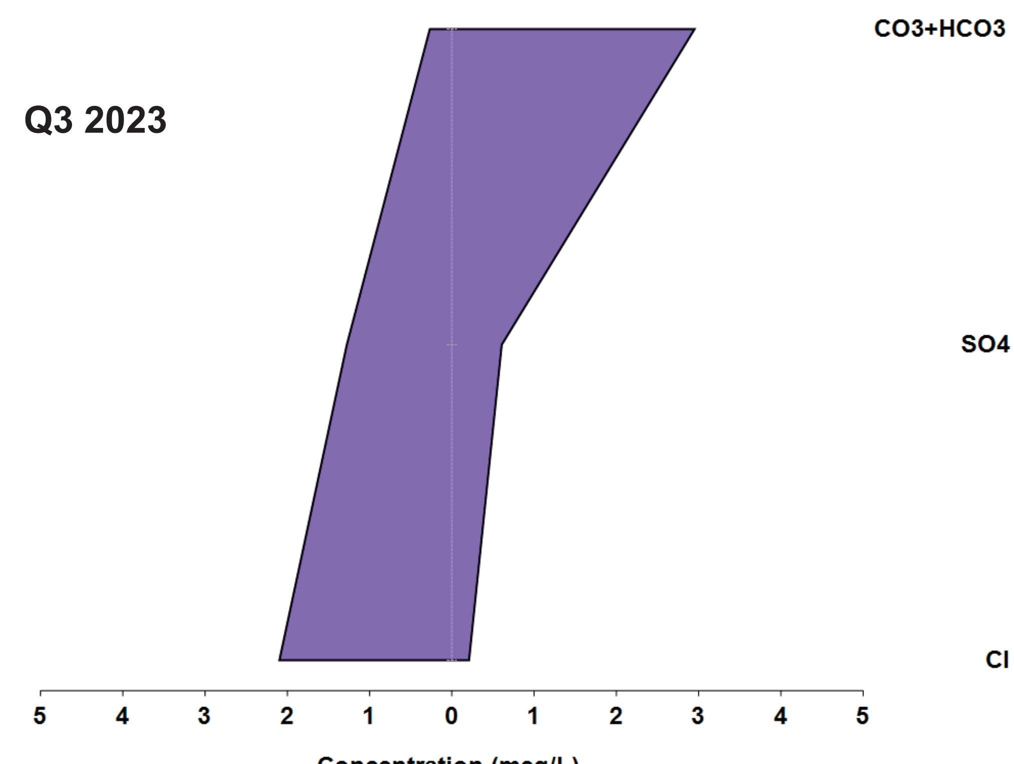

IG_MWB01_C_GW0004
Q3 2023
CO3+HCO3
SO4
Cl
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)

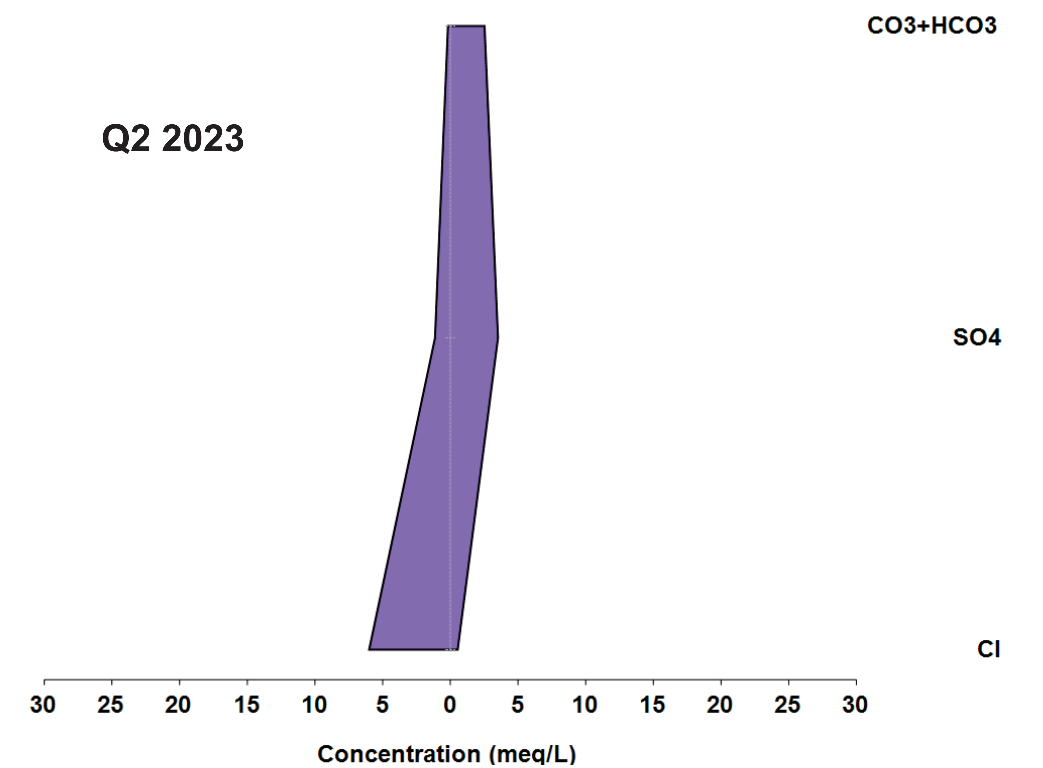

IG_MWB01_C_GW0008
Q1 2024
Mg
Ca
Na
5 4 3 2 1 0 1 2 3 4 5



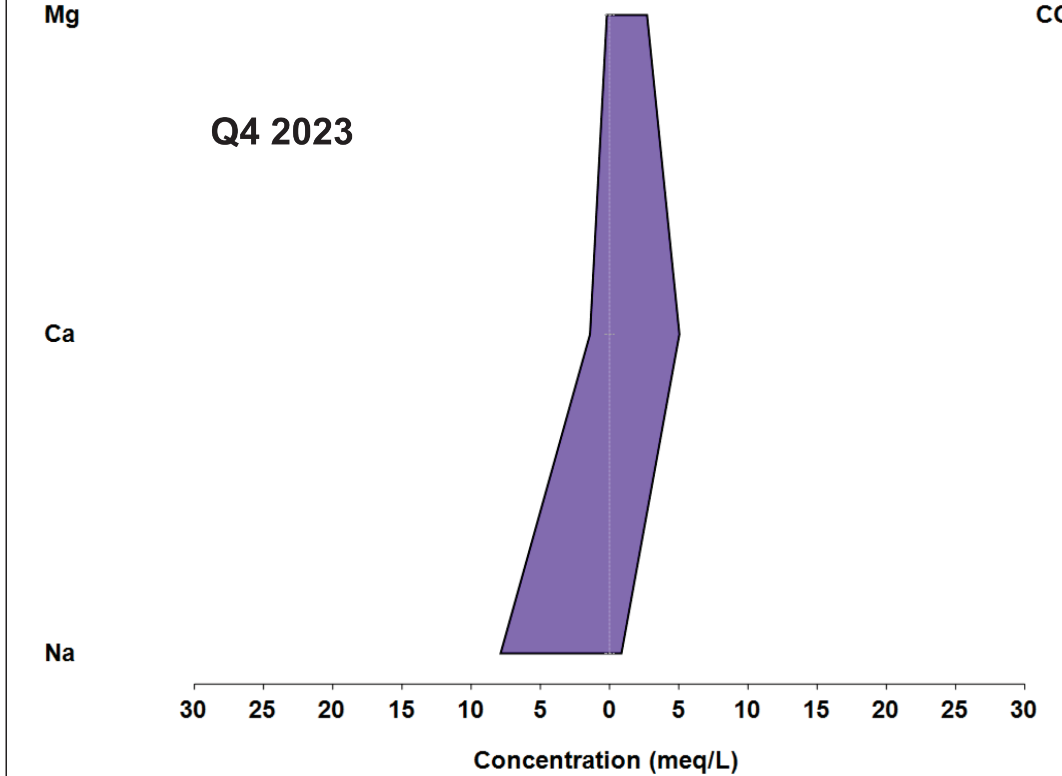


IG_MWB03_A_GW0004

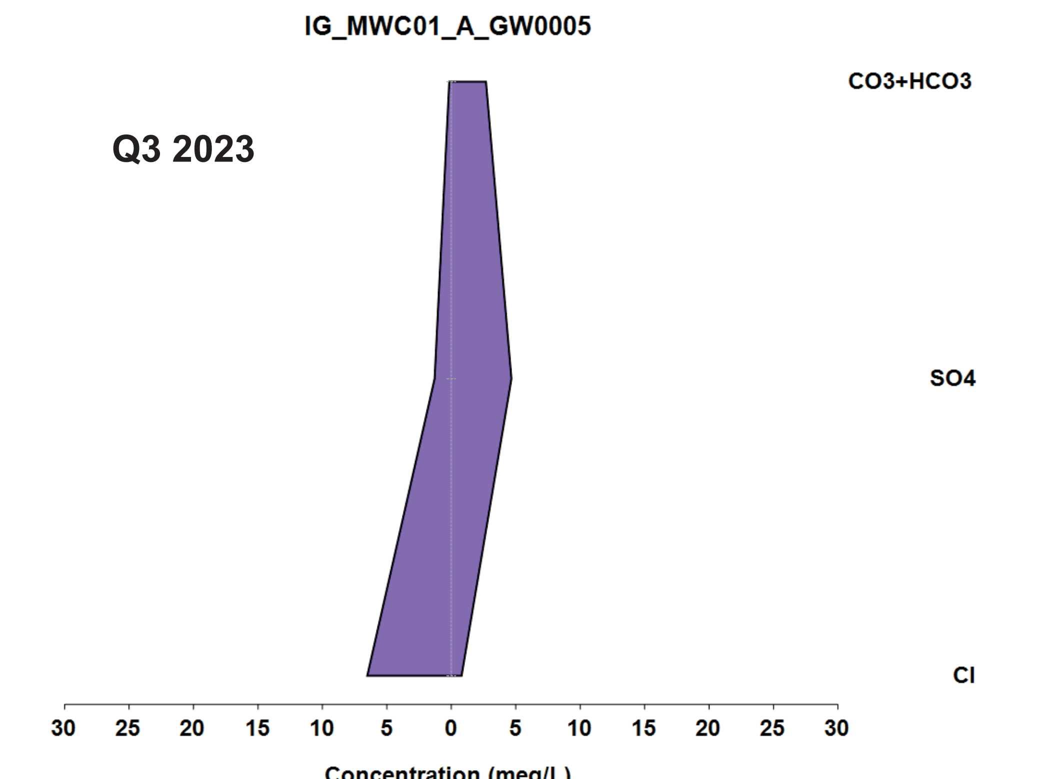




Q2 2023
CO3+HCO3
SO4
Cl
30 25 20 15 10 5 0 5 10 15 20 25 30
Concentration (meq/L)



Q4 2023
Mg
Ca
Na
30 25 20 15 10 5 0 5 10 15 20 25 30
Concentration (meq/L)



IG_MWC01_A_GW0005
Q3 2023
CO3+HCO3
SO4
Cl
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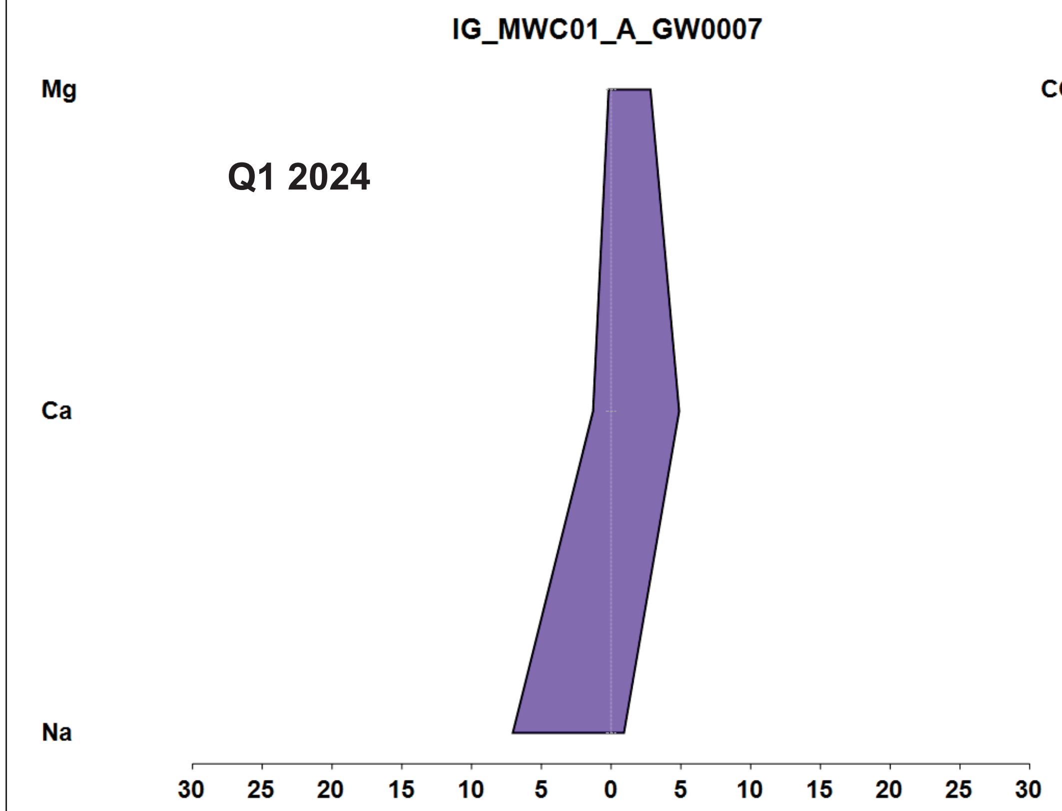

IG_MWC01_A_GW0007
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Mg
Ca
Na
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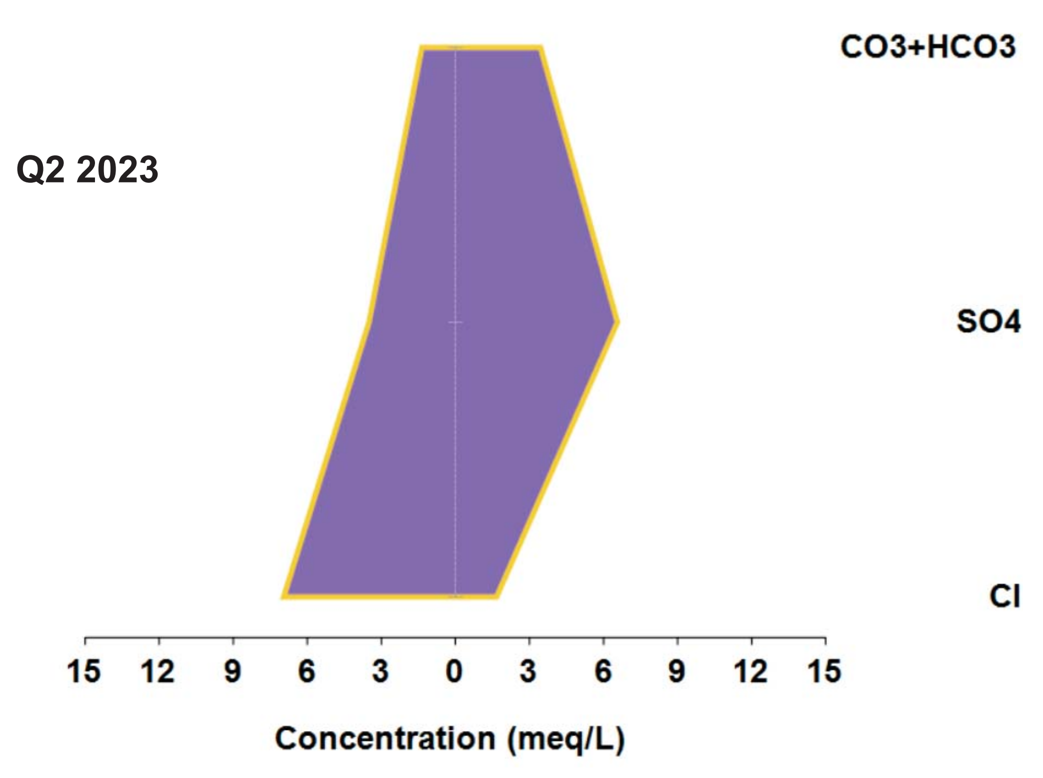
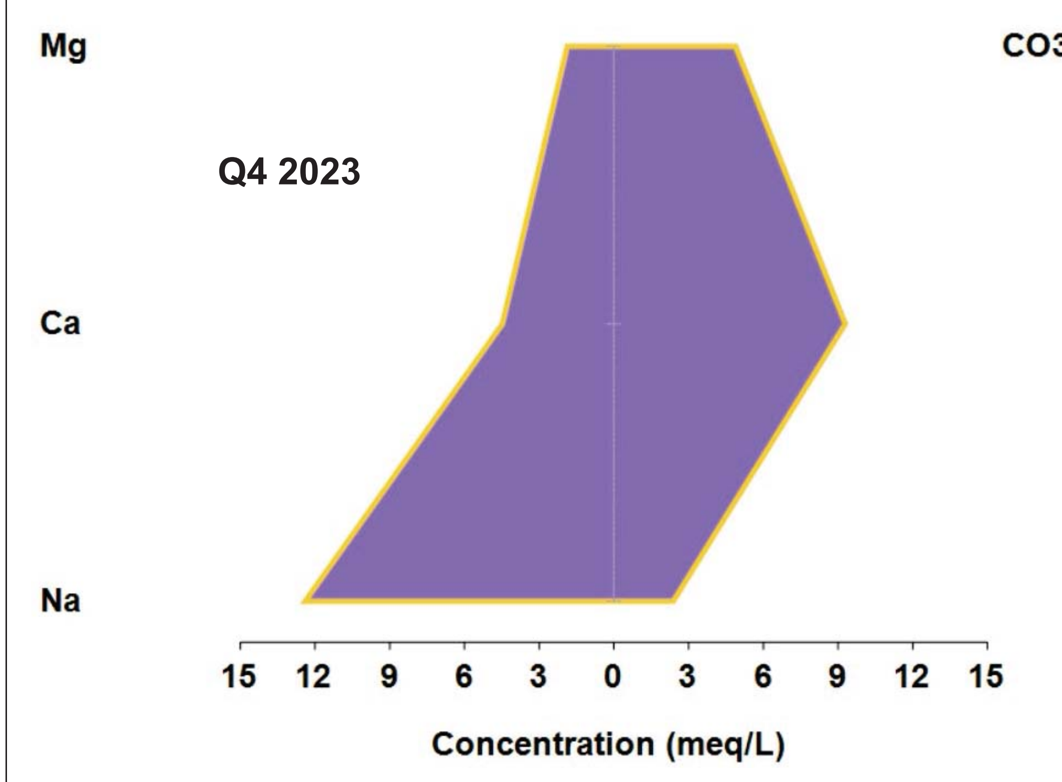
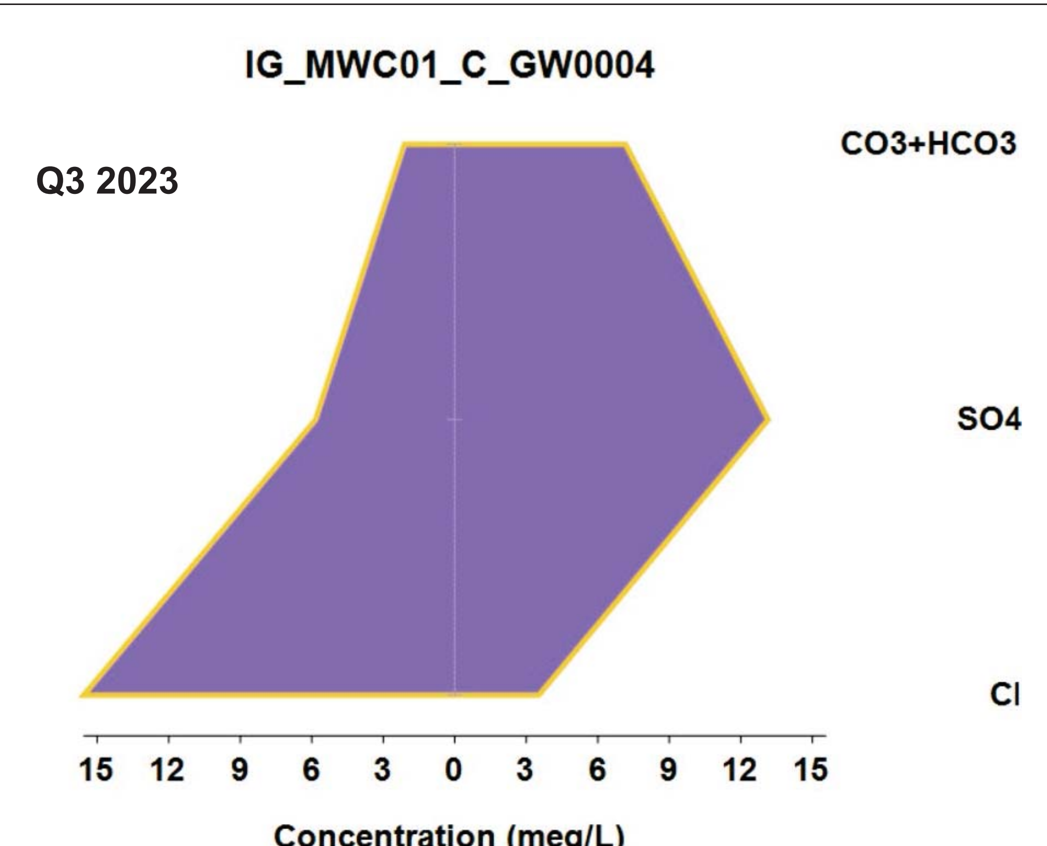
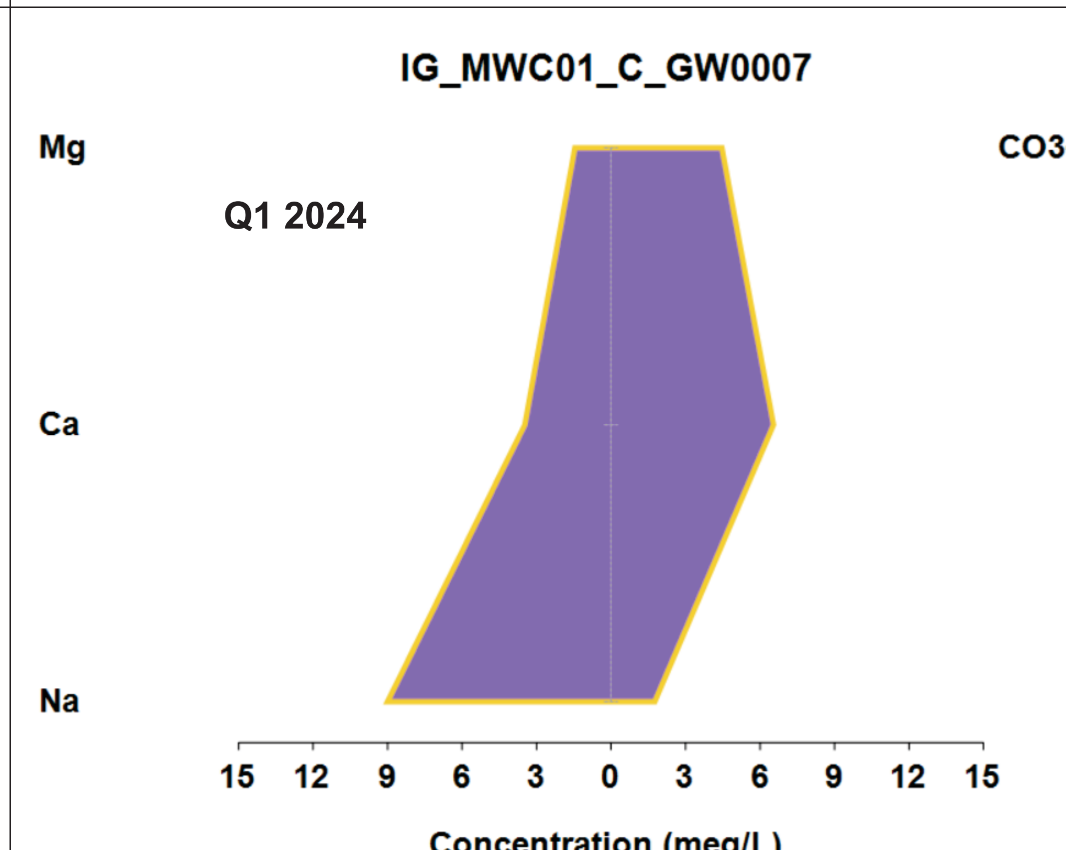
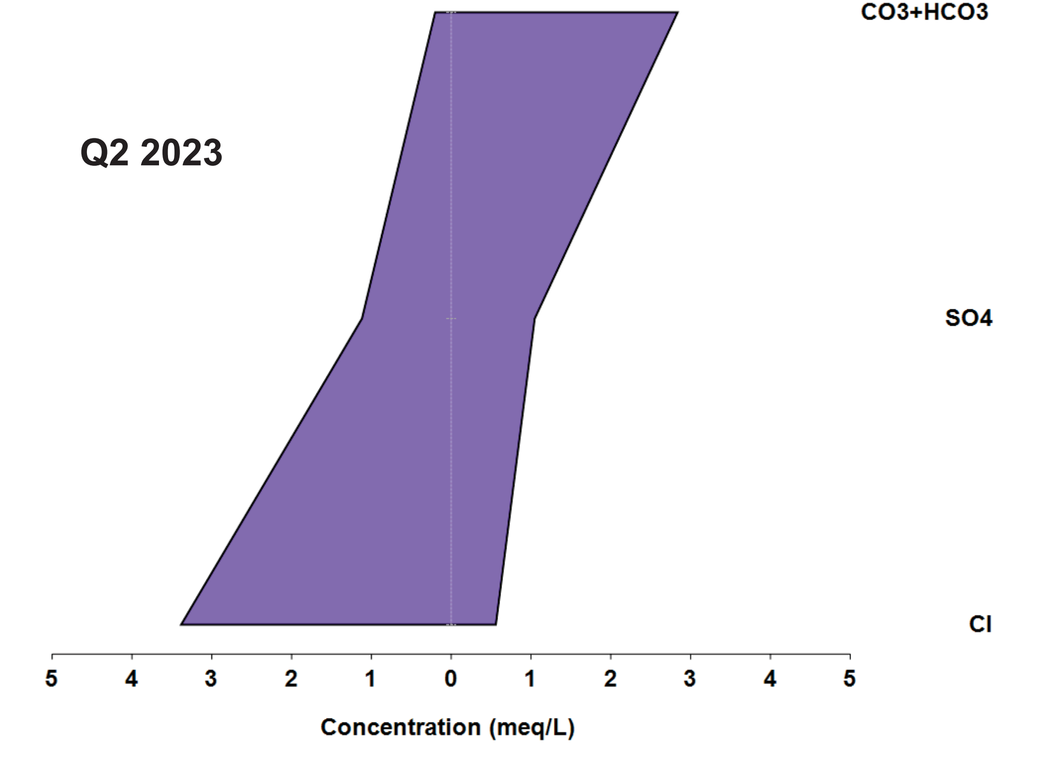

Q2 2023
CO3+HCO3
SO4
Cl
15 12 9 6 3 0 3 6 9 12 15
Concentration (meq/L)

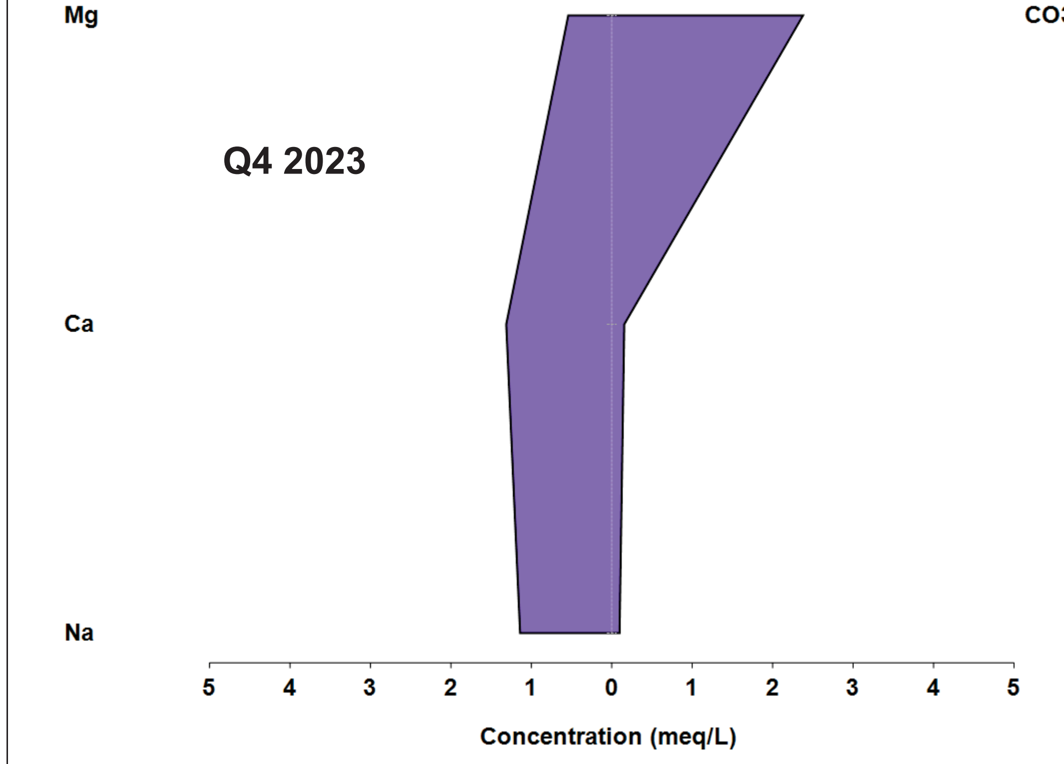

Mg
Ca
Na
Q4 2023
15 12 9 6 3 0 3 6 9 12 15
Concentration (meq/L)


IG_MWC01_C_GW0004
Q3 2023
CO3+HCO3
SO4
Cl
15 12 9 6 3 0 3 6 9 12 15

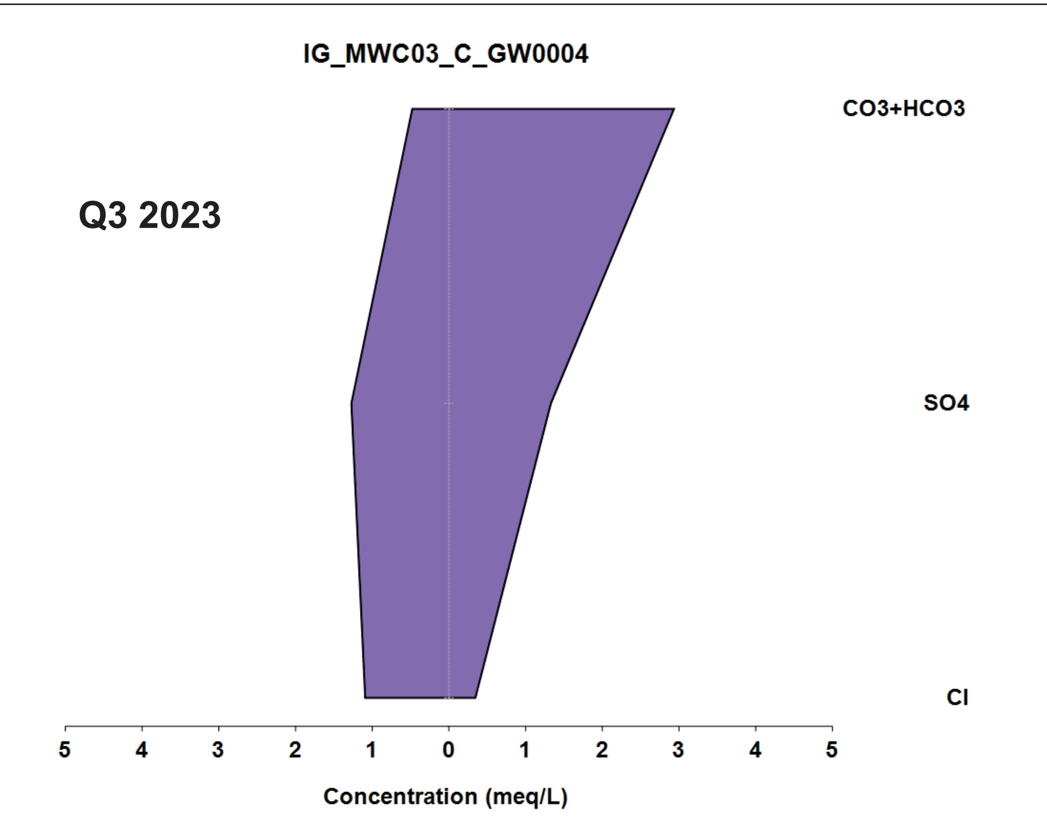

IG_MWC01_C_GW0007
Mg
Ca
Na
Q1 2024
15 12 9 6 3 0 3 6 9 12 15



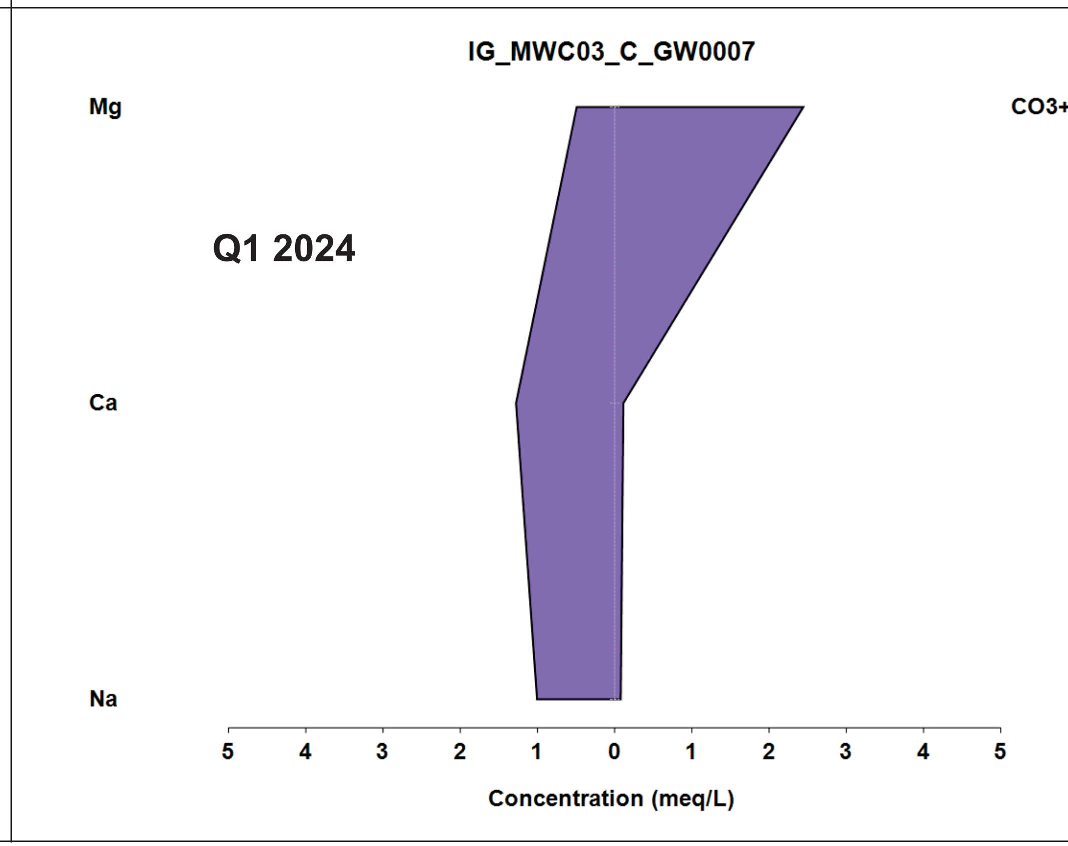
Q2 2023
CO3+HCO3
SO4
Cl
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)



Mg
Q4 2023
Ca
Na
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)



IG_MWC03_C_GW0004
Q3 2023
CO3+HCO3
SO4
Cl
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)



IG_MWC03_C_GW0007
Mg
Q1 2024
Ca
Na
5 4 3 2 1 0 1 2 3 4 5
Concentration (meq/L)

APPENDIX C

2023 General Chemistry Laboratory Results

Summary Table

APPENDIX C-1

2023 General Chemistry of High Confidence Samples

& Time Sampled (mm/yyyy hh:mm)	Comments	pH-Lab	Alkalinity-Bi as CaCO3	Alkalinity-Ca CaCO3	Alkalinity-Hy CaCO3	Cations Tota	Anions Tota	Cation - Ani	Alkalinity-To CaCO3	Total Ammo (NH4+NH3)	Bromide (Br	Chloride (Cl)	Fluoride (F)	Iodide (I)	Nitrate as N	Nitrite as NO	Nitrate + Ni	Total Kjelda	Total Nitrog	Orthophosp	Total Phosp (Ptot)	Total Reacti Phosphorus	Sulfate (SO4	Dissolved I
	Units:	units	mg/L	mg/L	mg/L	mEq/L	mEq/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	m
	Detection Limit:	-	1.0	1.0	1.0	0.10	0.10	0.01	1.0	0.005	0.1	0.5	0.02	0.2	0.089	0.033	-	0.050	0.055	0.0030	0.0020	0.0030	0.30	0
-06-22 13:30	Groundwater sample	6.91	17.1	<1.0	<1.0	0.48	0.45	3.22	17.1	0.054	<0.10	0.51	0.095	<0.20	0.598 HTD	<0.033 HTD	-	<0.15	<0.152	0.0836	0.153	0.0997	3.95	1
-09-27 12:15	Groundwater sample	6.79	30.7	<1.0	<1.0	0.75	0.71	2.74	30.7	0.0054	<0.10	0.61	0.074	<0.20	0.244	<0.0328	-	0.07	0.125	0.0978	0.125	0.103	3.38	7
-12-04 11:00	Groundwater sample	6.22	18.8	<1.0	<1.0	0.51	0.47	4.08	18.8	<0.0050	<0.10	<0.50	0.074	<0.20	0.284	<0.033	-	0.08	0.144	0.0772	0.11	0.0851	4.24	3
-04-03 11:25	Groundwater sample	6.38	15.7	<1.0	<1.0	0.42	0.41	1.20	15.7	0.0052	<0.10	0.54	0.088	<0.20	0.199	<0.0328	-	0.057	0.102	0.0884	0.109	0.0959	3.66	3
-09-25 12:45	Field Blank	5.41	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	0.0194	<0.10	<0.50	<0.020	<0.20	<0.0886	<0.0328	-	<0.050	<0.055	<0.0030	0.0088	<0.0030	<0.30	<
-12-04 13:20	Field Blank	5.68	1.0	<1.0	<1.0	<0.10	<0.10	<0.01	1.0	<0.0050	<0.10	<0.50	<0.020	<0.20	<0.089	<0.033	-	<0.050	<0.055	<0.0030	<0.0020	<0.0030	<0.30	<
-04-03 13:20	Field Blank	5.08	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	0.0264	<0.50 DLM	<0.50	<0.020	<0.20	<0.0886	<0.0328	-	<0.050	<0.055	<0.0030	<0.0020	<0.0030	<0.30	2
-06-22 16:45	Groundwater sample	8.28	194	<1.0	<1.0	16.4	16.0	1.23	194	<0.010	0.35	83	0.27	<0.20	0.735 HTD	<0.066 DLM, HTD	-	0.18	0.346	0.0383	0.0654	0.048	470	
-06-22 16:50	Field Duplicate of IG_MWA03_B_GW0003	8.30	191	2.8	<1.0	16.4	16.1	0.92	194	<0.010	0.43	83.5	0.274	<0.20	0.731 HTD	<0.066 DLM, HTD	-	0.17	0.335	0.0396	0.0646	0.0537	473	3
-09-27 10:20	Groundwater sample	7.95	264	<1.0	<1.0	22.6	23.0	-0.88	264	0.0102	<1.00 DLM	124	0.283	<0.20	1.15	<0.328 DLM	-	0.303	0.562	0.106	0.122	0.106	684	4
-12-04 15:25	Groundwater sample	7.85	255	<1.0	<1.0	23.4	22.4	2.18	255	<0.0050	<1.00 DLM	113	<0.200 DLM	<0.20	1.19	<0.328 DLM	-	0.235	0.504	0.0817	0.0964	0.0822	677	4
-04-03 16:20	Groundwater sample	7.72	350	<1.0	<1.0	28.0	30.0	-3.45	350	0.007	<2.00 DLM	150	0.252	<0.20	1.36	<0.164 DLM	-	0.232	0.539	0.104	0.116	0.1	898	5
-06-19 18:35	Groundwater sample	6.57	23.3	<1.0	<1.0	0.70	0.61	6.87	23.3	0.016	<0.10	0.51	0.039	<0.20	0.744	<0.033	-	<0.15	0.168	0.0095	0.0122	0.0104	5.78	5
-06-20 13:20	Field Blank	5.56	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	<0.010	<0.10	<0.50	<0.020	<0.20	<0.089	<0.033	-	0.34	0.34	<0.0030	0.0134	<0.0030	<0.30	<
-09-25 17:35	Groundwater sample	6.84	28.7	<1.0	<1.0	1.29	1.30	-0.39	28.7	<0.0050	<0.10	2.39	0.046	<0.20	0.248	<0.0328	-	0.08	0.136	0.0071	0.0088	0.007	31.6	
-09-25 17:40	Field Duplicate of IG_MWB01_C_GW0004	6.95	28.7	<1.0	<1.0	1.40	1.31	3.32	28.7	<0.0050	<0.10	2.53	0.044	<0.20	0.261	<0.0328	-	0.075	0.134	0.0064	0.0087	0.0068	31.7	5
-12-06 13:15	Groundwater sample	6.80	26.5	<1.0	<1.0	1.13	1.11	0.89	26.5	<0.0050	<0.10	1.05	0.033	<0.20	0.514	<0.033	-	0.111	0.227	0.0063	0.0099	0.0067	26	5
-12-06 13:20	Field Duplicate of IG_MWB01_C_GW0006	7.07	27.4	<1.0	<1.0	1.10	1.12	-0.90	27.4	<0.0050	<0.10	1	0.033	<0.20	0.509	<0.033	-	0.103	0.218	0.0062	0.0103	0.0069	25.8	5
-04-05 15:45	Groundwater sample	6.49	25.1	<1.0	<1.0	0.77	0.82	-3.14	25.1	<0.0050	<0.10	0.87	0.036	<0.20	0.766	<0.0328	-	0.056	0.229	0.0076	0.0109	0.0084	13.7	5
-04-05 15:50	Field Duplicate of IG_MWB01_C_GW0008	6.38	25.9	<1.0	<1.0	0.76	0.83	-4.40	25.9	0.0096	<0.10	0.86	0.034	<0.20	0.762	<0.0328	-	0.088	0.26	0.0076	0.0107	0.0078	13.3	4
-06-25 13:30	Groundwater sample	8.16	265	<1.0	<1.0	8.23	6.56	11.3	265	0.023	0.11	9.02	0.647	<0.20	<0.089	<0.033	-	0.27	0.27	0.0115	0.723	<0.0300	46.9	2
-09-25 15:45	Groundwater sample	8.29	178	<1.0	<1.0	3.79	4.40	-7.45	178	0.0096	<0.10	7.38	0.66	<0.20	<0.0886	<0.0328	-	0.11	0.11	0.0101	0.396	0.0388	29.1	2
-04-06 11:30	Groundwater sample	8.00	172	<1.0	<1.0	3.62	4.50	-10.8 IB:INT	172	0.0066	<0.10	7.86	0.632	<0.20	<0.0886	<0.0328	-	0.095	0.095	0.0113	0.25	<0.0150	38.9	3
-06-24 14:20	Groundwater sample	7.77	152	<1.0	<1.0	7.38	7.12	1.79	152	0.018	0.14	19.2	0.395	<0.20	0.195	<0.033	-	<0.15	<0.152	0.0072	0.0162	0.0114	169	2
-09-28 12:05	Groundwater sample	8.12	162	<1.0	<1.0	8.05	8.72	-4.00	162	0.0105	0.26	28.2	0.378	<0.20	0.368	<0.0656 DLM	-	0.142	0.225	0.0092	0.0167	0.0147	224	3
-12-05 11:45	Groundwater sample	7.59	163	<1.0	<1.0	9.56	9.18	2.03	163	0.0067	0.28	30.3	0.378	<0.20	0.447	<0.066 DLM	-	0.121	0.222	0.0075	0.0179	0.0139	242	3
-04-04 11:25	Groundwater sample	7.61	170	<1.0	<1.0	8.60	9.22	-3.48	170	0.0747	<0.50 DLM	32.6	0.454	<0.20	0.323	<0.0328	-	<0.500	<0.500	0.0128	0.0211	0.0146	234	3
-06-24 10:50	Groundwater sample	7.53	208	<1.0	<1.0	11.9	12.4	-2.06	208	0.016	0.38	59	0.3	<0.20	1.24	<0.066 DLM	-	0.17	0.449	<0.0030	0.0356	0.0229	315	3
-09-28 10:10	Groundwater sample	8.10	435	<1.0	<1.0	23.7	25.4	-3.46	435	<0.0050	<2.00 DLM	125	0.568	<0.20	2.91	<0.656 DLM	-	0.296	0.952	0.0138	0.0521	0.0407	631	8
-12-05 10:15	Groundwater sample	7.31	296	<1.0	<1.0	18.9	17.6	3.56	296	<0.0050	0.61	84.3	0.361	<0.20	2.08	<0.164 DLM	-	0.216	0.686	0.0035	0.0434	0.0306	446	6
-12-06 0:00	Trip Blank	5.49	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	0.0092	<0.10	<0.50	<0.020	<0.20	<0.089	<0.033	-	<0.050	<0.055	<0.0030	<0.0020	<0.0030	<0.30	<
-04-04 9:55	Groundwater sample	7.38	270	<1.0	<1.0	14.1	13.7	1.44	270	0.0308	0.51	62.3	0.432	<0.20	1.49	<0.0656 DLM	-	0.178	0.515	0.0068	0.0399	0.0314	314	5
-04-06 0:00	Trip Blank	5.16	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	<0.0050	<0.10	<0.50	<0.020	<0.20	<0.0886	<0.0328	-	<0.050	<0.055	<0.0030	<0.0020	<0.0030	<0.30	<
-06-24 17:10	Groundwater sample	8.27	171	<1.0	<1.0	4.75	5.08	-3.36	171	0.034	0.19	19.8	0.98	<0.20	0.319	<0.033	-	<0.15	<0.152	0.0083	0.0161	0.0124	50.2	3
-06-24 0:00	Trip Blank	5.71	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	0.013	<0.10	<0.50	<0.020	<0.20	<0.089	<0.033	-	<0.15	<0.152	<0.0030	<0.0020	<0.0030	<0.30	<
-09-28 14:25	Groundwater sample	8.23	177	<1.0	<1.0	2.90	5.23	-28.6	177	0.015	0.4	12.2	0.395	<0.20	<0.0886	<0.0328	-	0.068	0.068	2.54	0.0101 RRV	2.53	63.8	2
-09-29 0:00	Trip Blank	5.35	<1.0	<1.0	<1.0	<0.10	<0.10	<0.01	<1.0	<0.0050	<0.10	<0.50	<0.020	0.27	<0.0886	<0.0328	-	<0.050	<0.055	<0.0030	<0.0020	<0.0030	<0.30	<
-12-05 14:05	Groundwater sample	7.99	143	<1.0	<1.0	3.05	3.13	-1.29	143	0.0083	<0.10	3.41	0.407	<0.20	<0.089	<0.033	-	0.058	0.058	0.0042	0.0111	0.0087	7.43	2
-04-04 13:55	Groundwater sample	7.95	147	<1.0	<1.0	2.83	3.15	-5.35	147	0.0431	<0.50 DLM	2.78	0.406	<0.20	<0.0886	<0.0328	-	0.074	0.074	0.0048	0.0108	0.0778	5.41	2

effects (e.g. chemical interference, colour, turbidity).
but initial testing was conducted within hold time.
terference or non-measured component.

litrate as N" is converted to "Nitrate as NO3" using the expression: Nitrate-NO3 = (Nitrate-N)*4.43. Nitrate molecule weighs 62 g/mole; the nitrogen content of nitrate is 22.5% of the total weight of the molecule.
trite as N" is converted to "Nitrite as NO2" using the expression: Nitrite-NO2 = (Nitrate-N)*3.28. Nitrite molecule weighs 46 g/mole; the nitrogen content of nitrite is 30.4% of the total weight of the molecule.

& Time Sampled (mm/yyyy hh:mm)	Comments	Aluminum (A	Antimony (S	Arsenic (As)	Barium (Ba)	Beryllium (B	Bismuth (Bi)	Boron (B) di	Cadmium (C	Calcium (Ca)	Cesium (Cs)	Chromium (	Cobalt (Co) c	Copper (Cu)	Iron (Fe) dis	Lead (Pb) dis	Lithium (Li) c	Magnesium	Manganese	Molybdenum diss.	Nickel (Ni) d
	Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Detection Limit:	0.001	0.0001	0.0001	0.0001	0.00002	0.00005	0.01	0.000005	0.05	0.00001	0.0005	0.0001	0.0002	0.01	0.00005	0.001	0.005	0.0001	0.00005	0.000
-06-22 13:30	Groundwater sample	0.367	<0.00010	0.00019	0.00274	0.000024	<0.000050	<0.010	0.0000149	3.6	0.000019	0.00067	<0.00010	0.00128	0.133	0.000191	0.0022	0.866	0.00824	0.000152	<0.0005
-09-27 12:15	Groundwater sample	0.0174	<0.00010	0.00011	0.00384	0.000023	<0.000050	0.01	0.0000317	6.74	<0.000010	0.00076	<0.00010	0.00323	0.032	<0.000050	0.0035	1.62	0.02	0.000416	0.0006
-12-04 11:00	Groundwater sample	0.0291	<0.00010	0.00015	0.00245	0.000025	<0.000050	0.014	0.0000197	4.36	<0.000010	<0.00050	<0.00010	0.00245	0.016	0.000104	0.0024	1.09	0.0125	0.000189	0.0007
-04-03 11:25	Groundwater sample	0.0262	<0.00010	0.00012	0.00206	<0.000020	<0.000050	<0.010	0.0000167	3.55	<0.000010	0.00056	<0.00010	0.00217	0.014	<0.000050	0.0018	0.878	0.00678	0.000158	<0.0005
-09-25 12:45	Field Blank	0.0034	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	<0.000050	<0.0005
-12-04 13:20	Field Blank	<0.0010	<0.00010	<0.00010	0.00011	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	0.0079	<0.00010	<0.000050	<0.0005
-04-03 13:20	Field Blank	<0.0010	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	0.00139	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	0.000181	0.0008
-06-22 16:45	Groundwater sample	0.0039	<0.00010	0.0061	0.00937	<0.000020	<0.000050	0.072	<0.0000050	60.3	<0.000010	<0.00050	0.00014	<0.00020	0.149	<0.000050	0.0379	6.66	0.394	0.0018	0.0008
-06-22 16:50	Field Duplicate of IG_MWA03_B_GW0003	0.0038	<0.00010	0.00618	0.00911	<0.000020	<0.000050	0.075	<0.0000050	61.1	<0.000010	<0.00050	0.00013	<0.00020	0.147	<0.000050	0.0407	6.69	0.386	0.00174	0.0008
-09-27 10:20	Groundwater sample	0.004	0.0001	0.00667	0.0102	0.000035	<0.000050	0.1	<0.0000050	64.2	<0.000010	0.0006	<0.00010	0.00024	0.056	<0.000050	0.0415	5.81	0.449	0.000798	0.0007
-12-04 15:25	Groundwater sample	0.0046	<0.00010	0.00675	0.00963	0.000023	<0.000050	0.102	<0.0000050	64.5	<0.000010	0.00066	<0.00010	0.00166	0.061	<0.000050	0.0442	7.71	0.453	0.000624	0.0009
-04-03 16:20	Groundwater sample	0.0047	<0.00010	0.00976	0.0115	0.000039	<0.000050	0.132	<0.0000050	94.4	<0.000010	0.0005	<0.00010	<0.00020	0.049	<0.000050	0.0636	8.39	0.63	0.000472	0.0011
-06-19 18:35	Groundwater sample	0.0317	<0.00010	0.00021	0.0121	0.000032	<0.000050	<0.010	<0.0000050	9.87	<0.000010	<0.00050	0.00022	0.00025	0.04	<0.000050	0.0014	0.977	0.0563	0.000086	0.0007
-06-20 13:20	Field Blank	<0.0010	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	<0.000050	<0.0005
-09-25 17:35	Groundwater sample	0.0446	<0.00010	0.0001	0.0254	0.000084	<0.000050	<0.010	0.0000128	18	<0.000010	<0.00050	0.00029	0.00054	0.04	<0.000050	0.0026	1.96	0.0625	0.000056	0.0005
-09-25 17:40	Field Duplicate of IG_MWB01_C_GW0004	0.0452	<0.00010	0.00167	0.0255	0.000095	<0.000050	<0.010	0.0000122	20.5	<0.000010	<0.00050	0.00029	0.00078	0.04	<0.000050	0.0028	1.95	0.0626	0.000088	0.0005
-12-06 13:15	Groundwater sample	0.0398	<0.00010	0.00022	0.0215	0.000066	<0.000050	<0.010	0.0000099	15.7	<0.000010	<0.00050	0.0003	0.001	0.05	<0.000050	0.0027	1.54	0.0711	0.000157	0.0014
-12-06 13:20	Field Duplicate of IG_MWB01_C_GW0006	0.0399	<0.00010	0.00022	0.0216	0.000063	<0.000050	<0.010	0.0000112	15.3	<0.000010	<0.00050	0.00031	0.00432	0.074	0.000091	0.0026	1.51	0.0701	0.000187	0.0013
-04-05 15:45	Groundwater sample	0.0352	<0.00010	0.00022	0.019	0.000055	<0.000050	<0.010	0.0000114	11.1	<0.000010	<0.00050	0.00022	0.00181	0.031	<0.000050	0.0017	1.05	0.0489	0.000074	0.0006
-04-05 15:50	Field Duplicate of IG_MWB01_C_GW0008	0.0368	<0.00010	0.00021	0.0179	0.000061	<0.000050	<0.010	0.0000122	11.1	<0.000010	<0.00050	0.00022	0.0005	0.027	<0.000050	0.0016	1.03	0.0475	<0.000050	<0.0005
-06-25 13:30	Groundwater sample	2.11	<0.00010	0.00104	0.0891	0.00167	<0.000050	0.078	0.000161	82.2	0.000296	<0.00050	0.00114	0.00213	1.27	0.0134	0.0408	3.92	0.579	0.00268	0.0010
-09-25 15:45	Groundwater sample	0.698	<0.00010	0.00055	0.0527	0.000066	<0.000050	0.066	0.0000071	25.6	0.000066	<0.00050	0.00017	0.00071	0.205	0.000596	0.0362	3.26	0.236	0.00438	<0.0005
-04-06 11:30	Groundwater sample	<0.0010	<0.00010	0.00046	0.0279	<0.000020	<0.000050	0.06	<0.0000050	18.1	<0.000010	<0.00050	<0.00010	0.00032	0.07	<0.000050	0.0344	2.05	0.235	0.00483	<0.0005
-06-24 14:20	Groundwater sample	0.0022	<0.00010	0.00031	0.00571	0.00003	<0.000050	0.168	<0.0000050	22.7	<0.000010	<0.00050	0.00014	<0.00020	0.575	<0.000050	0.0228	2.17	0.173	0.00103	<0.0005
-09-28 12:05	Groundwater sample	0.0022	<0.00010	0.00049	0.00591	0.000029	<0.000050	0.149	<0.0000050	26	<0.000010	<0.00050	<0.00010	0.00036	0.573	<0.000050	0.0239	1.94	0.232	0.000974	<0.0005
-12-05 11:45	Groundwater sample	0.0023	<0.00010	0.00056	0.00559	0.000028	<0.000050	0.182	<0.0000050	28.3	<0.000010	<0.00050	<0.00010	0.00069	0.653	<0.000050	0.0266	2.39	0.26	0.00108	<0.0005
-04-04 11:25	Groundwater sample	0.0017	<0.00010	0.00069	0.00548	0.000028	<0.000050	0.153	<0.0000050	26	<0.000010	<0.00050	<0.00010	0.00037	0.481	<0.000050	0.0254	2.15	0.25	0.00113	<0.0005
-06-24 10:50	Groundwater sample	0.0021	<0.00010	0.00099	0.0167	0.000038	<0.000050	0.074	<0.0000050	70.2	<0.000010	<0.00050	0.00041	<0.00020	1.34	<0.000050	0.032	16.5	0.422	0.000774	<0.0005
-09-28 10:10	Groundwater sample	0.0024	<0.00010	0.00212	0.035	0.000054	<0.000050	0.117	<0.0000050	117	<0.000010	<0.00050	0.00042	<0.00020	1.73	<0.000050	0.0413	25.6	0.827	0.000316	0.0006
-12-05 10:15	Groundwater sample	0.0027	<0.00010	0.00167	0.0274	0.000052	<0.000050	0.1	<0.0000050	89.6	<0.000010	<0.00050	0.00044	0.00185	2.27	<0.000050	0.0381	22.7	0.686	0.000314	0.0005
-12-06 0:00	Trip Blank	<0.0010	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	<0.000050	<0.0005
-04-04 9:55	Groundwater sample	0.0012	<0.00010	0.00107	0.0211	0.00004	<0.000050	0.074	<0.0000050	69.6	<0.000010	<0.00050	0.00028	<0.00020	1.47	<0.000050	0.0345	17.7	0.441	0.00034	<0.0005
-04-06 0:00	Trip Blank	<0.0010	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	<0.000050	<0.0005
-06-24 17:10	Groundwater sample	0.008	<0.00010	0.00042	0.0207	<0.000020	<0.000050	0.153	<0.0000050	22.4	<0.000010	<0.00050	<0.00010	<0.00020	0.122	<0.000050	0.0215	2.44	0.233	0.00382	0.0013
-06-24 0:00	Trip Blank	<0.0010	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	0.018	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	<0.000050	<0.0005
-09-28 14:25	Groundwater sample	0.0032	<0.00010	0.00026	0.0231	<0.000020	<0.000050	0.042	<0.0000050	25.5	<0.000010	<0.00050	<0.00010	0.00096	0.162	<0.000050	0.0246	5.81	0.218	0.00128	<0.0005
-09-29 0:00	Trip Blank	<0.0010	<0.00010	<0.00010	<0.00010	<0.000020	<0.000050	<0.010	<0.0000050	<0.050	<0.000010	<0.00050	<0.00010	<0.00020	<0.010	<0.000050	<0.0010	<0.0050	<0.00010	<0.000050	<0.0005
-12-05 14:05	Groundwater sample	0.0036	<0.00010	0.00024	0.0215	<0.000020	<0.000050	0.042	<0.0000050	26.3	<0.000010	<0.00050	<0.00010	0.0017	0.188	<0.000050	0.025	6.58	0.221	0.00129	<0.0005
-04-04 13:55	Groundwater sample	0.0027	<0.00010	0.00026	0.0237	<0.000020	<0.000050	0.039	<0.0000050	25.6	<0.000010	<0.00050	<0.00010	0.00101	0.152	<0.000050	0.0256	5.98	0.205	0.00122	<0.0005

effects (e.g. chemical interference, colour, turbidity).
but initial testing was conducted within hold time.
terference or non-measured component.

litrate as N" is converted to "Nitrate as NO3" using the expression: Nitrate-NO3 = (Nitrate-N)*4.43. Nitrate molecule weighs 62 g/mole; the nitrogen content of nitrate is 22.5% of the total weight of the molecule.
trite as N" is converted to "Nitrite as NO2" using the expression: N Nitrite-NO2 = (Nitrate-N)*3.28. Nitrite molecule weighs 46 g/mole; the nitrogen content of nitrite is 30.4% of the total weight of the molecule.

& Time Sampled mm/yyyy hh:mm)	Comments	Ruthenium (	Selenium (Se	Silicon (Si) d	Silver (Ag) d	Sodium (Na)	Strontium (S	Sulfur (S) dis	Tellurium (T	Thallium (Tl	Thorium (Th	Tin (Sn) diss	Titanium (Ti	Tungsten (W	Uranium (U)	Vanadium (V	Zinc (Zn) dis	Zirconium (Z
	Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Detection Limit:	0.000005	0.00005	0.05	0.00001	0.05	0.0002	0.5	0.0002	0.00001	0.0001	0.0001	0.0003	0.0001	0.00001	0.0005	0.001	0.0003
-06-22 13:30	Groundwater sample	<0.0000050	0.000177	5.55	<0.000010	3.78	0.0218	1.26	<0.00020	<0.000010	<0.00010	<0.00010	0.00502	<0.00010	0.000378	<0.00050	0.0035	0.00039
-09-27 12:15	Groundwater sample	-	0.000195	6.07	<0.000010	5.73	0.0367	1.28	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00036	0.000487	<0.00050	0.008	<0.00030
-12-04 11:00	Groundwater sample	-	0.000238	5.52	<0.000010	4.18	0.0265	1.34	0.00028	<0.000010	<0.00010	<0.00010	0.00059	<0.00010	0.000312	<0.00050	0.0058	<0.00030
-04-03 11:25	Groundwater sample	-	0.000166	5.14	<0.000010	3.56	0.0203	1.16	<0.00020	<0.000010	<0.00010	<0.00010	0.00084	<0.00010	0.000241	<0.00050	0.0037	<0.00030
-09-25 12:45	Field Blank	-	<0.000050	<0.050	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-12-04 13:20	Field Blank	-	<0.000050	<0.050	<0.000010	0.127	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	0.00026	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-04-03 13:20	Field Blank	-	<0.000050	<0.050	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-06-22 16:45	Groundwater sample	<0.0000250 DLA	0.000782	7.8	<0.000010	293	0.675	184	<0.00020	<0.000010	<0.00010	<0.00010	0.00063	0.00011	0.0292	0.0019	<0.0010	0.00102
-06-22 16:50	Field Duplicate of IG_MWA03_B_GW0003	<0.0000250 DLA	0.00088	7.79	<0.000010	293	0.678	183	<0.00020	<0.000010	<0.00010	<0.00010	0.00052	<0.00010	0.0295	0.00186	<0.0010	0.00106
-09-27 10:20	Groundwater sample	-	0.00062	7.62	<0.000010	432	0.835	251	0.00042	<0.000010	<0.00010	<0.00010	0.00061	0.00032	0.0208	0.00276	<0.0010	0.00196
-12-04 15:25	Groundwater sample	-	0.00103	8.76	<0.000010	447	0.853	243	<0.00020	<0.000010	<0.00010	<0.00010	0.00078	0.00022	0.0253	0.00275	<0.0010	0.00189
-04-03 16:20	Groundwater sample	-	0.000934	9.81	<0.000010	517	1.12	304	<0.00020	<0.000010	<0.00010	<0.00010	0.00122	0.00017	0.022	0.0042	0.001	0.00314
-06-19 18:35	Groundwater sample	<0.0000050	0.000087	5.8	<0.000010	2.57	0.052	2.1	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.000868	<0.00050	<0.0010	<0.00030
-06-20 13:20	Field Blank	<0.0000050	<0.000050	<0.050	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-09-25 17:35	Groundwater sample	-	0.000091	6.99	<0.000010	4.66	0.0798	10.1	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.000693	<0.00050	<0.0010	<0.00030
-09-25 17:40	Field Duplicate of IG_MWB01_C_GW0004	-	0.000081	6.89	<0.000010	4.54	0.0765	10.2	<0.00020	0.00001	<0.00010	<0.00010	<0.00030	<0.00010	0.000662	<0.00050	<0.0010	<0.00030
-12-06 13:15	Groundwater sample	-	0.000071	6.36	<0.000010	4.35	0.0853	8.41	<0.00020	0.000012	<0.00010	<0.00010	<0.00030	<0.00010	0.00071	<0.00050	0.0028	<0.00030
-12-06 13:20	Field Duplicate of IG_MWB01_C_GW0006	-	0.0001	6.33	<0.000010	4.35	0.0795	8.57	<0.00020	0.000012	<0.00010	<0.00010	<0.00030	<0.00010	0.000702	<0.00050	0.0055	<0.00030
-04-05 15:45	Groundwater sample	-	0.000092	5.29	<0.000010	2.48	0.0616	4.66	<0.00020	0.000013	<0.00010	<0.00010	<0.00030	<0.00010	0.00058	<0.00050	0.0016	<0.00030
-04-05 15:50	Field Duplicate of IG_MWB01_C_GW0008	-	0.000078	5.14	<0.000010	2.37	0.0585	4.33	<0.00020	0.000014	<0.00010	<0.00010	<0.00030	<0.00010	0.000615	<0.00050	0.0013	<0.00030
-06-25 13:30	Groundwater sample	<0.0000250 DLA	<0.000050	12.6	<0.000010	79	1.41	19	<0.00020	0.000067	0.00362	<0.00010	0.0118	<0.00010	0.0231	0.0036	0.0165	0.0014
-09-25 15:45	Groundwater sample	-	<0.000050	8.85	<0.000010	48.2	0.94	9.7	<0.00020	<0.000010	0.00067	<0.00010	0.0149	0.00018	0.0186	0.00064	0.0019	0.00095
-04-06 11:30	Groundwater sample	-	<0.000050	6.57	<0.000010	57.1	0.764	12.7	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00018	0.0176	<0.00050	0.0012	<0.00030
-06-24 14:20	Groundwater sample	<0.0000100 DLA	0.00008	6.6	<0.000010	138	0.255	59.7	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.00554	<0.00050	0.0027	<0.00030
-09-28 12:05	Groundwater sample	-	0.000055	5.89	<0.000010	150	0.331	78	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.00786	<0.00050	<0.0010	<0.00030
-12-05 11:45	Groundwater sample	-	0.000102	6.57	<0.000010	181	0.347	95.3	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.00998	<0.00050	0.001	<0.00030
-04-04 11:25	Groundwater sample	-	0.000115	6.15	<0.000010	162	0.325	84.9	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.00832	<0.00050	0.0025	<0.00030
-06-24 10:50	Groundwater sample	<0.0000100 DLA	0.000173	9.27	<0.000010	160	0.743	100	0.00033	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.0113	<0.00050	<0.0010	<0.00030
-09-28 10:10	Groundwater sample	-	0.000181	8.51	<0.000010	358	1.51	227	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.051	0.00056	<0.0010	0.00089
-12-05 10:15	Groundwater sample	-	0.000147	9.78	<0.000010	285	1.09	191	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.0287	<0.00050	0.0016	0.00046
-12-06 0:00	Trip Blank	-	<0.000050	<0.050	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-04-04 9:55	Groundwater sample	-	0.000108	9.32	<0.000010	207	0.829	123	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.017	<0.00050	0.001	<0.00030
-04-06 0:00	Trip Blank	-	<0.000050	<0.050	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-06-24 17:10	Groundwater sample	<0.0000050	<0.000050	6.42	<0.000010	77.8	0.297	15.4	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00012	0.00965	<0.00050	<0.0010	<0.00030
-06-24 0:00	Trip Blank	<0.0000050	<0.000050	0.118	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-09-28 14:25	Groundwater sample	-	<0.000050	7	<0.000010	25.1	0.267	2.93	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.00927	<0.00050	<0.0010	<0.00030
-09-29 0:00	Trip Blank	-	<0.000050	<0.050	<0.000010	<0.050	<0.00020	<0.50	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	<0.000010	<0.00050	<0.0010	<0.00030
-12-05 14:05	Groundwater sample	-	<0.000050	7.59	<0.000010	26.2	0.256	2.68	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.0106	<0.00050	0.0013	<0.00030
-04-04 13:55	Groundwater sample	-	0.000485	7.29	<0.000010	23.1	0.251	1.95	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00013	0.00976	<0.00050	0.0014	<0.00030

effects (e.g. chemical interference, colour, turbidity).
but initial testing was conducted within hold time.
terference or non-measured component.

Nitrate as N" is converted to "Nitrate as NO3" using the expression: Nitrate-NO3 = (Nitrate-N)*4.43. Nitrate molecule weighs 62 g/mole; the nitrogen content of nitrate is 22.5% of the total weight of the molecule.
trite as N" is converted to "Nitrite as NO2" using the expression: Nitrite-NO2 = (Nitrate-N)*3.28. Nitrite molecule weighs 46 g/mole; the nitrogen content of nitrite is 30.4% of the total weight of the molecule.

APPENDIX C-2

2023 General Chemistry of Low Confidence Samples

& Time Sampled mm/yyyy hh:mm)	Comments	pH-Lab	Alkalinity-Bi as CaCO3	Alkalinity-Ca CaCO3	Alkalinity-Hy CaCO3	Cations Tota	Anions Tota	Cation - Anio	Alkalinity-To CaCO3	Total Ammo (NH4+NH3)	Bromide (Br	Chloride (Cl)	Fluoride (F)
Units:		units	mg/L	mg/L	mg/L	mEq/L	mEq/L	%	mg/L	mg/L	mg/L	mg/L	mg/L
Detection Limit:		-	1.0	1.0	1.0	0.10	0.10	0.01	1.0	0.005	0.1	0.5	0.02
-06-20 13:08	Groundwater sample	8.18	422	<1.0	<1.0	22.5	22.5	<0.01	422	0.055	1.57	204	0.874
-09-27 15:10	Groundwater sample	8.44	442	19.8	<1.0	18.2	20.2	-5.21	462	0.0748	1.32	156	0.704
-12-04 12:55	Groundwater sample	8.08	445	<1.0	<1.0	19.8	19.0	2.06	445	<0.0050	0.98	141	0.623
-04-03 13:28	Groundwater sample	8.09	464	<1.0	<1.0	20.6	18.6	5.10	464	<0.0050	1.16	130	0.754

& Time Sampled mm/yyyy hh:mm)	Iodide (I)	Nitrate as N	Nitrite as NO	Nitrate + Ni	Total Kjelda	Total Nitrog	Orthophosp	Total Phosp (Ptot)	Total Reacti Phosphorus	Sulfate (SO4	Dissolved I
Units:	mg/L	mg/L	mg/L	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	m
Detection Limit:	0.2	0.089	0.033	-	0.050	0.055	0.0030	0.0020	0.0030	0.30	0
-06-20 13:08	<0.20	3.67	<0.328 DLM	-	0.51	1.34	0.0443	0.17	0.0872	393	7
-09-27 15:10	<0.20	2.97	<0.328 DLM	-	0.383	1.05	0.0181	0.139	0.133	314	8
-12-04 12:55	<0.20	2.82	<0.164 DLM	-	0.308	0.945	0.015	0.14	0.0787	290	8
-04-03 13:28	<0.20	2.73	<0.0656 DLM	-	0.292	0.908	0.0098	0.144	0.0313	268	9

effects (e.g. chemical interference, colour, turbidity).
but initial testing was conducted within hold time.
terference or non-measured component.

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trite as N" is converted to "Nitrite as NO2" using the expression: Nitrite-NO2 = (Nitrate-N)*3.28. Nitrite molecule weighs 46 g/mole; the nitrogen content of nitrite is 30.4% of the total weight of the molecule.

& Time Sampled mm/yyyy hh:mm)	Comments	Aluminum (A	Antimony (S	Arsenic (As)	Barium (Ba)	Beryllium (B	Bismuth (Bi)	Boron (B) di	Cadmium (C	Calcium (Ca)	Cesium (Cs)
Units:		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Detection Limit:		0.001	0.0001	0.0001	0.0001	0.00002	0.00005	0.01	0.000005	0.05	0.00001
-06-20 13:08	Groundwater sample	0.0021	<0.00010	0.0102	0.122	<0.000020	<0.000050	0.083	<0.0000050	50.8	<0.000010
-09-27 15:10	Groundwater sample	0.0068	<0.00010	0.0104	0.103	0.000024	<0.000050	0.093	<0.0000050	43.2	<0.000010
-12-04 12:55	Groundwater sample	0.0022	<0.00010	0.0132	0.102	0.000023	<0.000050	0.095	<0.0000050	45.2	<0.000010
-04-03 13:28	Groundwater sample	0.0032	<0.00010	0.0124	0.0984	0.00002	<0.000050	0.091	<0.0000050	47.2	<0.000010

& Time Sampled mm/yyyy hh:mm)	Chromium (	Cobalt (Co) (	Copper (Cu)	Iron (Fe) diss	Lead (Pb) dis	Lithium (Li) (	Magnesium	Manganese	Molybdenum diss.	Nickel (Ni) d
Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Detection Limit:	0.0005	0.0001	0.0002	0.01	0.00005	0.001	0.005	0.0001	0.00005	0.0005
-06-20 13:08	<0.00050	0.00041	<0.00020	0.432	<0.000050	0.0295	9.48	2.39	0.00269	0.0014
-09-27 15:10	<0.00050	0.00031	0.00021	0.901	<0.000050	0.0331	6.14	2.08	0.00154	0.0010
-12-04 12:55	<0.00050	0.00029	<0.00020	1.3	<0.000050	0.0329	6.99	2.29	0.00122	0.0009
-04-03 13:28	<0.00050	0.0004	0.00074	1.67	<0.000050	0.0373	7.09	2.39	0.00148	0.0021

effects (e.g. chemical interference, colour, turbidity).
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terference or non-measured component.

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& Time Sampled mm/yyyy hh:mm)	Comments	Ruthenium (	Selenium (Se	Silicon (Si) d	Silver (Ag) d	Sodium (Na)	Strontium (S	Sulfur (S) dis	Tellurium (T	Thallium (Tl	Thorium (Th	Tin (Sn) diss	Titanium (Ti	Tungsten (W	Uranium (U)	Vanadium (V	Zinc (Zn) dis	Zirconium (Z
	Units:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Detection Limit:	0.000005	0.00005	0.05	0.00001	0.05	0.0002	0.5	0.0002	0.00001	0.0001	0.0001	0.0003	0.0001	0.00001	0.0005	0.001	0.0003
-06-20 13:08	Groundwater sample	<0.0000250 DLA	0.000156	12.2	<0.000010	436	0.774	137	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.00856	<0.00050	<0.0010	0.00034
-09-27 15:10	Groundwater sample	-	0.000218	12.3	<0.000010	353	0.961	110	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.0102	<0.00050	0.0013	0.00046
-12-04 12:55	Groundwater sample	-	0.000266	15.1	<0.000010	386	0.871	121	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	<0.00010	0.0119	<0.00050	<0.0010	0.00038
-04-03 13:28	Groundwater sample	-	0.000231	14.5	<0.000010	400	0.859	109	<0.00020	<0.000010	<0.00010	<0.00010	<0.00030	0.00019	0.00999	<0.00050	0.0025	0.00034

effects (e.g. chemical interference, colour, turbidity).
but initial testing was conducted within hold time.
terference or non-measured component.

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