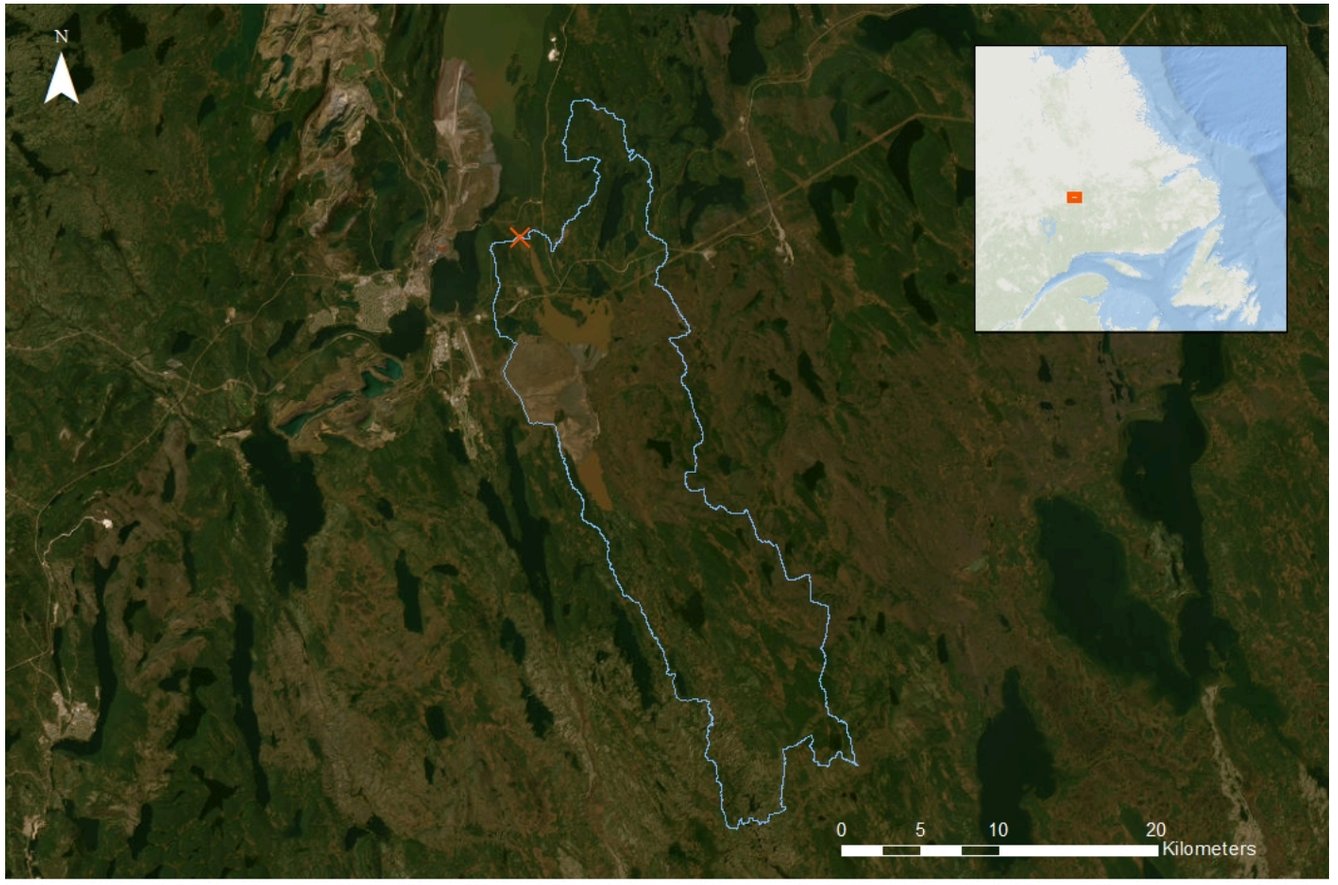
# Real Time Water Quality Deployment Report
# Flora Creek below Trans Labrador Highway
# NF03OA0022

2024-07-25 to 2024-09-18

Government of Newfoundland & Labrador
Department of Environment & Climate Change
Water Resources Management Division

# Flora Creek below Trans Labrador Highway




Tacora Resources - Flora Creek below Trans-Labrador Highway
NF03OA0022

The Water Resources Management Division (WRMD), in partnership with Tacora Resources Inc. and Environment and Climate Change Canada (ECCC), maintains a real-time water quality and water quantity monitoring station at Flora Creek, downstream of the mine's tailings disposal area in Flora Lake. The real-time station allows for assessment and management of the water body. The purpose of this real-time station is to monitor, process, and publish hydrometric (water quantity) and real-time water quality data at the station.
The watershed is outlined in the figure to the left in light blue.

On July 25th, 2024, a clean and calibrated real-time water quality monitoring instrument was deployed at the station Flora Creek below TLH.
The instrument was deployed for a period of 55 days and was removed on September 18th, 2024.
This was the first deployment for 2024.

# Quality Assurance and Quality Control

As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey. Water Survey Canada operates the hydrometric component of this station. Due to differences in protocols, Water Survey Canada hydrometric data is quality controlled on a less frequent basis than water quality data. The hydrometric data shown in this report is provisional and has not undergone quality control checks. Corrected hydrometric data can be obtained at https://wateroffice.ec.gc.ca/ or upon request to Water Survey Canada.

| Parameter | Excellent | Good | Fair | Marginal | Poor |
|---|---|---|---|---|---|
| Dissolved oxygen | ≤ ± 0.3 mg/L | ≤ ± 0.31 -0.5 mg/L | ≤ ± 0.51 - 0.8 mg/L | ≤ ± 0.81 - 1 mg/L | > ± 1 mg/L |
| pH | ≤ ± 0.2 units | ≤ ± 0.21 - 0.5 units | ≤ ± 0.51 - 0.8 units | ≤ ± 0.81 - 1 units | > ± 1 units |
| Specific Conductance | ≤ ± 3 µS/cm or ≤ ± 3%, whichever is greater | ≤ ± 3.1-10 µS/cm or ≤ ± 3.1-10%, whichever is greater | ≤ ± 10 - 15 µS/cm or ≤ ± 10.1-15 %, whichever is greater | ≤ ± 15.1 - 20 µS/cm or ≤ ± 15.1-20 %, whichever is greater | > ± 20 µS/cm or > ± 20 %, whichever is greater |
| Turbidity | ≤ ± 2 turbidity units or ≤ ± 5%, whichever is greater | ≤ ± 2.1-5 turbidity units or ≤ ± 5.1-10 %, whichever is greater | ≤ ± 5.1-8 turbidity units or ≤ ± 10.1-15 %, whichever is greater | ≤ ± 8.1-10 turbidity units or ≤ ± 15.1-20 %, whichever is greater | > ± 10 turbidity units or > ± 20 %, whichever is greater |
| Water Temperature | ≤ ± 0.2°C | ≤ ± 0.21 - 0.5°C | ≤ ± 0.51 - 0.8°C | ≤ ± 0.81 - 1°C | > ± 1°C |

At deployment and removal, a QA/QC Sonde is temporarily deployed adjacent to the Field Sonde. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments**.** Based on the degree of difference between parameters recorded by the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality.

There are a few circumstances which may cause QA/QC rankings below excellent, including the placement of the QA/QC sonde in relation to the field sonde, the amount of time each sonde was given to stabilize before readings were recorded, and deteriorating performance of one of the sensors.

The temperature sensor on any sonde is the most important.  All other parameters can be divided into subgroups of: temperature dependent, temperature compensated, and temperature independent. Due to the temperature sensor's location on the sonde, the entire sonde must be at a constant temperature before the temperature sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

## QAQC Rankings

| Parameter | Deployment Ranks | Removal Ranks | Grab Sample Ranks |
|---|---|---|---|
| Dissolved Oxygen (mg/l) | Good | Excellent | |
| pH | Excellent | Good | Excellent |
| Specific Conductivity (µS/cm) | Excellent | Excellent | Excellent |
| Temperature ('C) | Good | Excellent | |
| Turbidity (NTU) | Excellent | Excellent | Poor |

At deployment and removal, when compared to the QA/QC sonde, all parameters ranked either 'good' or  'excellent'.

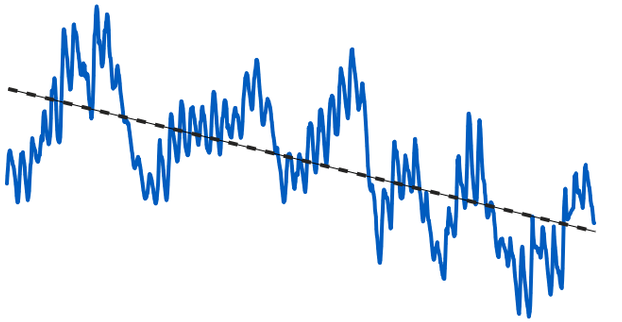
# Water Temperature

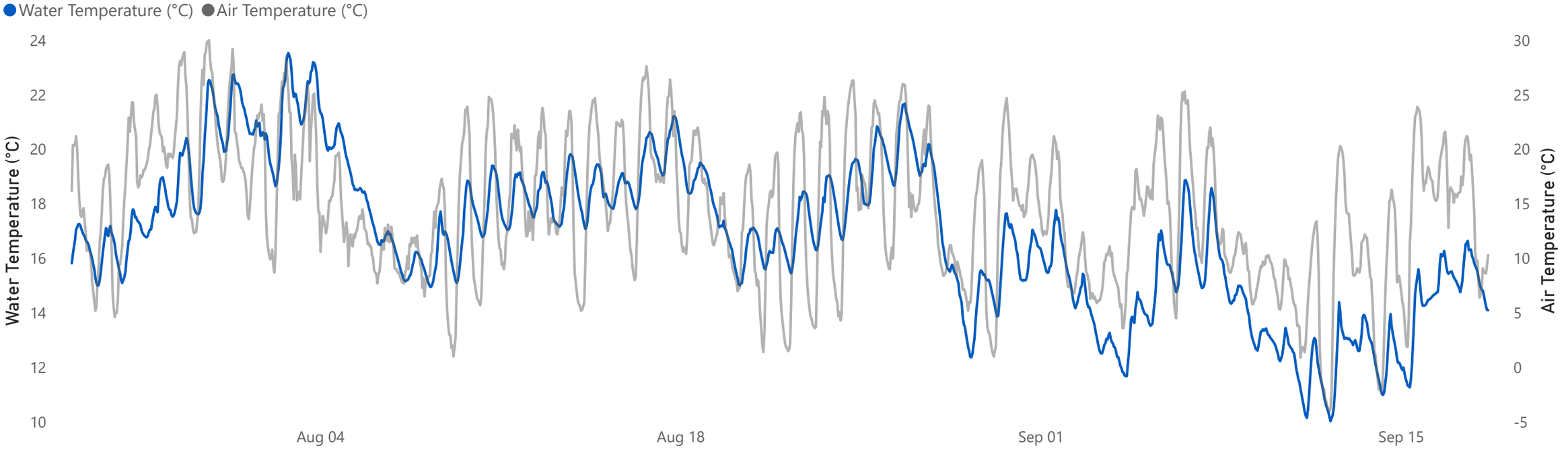
| 16.83 | 16.90 | 10.03 | 23.53 |
|---|---|---|---|
| Average (°C) | Median (°C) | Minimum (°C) | Maximum (°C) |

Water temperature is an important parameter for wildlife. Many organisms cannot regulate their own temperatures, and rely on surrounding air and water temperatures. Water temperature may be affected by inputs from industry or by modifying natural conditions like clearing trees and other vegetation, which eliminates the canopy protection they offer. Water temperature also affects other parameters monitored including dissolved oxygen and specific conductivity.

Water temperature data for this deployment was collected from 2024-07-25 until 2024-09-18. The minimum water temperature, 10.03°C, occurred on 2024-09-12. The maximum water temperature, 23.53°C, occurred on 2024-08-02. Water temperature usually falls overnight and rises during the day. Water temperature declined during this deployment period, as air temperature cooled into the fall.

## Water Temperature Trendline



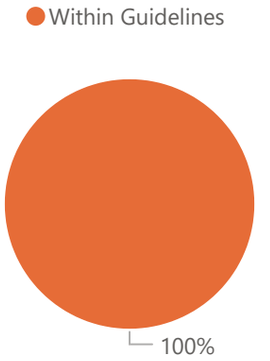


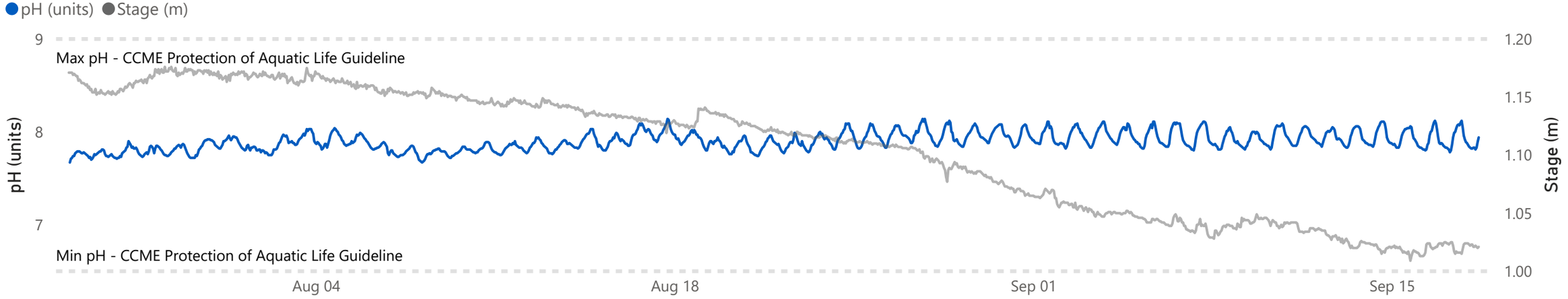
# pH

| 7.90 | 7.88 | 7.67 | 8.14 |
|---|---|---|---|
| Average pH | Median pH | Minimum pH | Maximum pH |

pH relates to the free hydrogen ions in water and it is a measure of acidity in water. A pH of 7 indicates a neutral pH, below 7 is considered acidic, and above 7 is considered basic. The Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life guideline provides a basis by which to judge the overall health of the brook. Their freshwater guidelines recommend a minimum pH of 6.5 and a maximum pH of 9.0; however, many rivers in Newfoundland and Labrador are naturally more acidic due to the local geology. Water parameter maps can be found on the Water Resources Management website.

pH data for this deployment was collected from 2024-07-25 until 2024-09-18. The minimum pH, 7.67 pH units, occurred on 2024-07-25. The maximum pH, 8.14 pH units, occurred on 2024-08-17. Daily fluctuations are common due to changes in temperature and photosynthesizing of aquatic plants. pH was stable throughout this deployment period. All values during the deployment are within the CCME guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units).




## Climate data from Moosehead Lake

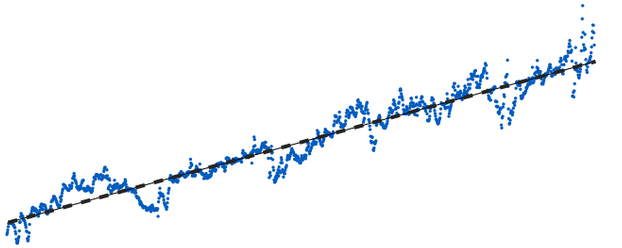
# Specific Conductivity

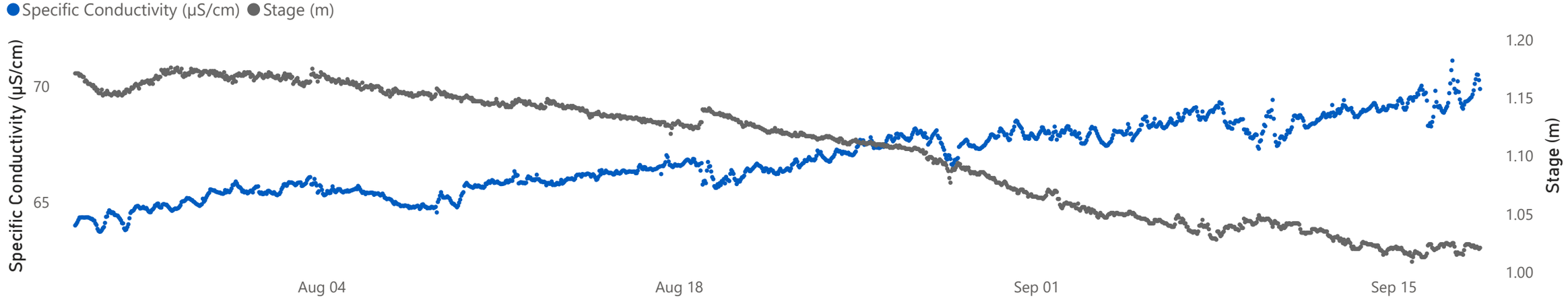
| 66.88 | 66.65 | 63.74 | 71.10 |
|---|---|---|---|
| Average µS/cm | Median µS/cm | Minumum µS/cm | Maximum µS/cm |

Conductivity relates to the ability of an electric charge to pass through a solution. Pure water has low conductance and water with dissolved ions has higher conductance. Specific conductance is corrected to 25°C to allow comparison across temperatures. Water parameter maps can be found on the Water Resources Management website.

Specific conductance data for this deployment was collected from 2024-07-25 until 2024-09-18. The minimum specific conductance, 63.74 µS/cm, occurred on 2024-07-26. The maximum specific conductance, 71.10 µS/cm, occurred on 2024-09-17. Precipitation and specific conductivity are correlated. During a precipitation event, the amount of water in the creek increases, this dilutes the solids that are present, decreasing the conductivity. Specific conductivity increased during this deployment period, with some decreases noted during precipitation events.

## Specific Conductivity Trendline





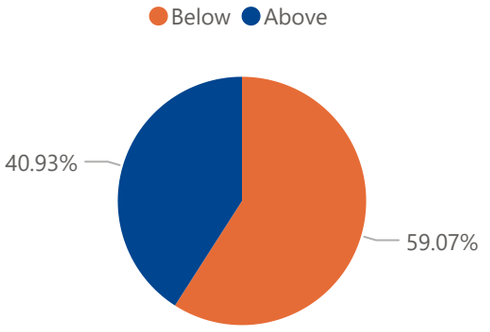

# Dissolved Oxygen Concentration and Saturation

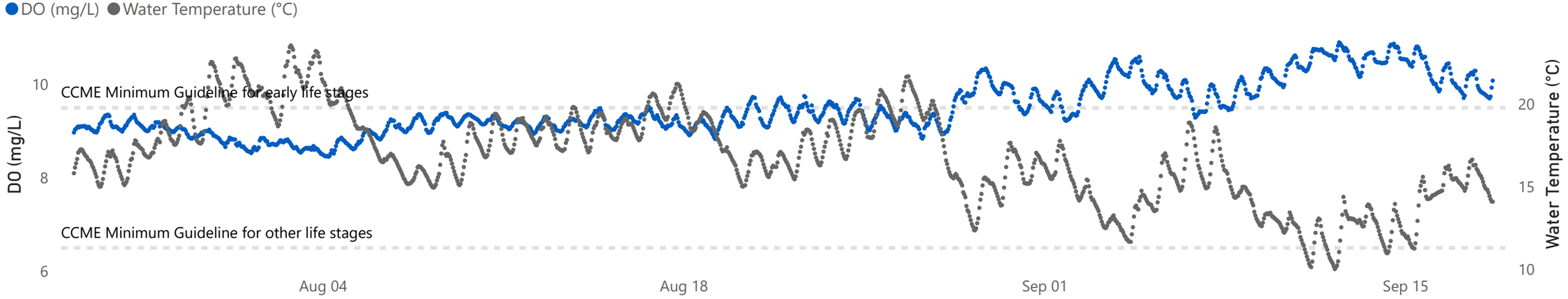
| 9.48 | 9.32 | 8.45 | 10.90 |
|---|---|---|---|
| Average (mg/L) | Median (mg/L) | Minimum (mg/L) | Maximum (mg/L) |

Dissolved oxygen (DO) in water is crucial for aquatic life. The CCME (Canadian Council of Ministers of the Environment) Freshwater Aquatic Life guidelines provide a basis by which to judge the overall health of waterways. The minimum guideline for early life stages in cold water is 9.5 mg/L and the minimum guideline for other life stages is 6.5 mg/L. DO and water temperatures are correlated; colder waters can hold higher concentrations of DO than warm waters.

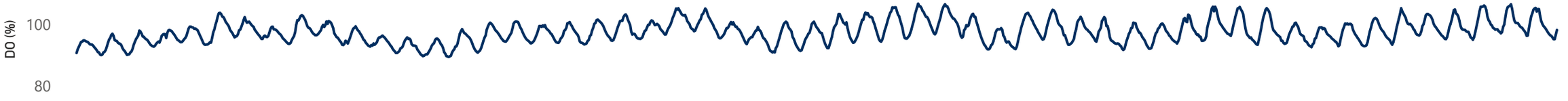
DO data for this deployment was collected from 2024-07-25 until 2024-09-18. The minimum DO reading, 8.45 mg/L, occurred on 2024-08-04. The maximum DO reading, 10.90 mg/L, occurred on 2024-09-12. Dissolved oxygen content fluctuates diurnally and displays an inverse relationship to water temperature. Dissolved oxygen increased slightly over the course of the deployment period, as is expected with cooling temperatures into Fall. During this deployment period, DO levels were below the minimum Guidelines for the Protection of Early Life Stages for Cold Water Biota 59.07% of the time and above the minimum guidelines for 40.93% of the time. However, DO levels were above the minimum CCME Guideline for the Protection of Other Life Stages for Cold Water Biota 100% of the time.

## CCME Early Life Stages




## Percent Saturation (%)



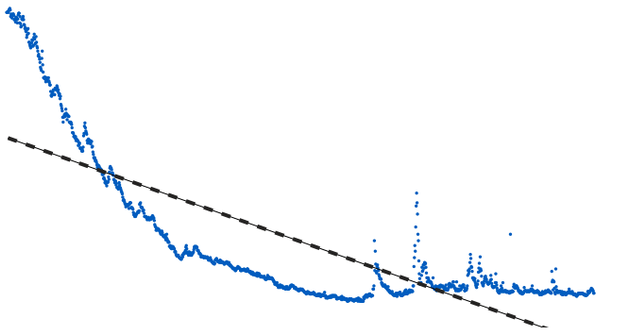
# Turbidity

| 10.34 | 5.80 | 3.00 | 39.30 |
|---|---|---|---|
| Average (NTU) | Median (NTU) | Minimum (NTU) | Maximum (NTU) |

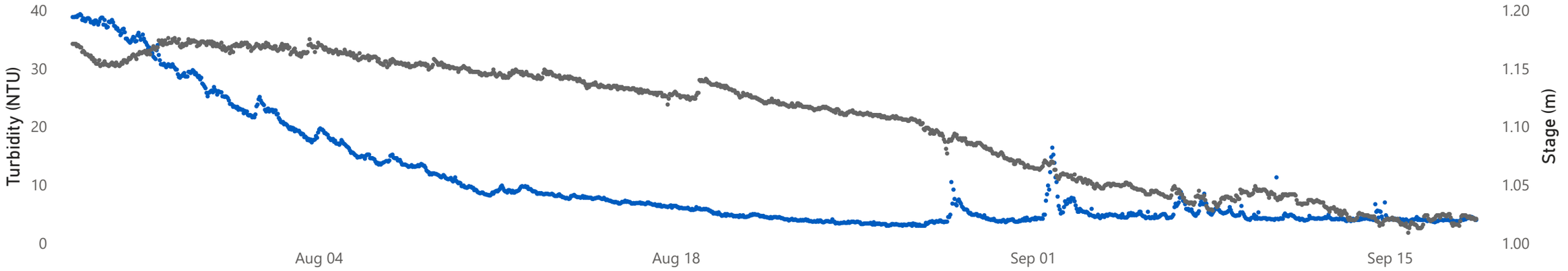
Increases in turbidity (cloudiness) are often caused by increased runoff during precipitation events. Runoff carries silt and other debris into the waterbody. Turbid conditions can prevent light from reaching plants, negatively impact benthic habitats, and clog or damage fish gills and equipment.

Turbidity data for this deployment was collected from 2024-07-25 until 2024-09-18. The minimum turbidity was 3.00 NTUs. The maximum turbidity, 39.30 NTUs, occurred on7/25/2024. Turbidity values decreased during this deployment period. Turbidity spikes occurred infrequently, for short periods of time, and generally corresponded with precipitation events.

## Turbidity Trendline



Turbidity (NTU) Stage (m)



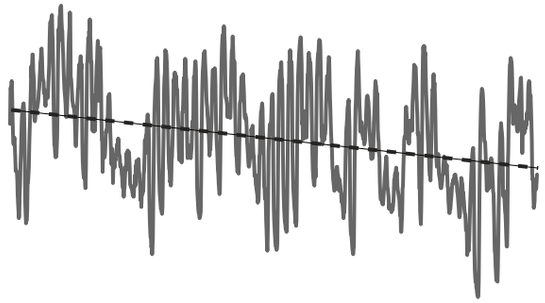

## Climate data from Moosehead Lake

Precipitation (mm) Air Temperature (°C)

# Meteorological and Hydrometric Data

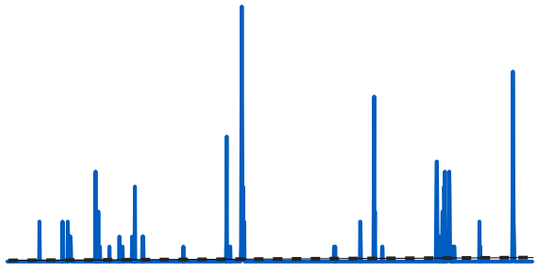
Newfoundland Labrador

## Air Temperature Trendline

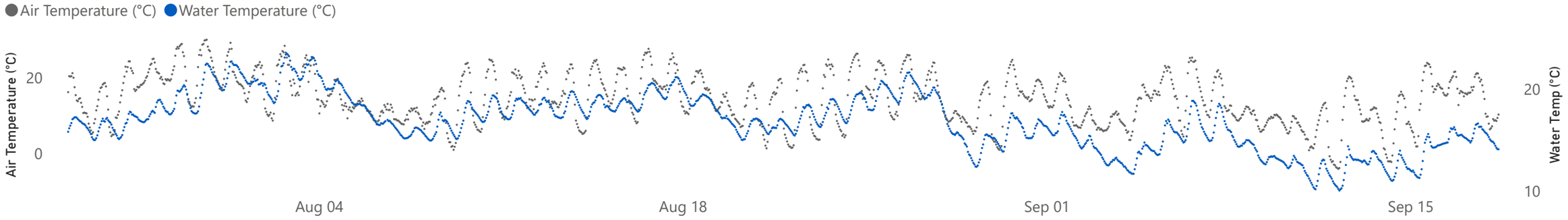


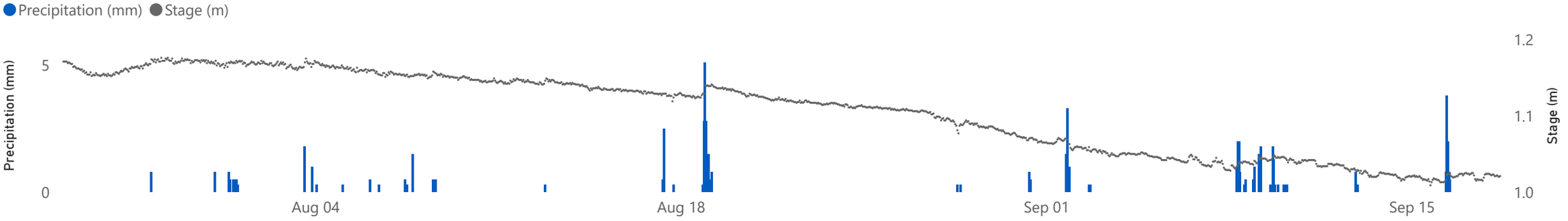
| 14.44 | 14.40 |
|---|---|
| Average (°C) | Median (°C) |
| -4.00 | 30.00 |
| Minimum (°C) | Maximum (°C) |

## Precipitation Trendline

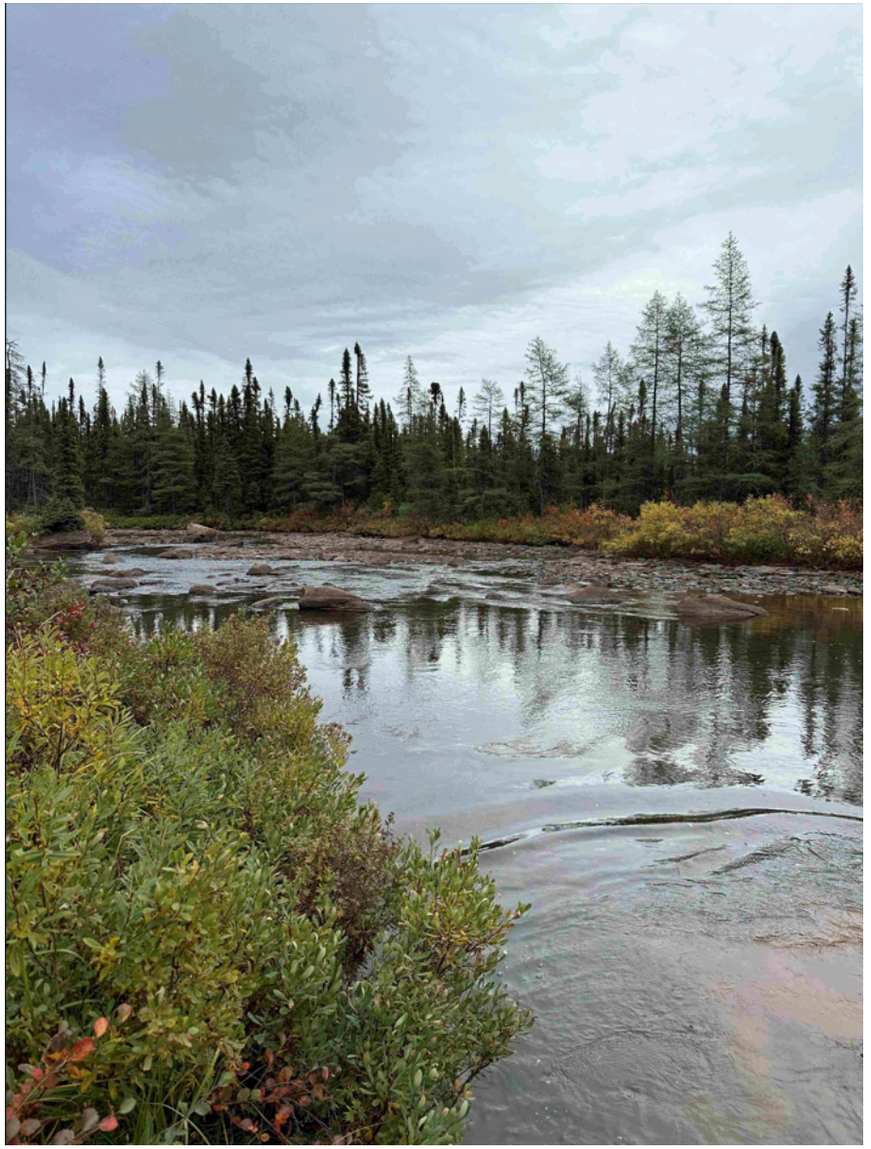


| 0.05 | 0.00 |
|---|---|
| Average (mm/hr) | Median (mm/hr) |
| 0.00 | 5.10 |
| Minimum (mm/hr) | Maximum (mm/hr) |



# Conclusions



- A clean and calibrated instrument was deployed at the Flora Creek below TLH water quality monitoring station on July 25, 2024 and removed on September 18, 2024. This was the first deployment for 2024.
- In most cases, weather related events or increases/decreases in water level explain parameter fluctuations. Almost all values recorded were within ranges as suggested by the CCME Guidelines for the Protection of Aquatic Life for pH and dissolved oxygen.
- Water temperature corresponded with ambient air temperatures, ranging between 10.03 and 23.53°C.
- pH values were all within the recommended CCME Guidelines for the Protection of Aquatic Life. pH ranged between 7.67 and 8.14.
- Specific conductivity increased gradually over the course of the deployment period, ranging from 63.74 to 71.10 µs/cm.
- Dissolved oxygen values were above the minimum CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Other Life Stages of 6.5 mg/l. The majority of the values were below the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Early Life Stages of 9.5 mg/l.
- Turbidity values decreased over the course of the deployment period. Levels were generally low with a few small spikes. Values ranged from 3.0 to 39.30 NTU.
- Stage decreased throughout the deployment period with some small increases after precipitation events.
- With the exception of water quantity data (stage), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol.  Water Survey of Canada is responsible for QA/QC of water quantity data.  Corrected data can be obtained upon request.

# Appendix 1
# Grab Sample Results

Bureau Veritas Job #: C4N2532
Report Date: 2024/08/09

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 224006869-3
Sampler Initials: MM

| Sample Details/Parameters | A | Result | RDL | UNITS | Extracted | Analyzed | By | Batch |
|---|---|---|---|---|---|---|---|---|
| ZWB140 FLORA CREEK<br>Sampling Date 2024/07/25 09:00<br>Matrix DR<br>Sample # 2024-6314-00-SI-SP<br>Registration # SA-0000 | | | | | | | | |
| **RESULTS OF ANALYSES OF DRINKING WATER** | | | | | | | | |
| **Calculated Parameters** | | | | | | | | |
| Hardness (CaCO3) | - | 31 | 1.0 | mg/L | N/A | 2024/07/31 | | 9545812 |
| Nitrate (N) | - | 0.23 | 0.050 | mg/L | N/A | 2024/08/01 | | 9545815 |
| Total dissolved solids (calc., EC) | - | 36 | 1.0 | mg/L | N/A | 2024/08/01 | | 9545914 |
| **Inorganics** | | | | | | | | |
| Conductivity | - | 64 | 1.0 | uS/cm | N/A | 2024/07/31 | LJV | 9548393 |
| Dup.Conductivity | - | 65 | 1.0 | uS/cm | N/A | 2024/07/31 | LJV | 9548393 |
| Chloride (Cl-) | - | ND | 1.0 | mg/L | N/A | 2024/08/01 | SUR | 9550868 |
| Bromide (Br-) | - | ND | 1.0 | mg/L | N/A | 2024/08/01 | SUR | 9550868 |
| Sulphate (SO4) | - | 3.2 | 1.0 | mg/L | N/A | 2024/08/01 | SUR | 9550868 |
| Total Alkalinity (Total as CaCO3) | - | 27 | 2.0 | mg/L | N/A | 2024/07/31 | LJV | 9548394 |
| Dup.Total Alkalinity (Total as CaCO3) | - | 27 | 2.0 | mg/L | N/A | 2024/07/31 | LJV | 9548394 |
| Colour | - | 13 | 5.0 | TCU | N/A | 2024/08/01 | EMT | 9548872 |
| Dup.Colour | - | 12 | 5.0 | TCU | N/A | 2024/08/01 | EMT | 9548872 |
| Dissolved Fluoride (F-) | - | ND | 0.10 | mg/L | N/A | 2024/07/31 | LJV | 9548395 |
| Dup.Dissolved Fluoride (F-) | - | ND | 0.10 | mg/L | N/A | 2024/07/31 | LJV | 9548395 |
| Total Kjeldahl Nitrogen (TKN) | - | ND | 0.10 | mg/L | 2024/08/06 | 2024/08/08 | RTY | 9559013 |
| Nitrate + Nitrite (N) | - | 0.23 | 0.050 | mg/L | N/A | 2024/08/01 | EMT | 9551115 |
| Dup.Nitrate + Nitrite (N) | - | 0.23 | 0.050 | mg/L | N/A | 2024/08/01 | EMT | 9551115 |
| Nitrite (N) | - | ND | 0.010 | mg/L | N/A | 2024/08/01 | EMT | 9551116 |
| Dup.Nitrite (N) | - | ND | 0.010 | mg/L | N/A | 2024/08/01 | EMT | 9551116 |
| Nitrogen (Ammonia Nitrogen) | - | ND | 0.050 | mg/L | N/A | 2024/08/01 | EMT | 9551194 |
| Dissolved Organic Carbon (C) | - | 2.0 | 0.50 | mg/L | N/A | 2024/07/31 | SSI | 9549152 |
| Total Organic Carbon (C) | - | 2.0 | 0.50 | mg/L | N/A | 2024/07/30 | MKY | 9546369 |
| pH | - | 7.63 | | pH | N/A | 2024/07/31 | LJV | 9548391 |
| Dup.pH | - | 7.63 | | pH | N/A | 2024/07/31 | LJV | 9548391 |
| Total Phosphorus | - | 0.005 | 0.004 | mg/L | 2024/08/06 | 2024/08/07 | SPC | 9558902 |
| Total Suspended Solids | - | ND | 1.0 | mg/L | 2024/07/31 | 2024/08/02 | ACK | 9548528 |
| Turbidity | - | 20 | 0.10 | NTU | N/A | 2024/08/01 | LJV | 9551181 |
| **MERCURY BY COLD VAPOUR AA (DRINKING WATER)** | | | | | | | | |
| **Metals** | | | | | | | | |
| Total Mercury (Hg) | - | ND | 0.000013 | mg/L | 2024/08/06 | 2024/08/06 | JEP | 9554144 |
| **ELEMENTS BY ICP/MS (DRINKING WATER)** | | | | | | | | |
| **Metals** | | | | | | | | |
| Total Aluminum (Al) | - | 0.0093 | 0.0050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Antimony (Sb) | - | ND | 0.0010 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Arsenic (As) | - | ND | 0.0010 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Barium (Ba) | - | 0.0058 | 0.0010 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Boron (B) | - | ND | 0.050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |



Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 224006869-3
Sampler Initials: MM

| Sample Details/Parameters | A | Result | RDL | UNITS | Extracted | Analyzed | By | Batch |
|---|---|---|---|---|---|---|---|---|
| ZWB140 FLORA CREEK<br>Sampling Date 2024/07/25 09:00<br>Matrix DR<br>Sample # 2024-6314-00-SI-SP<br>Registration # SA-0000 | | | | | | | | |
| **ELEMENTS BY ICP/MS (DRINKING WATER)** | | | | | | | | |
| **Metals** | | | | | | | | |
| Total Cadmium (Cd) | - | ND | 0.000010 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Calcium (Ca) | - | 6.9 | 0.10 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Chromium (Cr) | - | ND | 0.0010 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Copper (Cu) | - | ND | 0.00050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Iron (Fe) | - | 0.19 | 0.050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Lead (Pb) | - | ND | 0.00050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Magnesium (Mg) | - | 3.3 | 0.10 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Manganese (Mn) | - | 0.15 | 0.0020 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Nickel (Ni) | - | ND | 0.0020 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Phosphorus (P) | - | ND | 0.10 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Potassium (K) | - | 0.79 | 0.10 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Selenium (Se) | - | ND | 0.00050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Sodium (Na) | - | 0.73 | 0.10 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Strontium (Sr) | - | 0.0067 | 0.0020 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Uranium (U) | - | ND | 0.00010 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |
| Total Zinc (Zn) | - | ND | 0.0050 | mg/L | 2024/07/30 | 2024/07/30 | MOA | 9546414 |



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