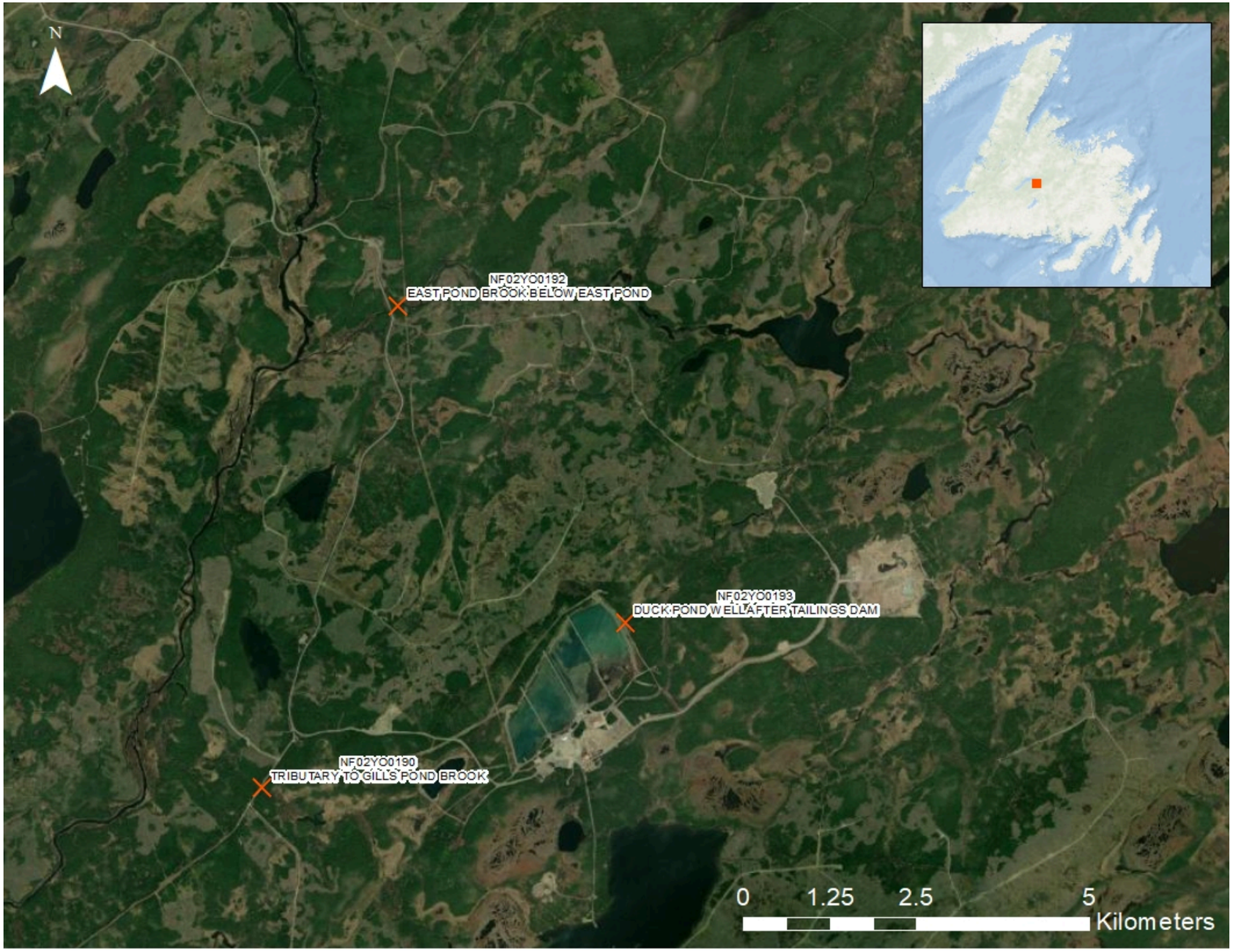
Real Time Water Quality Deployment Report
TECK: Duck Pond Operations
NF02YO0190 & NF02YO0192

2024-10-07 to 2024-11-11

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



TECK: Duck Pond Operations

This report will review the water quality data for the following two real-time water quality monitoring stations at TECK Duck Pond Operations: Tributary to Gill's Pond Brook and East Pond Brook below East Pond, for the duration of 2024-10-07 through to 2024-11-11. The HL7 sondes were removed from the brook at the end of this deployment period for the winter season. They will be redeployed in the Spring of 2025. DS5 instruments were deployed at both stations to log internally throughout the winter.

These stations are a part of the Real-Time Water Quality Network. The stations are maintained by the Department of Environment and Climate Change, Water Resources Management Division (WRMD). WRMD staff are responsible for the maintenance and calibration of the water quality instruments deployed at these sites. The data recorded by the real-time water quality stations is available on WRMD's website.

For the purposes of this report, air temperature and total precipitation data were used from the weather station located in Millertown. The data was retrieved from https://climate.weather.gc.ca/

Newfoundland Labrador

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. 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. Corrected data can be obtained upon request.

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
Water Temperature	≤ ± 0.2°C	≤ ± 0.21 - 0.5°C	≤ ± 0.51 - 0.8°C	≤ ± 0.81 - 1°C	> ± 1°C
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
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

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.

Additionally, grab samples are collected during deployment to compare pH, specific conductivity and turbidity values between the field instrument and grab samples. Variability in results may be attributed to differences in the sampling location or depth relative to the sonde's deployment site or insufficient equilibration time for the sonde when initial field data was collected.

Quality Assurance and Quality Control

Deployment Period Rankings

QAQC Rankings

Station	Parameter	Deployment Rank	Deployment Grab Sample Rank	Removal Rank	Removal Grab Sample Rank
East Pond Brook	Dissolved Oxygen (mg/l)	Excellent		Excellent	
East Pond Brook	pH	Excellent	Excellent	Excellent	Fair
East Pond Brook	Specific Conductivity (µS/cm)	Good	Good	Good	Good
East Pond Brook	Temperature (°C)	Excellent		Excellent	
East Pond Brook	Turbidity (NTU)	Excellent	Excellent	Excellent	Excellent
Tributary to Gill's	Dissolved Oxygen (mg/l)	Excellent		Excellent	
Tributary to Gill's	pH	Good	Good	Poor	Poor
Tributary to Gill's	Specific Conductivity (µS/cm)	Good	Excellent	Good	Good
Tributary to Gill's	Temperature (°C)	Excellent		Excellent	
Tributary to Gill's	Turbidity (NTU)	Excellent	Excellent	Excellent	Excellent

Upon deployment, all parameters at both stations were rated as good or excellent, indicating minimal discrepancies between field sonde readings and QAQC sonde measurements.

When comparing field sonde measurements to QAQC sonde measurements at the time of removal, all parameters were rated good or excellent at both stations, except for pH at Tributary to Gill's Pond Brook, which was rated poor. The pH sensor on the instrument deployed at Tributary to Gill's Pond Brook showed signs of an upwards drift throughout the deployment period. This sensor drift could be due to biofouling or a decline in sensor performance. The poor rating was linked to this drift.

Since the instruments were removed for the winter season, grab samples were taken during the removal process, in addition to the routine grab samples collected during deployment. Upon deployment, grab sample rankings were good or excellent for all parameters at both stations. During removal, grab sample rankings varied from poor to excellent. pH at Tributary to Gill's Pond Brook was rated poor due to sensor drift, while pH at East Pond Brook was rated fair. The fair rating for East Pond Brook's pH can be attributed to factors such as the location and depth of the sample in relation to the field sonde, as well as the time between sample collection and laboratory analysis.

Water Temperature

(°C)

Water temperature plays a crucial role in wildlife health, as many organisms rely on air and water conditions to regulate their body temperatures. Additionally, water temperature affects other key parameters, such as dissolved oxygen levels and specific conductivity.

Water temperature data for this deployment was collected from 2024-10-07 until 2024-11-11. The minimum water temperature at East Pond Brook was 0.98°C and occurred on 2024-11-10, while the maximum water temperature, 12.26 °C, occurred on 2024-10-24. The minimum water temperature at Tributary to Gill's Pond Brook was 1.35°C and occurred on 2024-11-10, while the maximum water temperature, 12.36°C, occurred on 2024-10-24. East Pond Brook below East Pond is a rapid waterway with minimal canopy cover. Tributary to Gill's Pond Brook is a narrower waterbody and during the summer months is mostly covered by tree canopy.

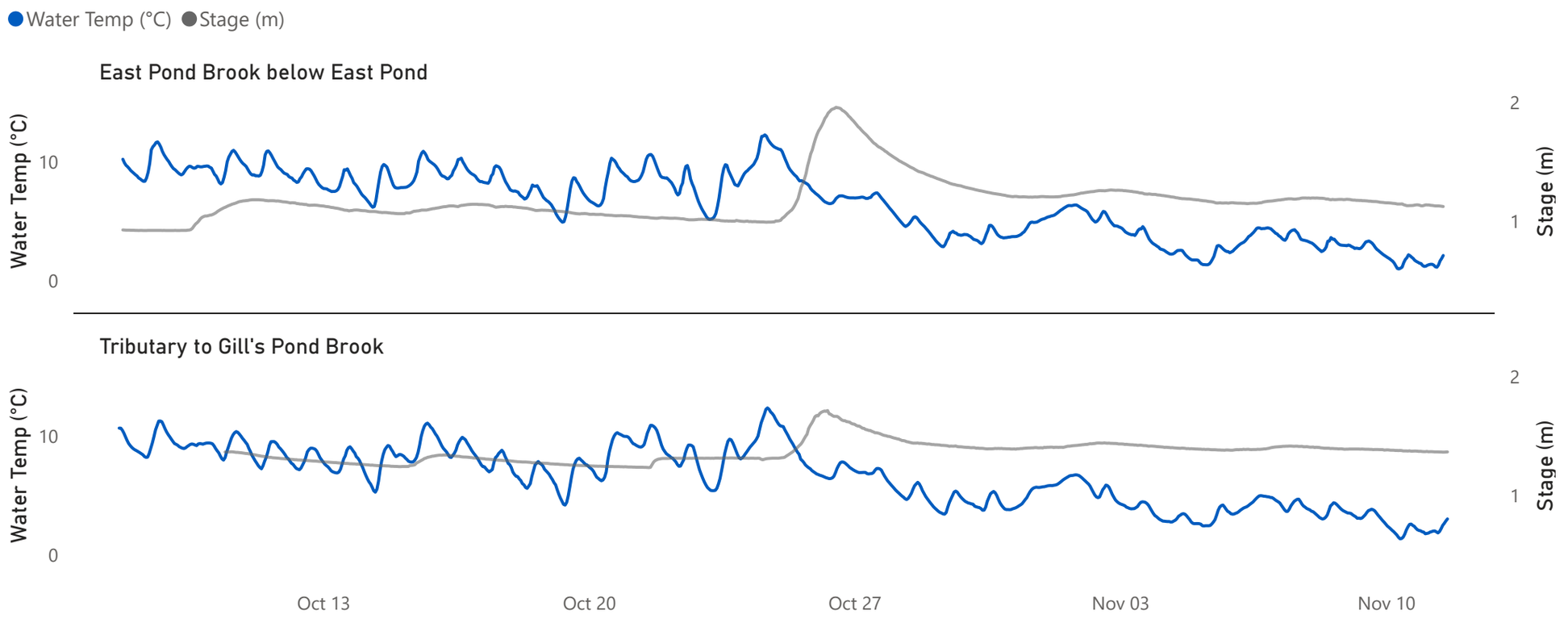
Throughout this deployment period, a natural diurnal pattern was evident, with warmer temperatures during daylight hours and cooler temperatures at night. A decreasing trend was observed at both stations, which would be expected during the seasonal transition into late autumn months.

East Pond Brook Below East Pond

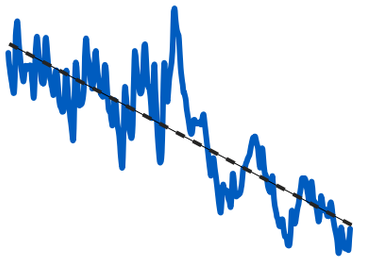
6.45 Average	6.95 Median
0.98 Minimum	12.26 Maximum

Tributary to Gill's Pond Brook

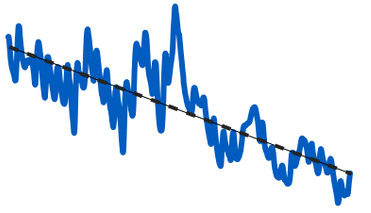
6.54 Average	6.76 Median
1.35 Minimum	12.36 Maximum



East Pond Brook Trendline



Tributary to Gill's Trendline



pH
(pH Units)

pH relates to the free hydrogen ions in water and it is a measure of acidity in water. According to the Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life Guidelines, the recommended pH range for aquatic health is between 6.5 and 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.

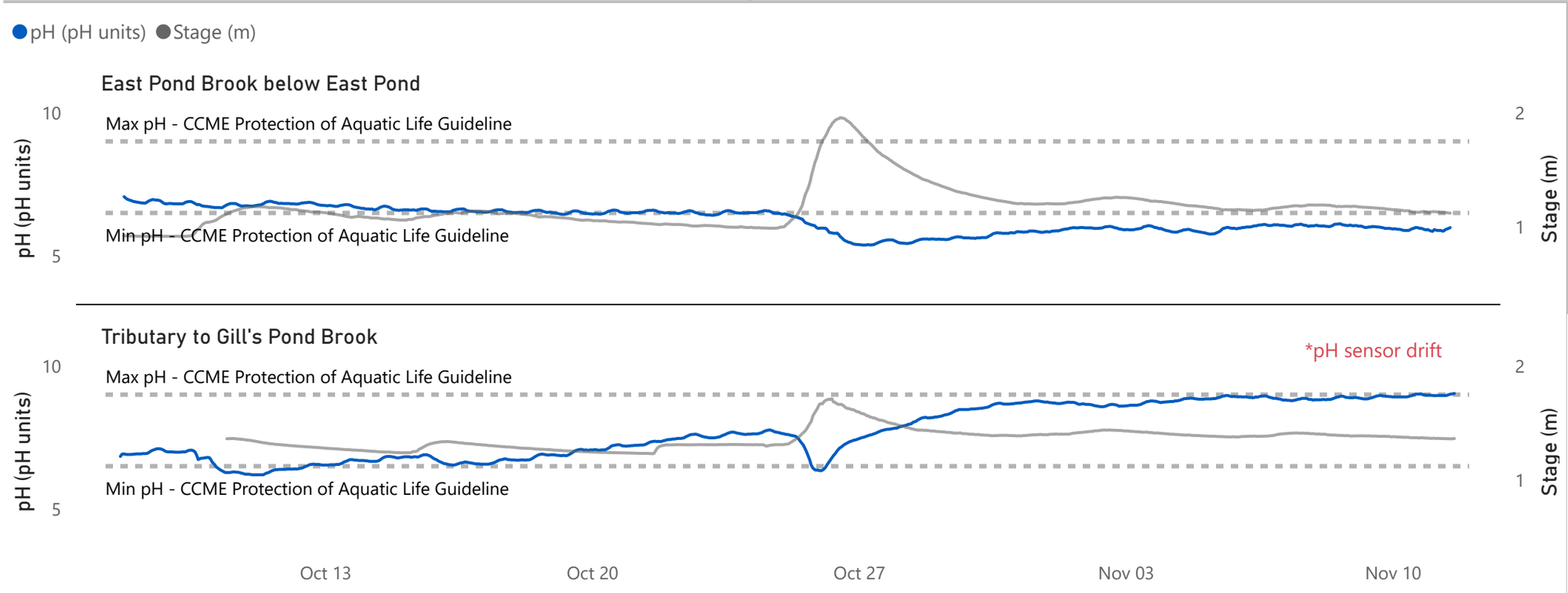
pH at East Pond Brook ranged between 5.38 to 7.07 pH units, while pH at Tributary to Gill's Pond Brook ranged between 6.20 to 9.04 pH units. Daily fluctuations in pH are typical and are often influenced by temperature changes, precipitation and the respiration of aquatic plants. At East Pond Brook, pH remained relatively stable throughout the deployment period, with a decrease recorded around October 25 which coincided with an increase in stage as a result of a precipitation event. Rainwater, naturally lower in pH, can briefly dilute the water and cause a temporary drop in pH, but levels generally return to normal within a few days to weeks. During the early stages of the deployment, pH values at East Pond Brook remained within the CCME guidelines. However, after October 25, the pH remained below the minimum value of 6.5. In contrast, pH levels at Tributary to Gill's Pond Brook showed a continuous upward trend, suggesting sensor drift. In the second half of the deployment, pH readings exceeded the station's typical range of approximately 6 to 7.5 pH units, which indicates potential inaccuracies in the data. Decreases in pH at this station also coincided with stage increases, likely due to precipitation. While pH levels remained within CCME guidelines for most of the period, there were brief dips below the minimum guideline value, and by the end of the deployment, pH levels had drifted above the maximum guideline value.

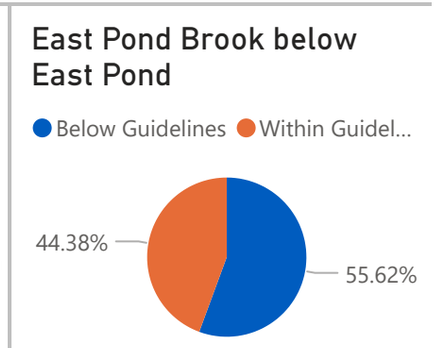
East Pond Brook Below East Pond

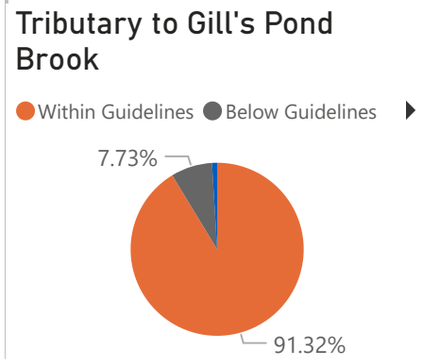
6.26 Average	6.42 Median
5.38 Minimum	7.07 Maximum

Tributary to Gill's Pond Brook

7.70 Average	7.57 Median
6.20 Minimum	9.04 Maximum







Specific Conductivity

(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 variable temperatures. Water parameter maps can be found on the Water Resources Management website. Specific conductivity is often affected by precipitation, as rainwater often has a lower conductivity and can temporarily dilute the water column, resulting in a short-term decrease in conductivity.

Specific conductivity at East Pond Brook ranged between 10.70 µS/cm to 34.20 µS/cm, and remained generally low and stable, with an overall decreasing trend across the deployment period. Small fluctuations can be associated with precipitation events.

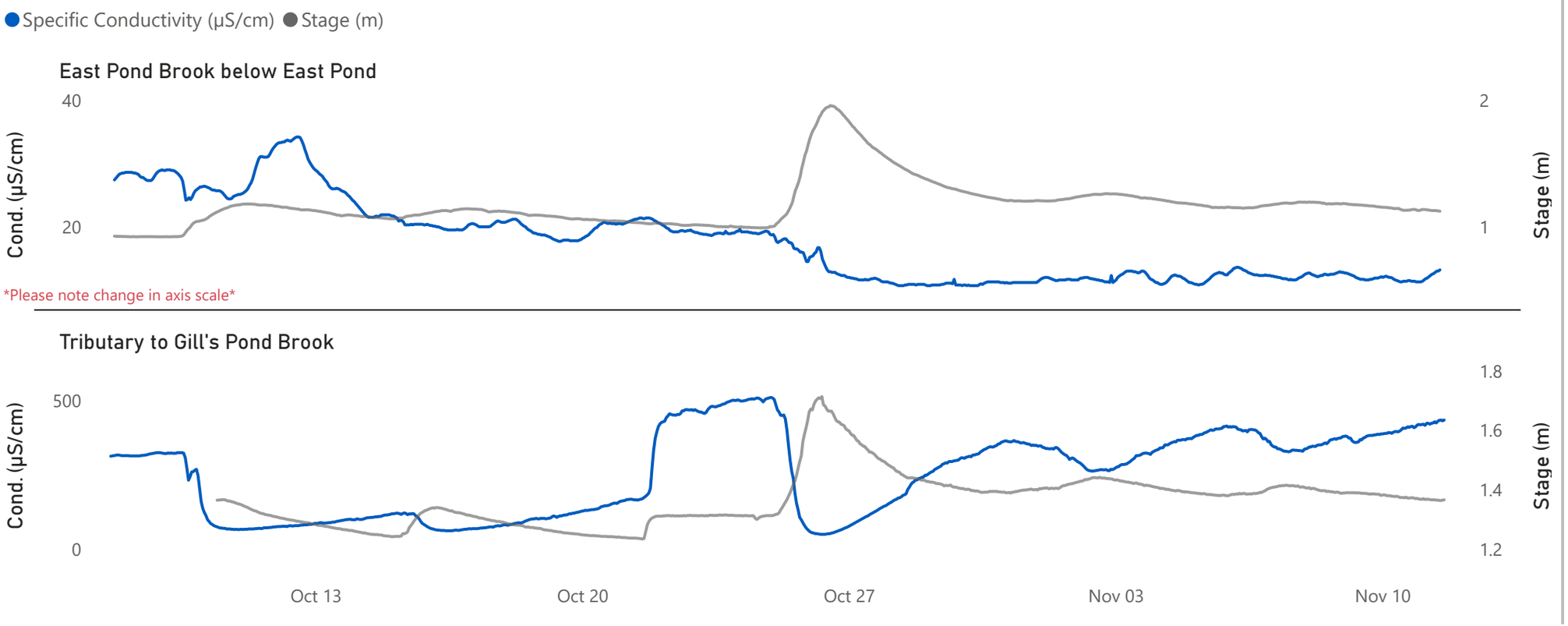
Specific conductivity at Tributary to Gill's Pond Brook ranged between 50.00 µS/cm and 511.00 µS/cm, with an overall increasing trend throughout the deployment period. Conductivity varied slightly which may be related to the discharge of effluent into the brook and/or precipitation events. A noticeable increase occurred on October 21st coinciding with a stage increase, which could be attributed to the discharge of effluent into the brook. One large decrease in conductivity around October 25th coincided with a stage increase related to a precipitation event.

East Pond Brook Below East Pond

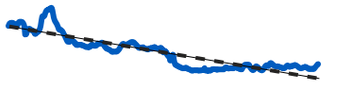
17.50 Average	17.80 Median
10.70 Minimum	34.20 Maximum

Tributary to Gill's Pond Brook

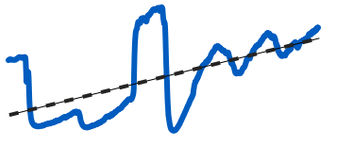
251.74 Average	289.00 Median
50.00 Minimum	511.00 Maximum



East Pond Brook Trendline



Tributary to Gill's Trendline



Dissolved Oxygen

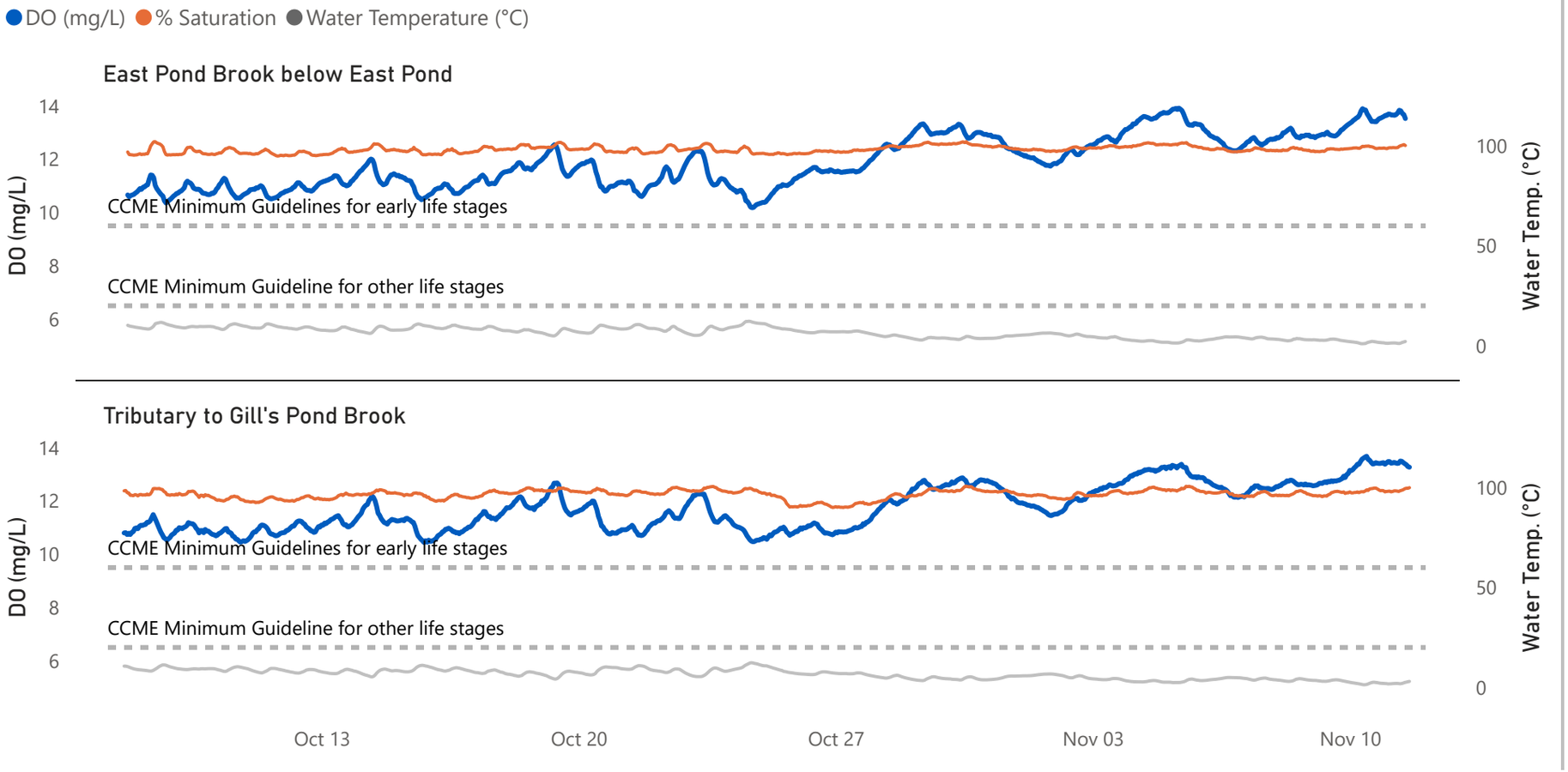
(mg/L and % Sat)

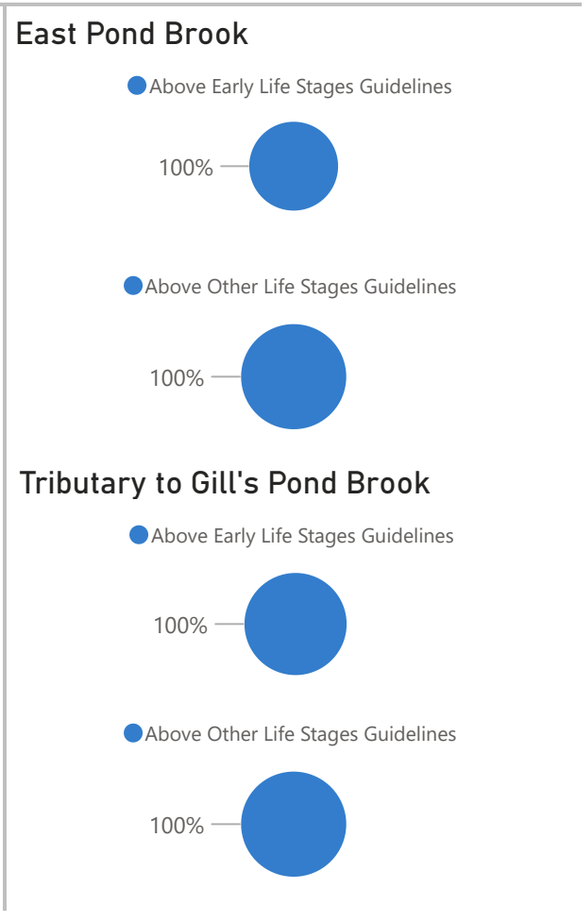
Newfoundland Labrador

East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
11.90 Average	11.68 Median	11.76 Average	11.60 Median
10.18 Minimum	13.92 Maximum	10.44 Minimum	13.68 Maximum

Dissolved oxygen (DO) in water is crucial for aquatic life. The CCME Freshwater Aquatic Life Guidelines provide benchmarks to assess waterway health, with the minimum DO guideline being 9.5 mg/L for early life stages in cold water and 6.5 mg/L for other life stages. DO levels are influenced by water temperature, with colder water able to retain higher DO concentrations. This inverse relationship can be observed on the graphs below, as well as daily fluctuations that can be attributed to changes in temperature and respiration of aquatic plants.

DO at East Pond Brook ranged between 10.18 mg/L and 13.92 mg/L, while DO at Tributary to Gill's Pond Brook ranged between 10.44 mg/L and 13.68 mg/L. Values stayed above the CCME Guideline for the protection of other life stages and early life stages at both stations throughout the deployment period. DO generally increased throughout the period, which is expected given the decreasing water temperatures.



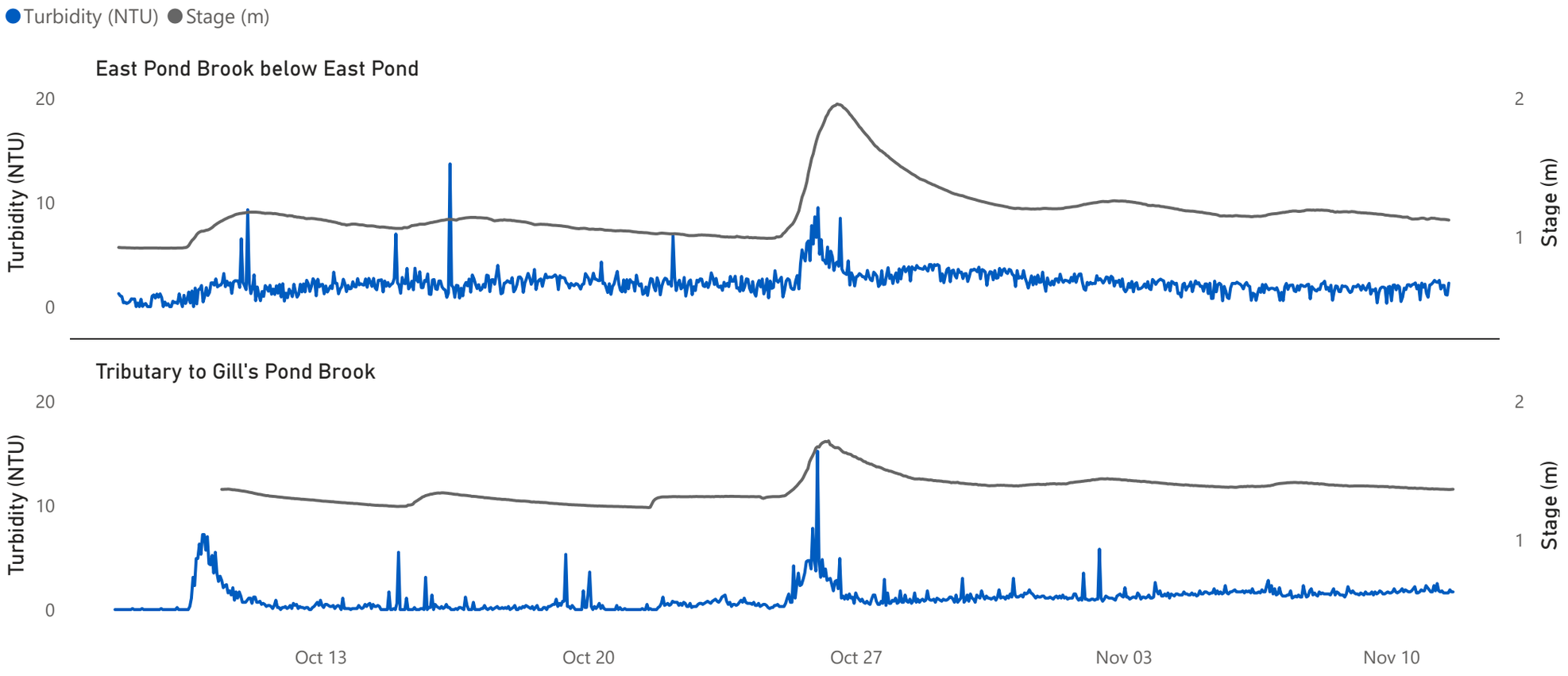


Turbidity
(NTU)

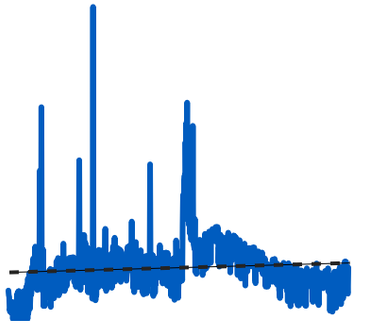
Turbidity, or water cloudiness, often increases during precipitation events when runoff carries silt and debris into the waterbody. Elevated turbidity can block light from reaching aquatic plants, disrupt benthic habitats, and harm fish gills or equipment.

Turbidity at East Pond Brook ranged between 0.00 NTU and 13.70 NTU. Turbidity at Tributary to Gill's Pond Brook ranged between 0.00 NTU and 15.20 NTU. Turbidity at both stations remained relatively low and stable throughout the deployment period, with a slightly increasing trend. Turbidity spikes are often associated with precipitation events or sediment passing by the sensor during measurements. There was a noticeable turbidity spike at both stations on October 25th which coincides with a stage increase related to a precipitation event. Precipitation can disturb bottom substrate or carry run-off into the water body, temporarily increasing turbidity.

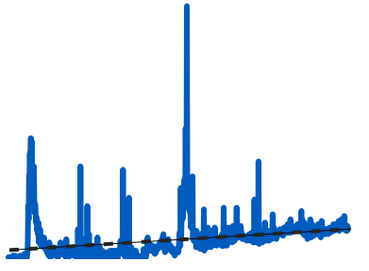
East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
2.25 Average	2.16 Median	1.07 Average	0.90 Median
0.00 Minimum	13.70 Maximum	0.00 Minimum	15.20 Maximum



East Pond Brook Trendline



Tributary to Gill's Trendline



Stage
(m)

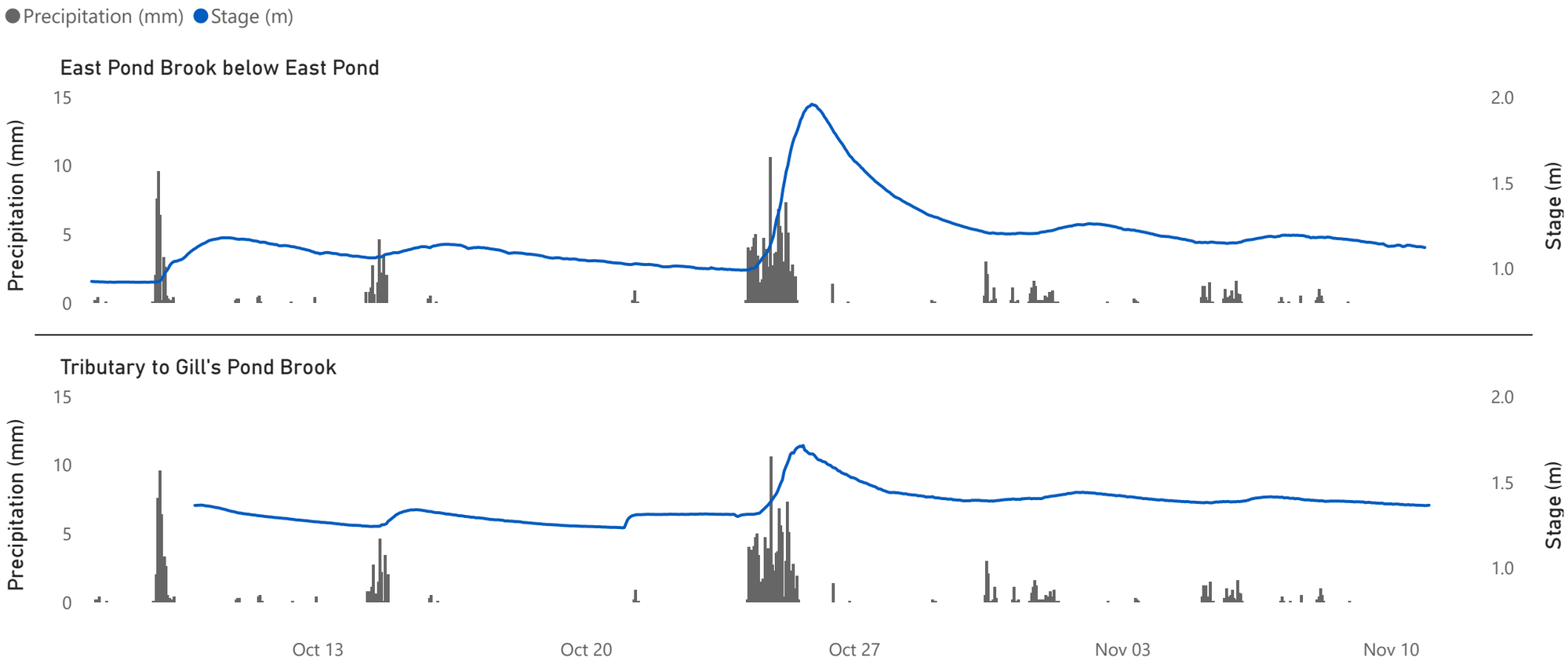
Newfoundland Labrador

East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
1.18 Average	1.15 Median	1.37 Average	1.37 Median
0.92 Minimum	1.96 Maximum	1.23 Minimum	1.71 Maximum

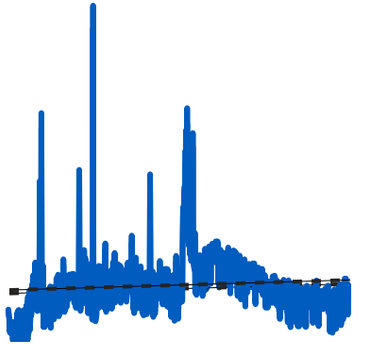
Stage provides an estimate of the water level at a monitoring station and plays a vital role in analyzing trends in water quality data, particularly for parameters such as specific conductivity, pH, and turbidity. Stage generally rises during precipitation events as rainwater and runoff enter the water column. By monitoring stage alongside precipitation events, we can better interpret our data, distinguish whether a stage increase is caused by rainfall or potential industrial activities, and assess its impact on water quality. Precipitation data was retrieved from the Millertown, NL meteorological station.

Stage ranged between 0.92 to 1.96 at East Pond Brook, and ranged between 1.23 to 1.71 at Tributary to Gill's Pond Brook. Stage remained stable across the deployment period, with small increases coinciding with precipitation events, such as October 25th.

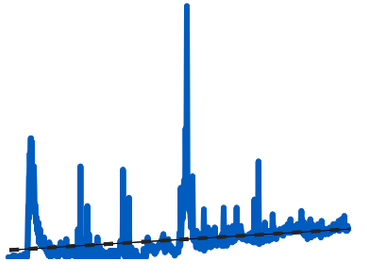
There is no stage data available for Tributary to Gill's Pond Brook from October 7th to October 10th due to transmission malfunctions experienced at the station.



East Pond Brook Trendline



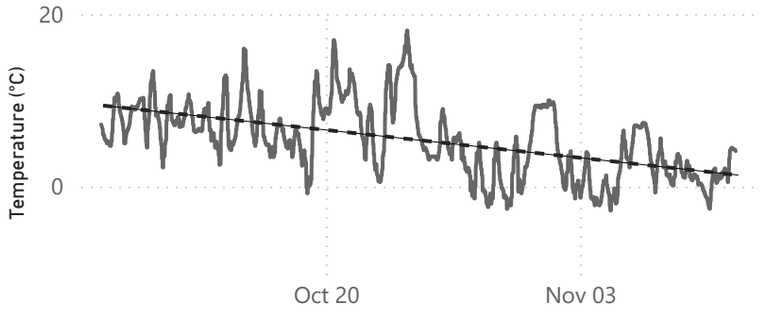
Tributary to Gill's Trendline



Meteorological and Hydrometric Data

Millertown, NL MET Station Data

Air Temperature Recorded at Millertown MET Station

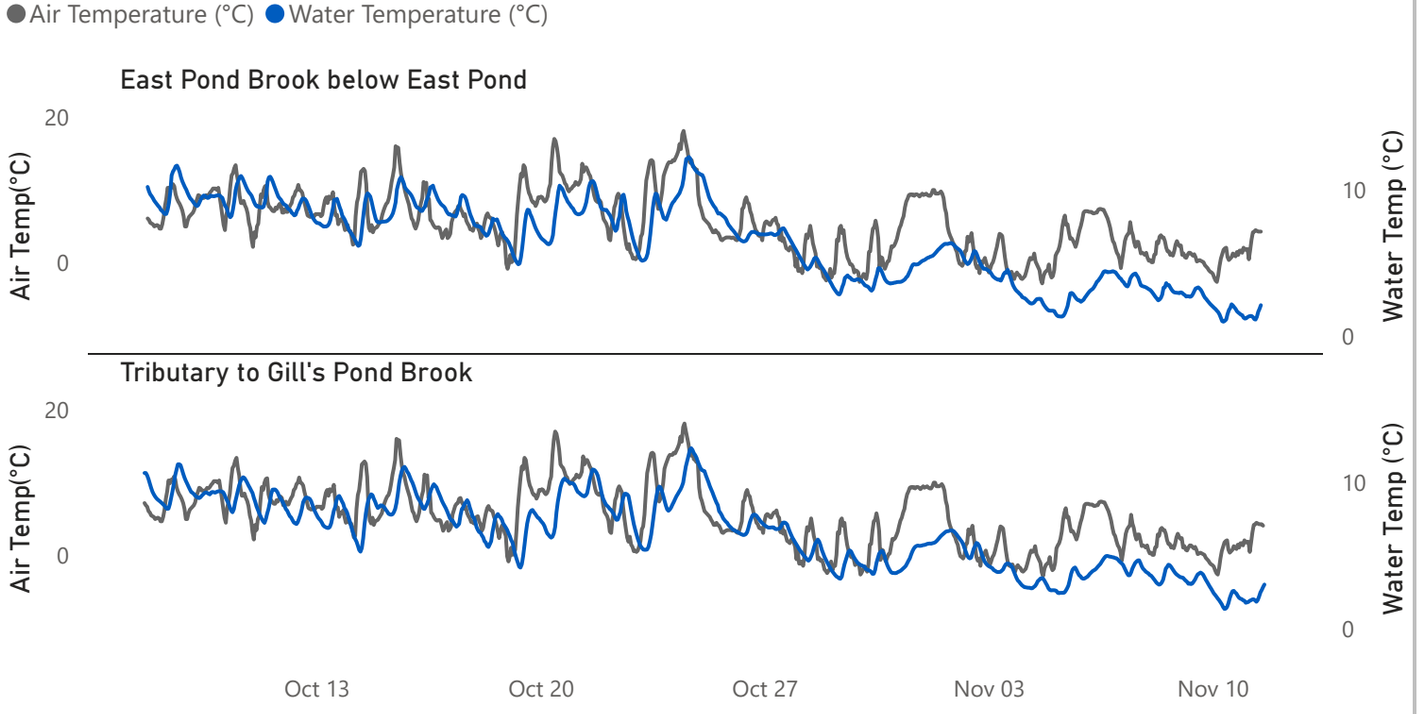


Air Temperature Data Statistics

5.36 Average (°C)	5.10 Median (°C)
-2.80 Minimum (°C)	18.10 Maximum (°C)

Precipitation Data Statistics

0.25 Average (mm/hr)	0.00 Median (mm/hr)
0.00 Minimum (mm/hr)	10.60 Maximum (mm/hr)



Precipitation Recorded at Millertown, NL MET Station