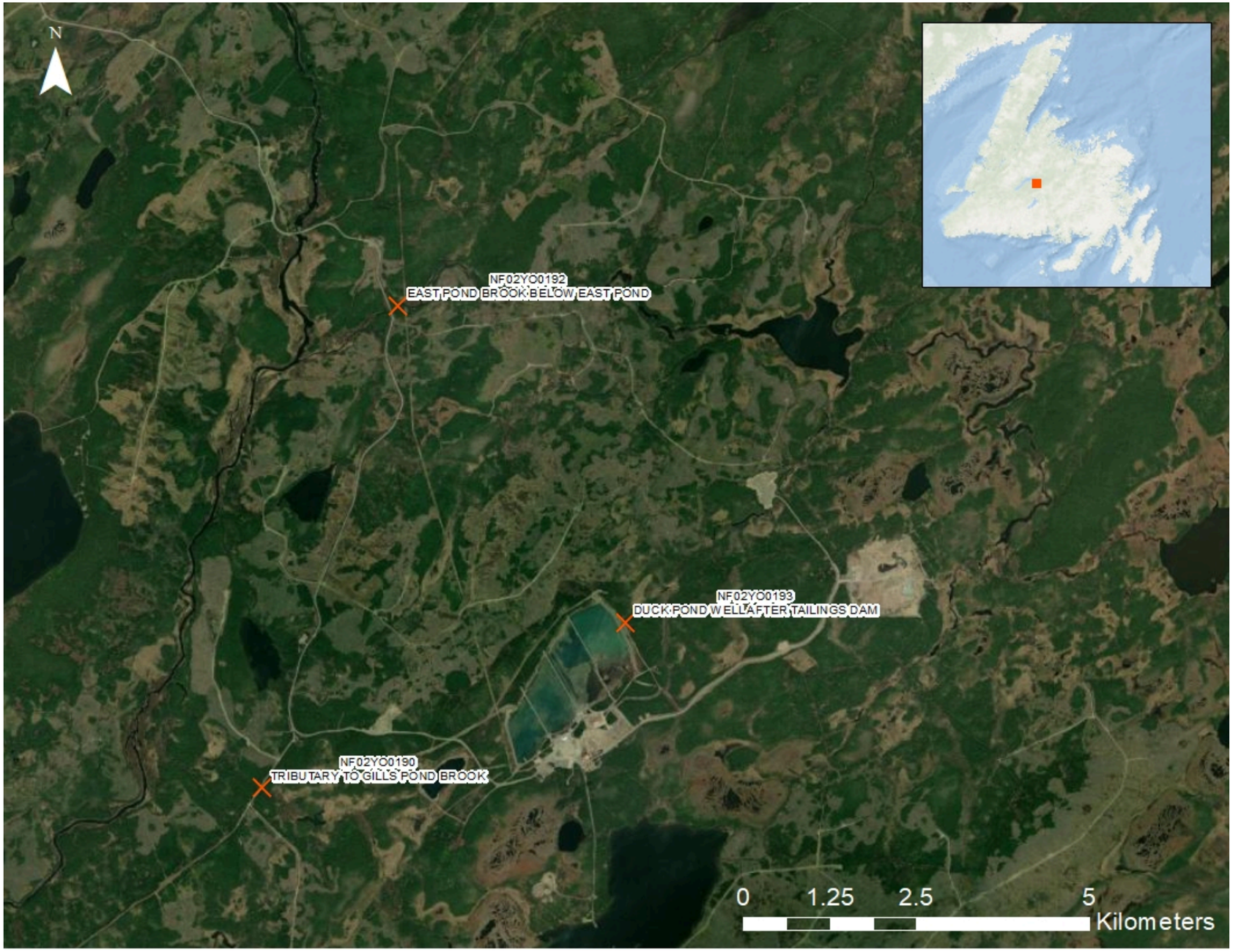
Real Time Water Quality Deployment Report
TECK: Duck Pond Operations
NF02YO0190 & NF02YO0192

2024-09-09 to 2024-10-07

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 2024-09-09 through to 2024-10-07.

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

Upon deployment and removal, all parameters ranked good or excellent at both stations, except for dissolved oxygen at Tributary to Gill's Pond Brook which ranked poor during deployment. This instrument experienced a dissolved oxygen sensor failure shortly after the beginning of this deployment, so the ranking can be attributed to deteriorating sensor performance. Due to the sensor failure, there is no removal data for dissolved oxygen at Tributary to Gill's Pond Brook.

When comparing grab sample data to field sonde data, all parameters ranked excellent at East Pond Brook, indicating minimal difference between the measurements. Parameters at Tributary to Gill's Pond Brook ranked good and excellent, except for specific conductivity which ranked marginal. The marginal ranking may be due to differences in the sampling location or depth compared to the field sonde, or insufficient time for the field sonde to stabilize before taking initial deployment measurements.

QAQC Rankings

Station	Parameter	Deployment Rank	Grab Sample Rank	Removal Rank
East Pond Brook	Dissolved Oxygen (mg/l)	Excellent		Good
East Pond Brook	pH	Good	Excellent	Good
East Pond Brook	Specific Conductivity (µS/cm)	Excellent	Excellent	Excellent
East Pond Brook	Temperature (°C)	Excellent		Excellent
East Pond Brook	Turbidity (NTU)	Excellent	Excellent	Excellent
Tributary to Gill's	Dissolved Oxygen (mg/l)	Poor		No Data
Tributary to Gill's	pH	Excellent	Good	Excellent
Tributary to Gill's	Specific Conductivity (µS/cm)	Good	Marginal	Good
Tributary to Gill's	Temperature (°C)	Excellent		Excellent
Tributary to Gill's	Turbidity (NTU)	Excellent	Excellent	Excellent

Instrument Malfunction

The instrument deployed at Tributary to Gill's Pond Brook experienced sensor failure for dissolved oxygen on September 10th, therefore, there is no dissolved oxygen data for this deployment period.

Water Temperature

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 2024-09-09 until 2024-10-07. The minimum water temperature at East Pond Brook was 6.53°C and occurred on 2024-10-04, while the maximum water temperature, 22.08 °C, occurred on 2024-09-18. The minimum water temperature at Tributary to Gill's Pond Brook was 7.89°C and occurred on 2024-10-04, while the maximum water temperature, 23.67°C, occurred on 2024-09-18. 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.

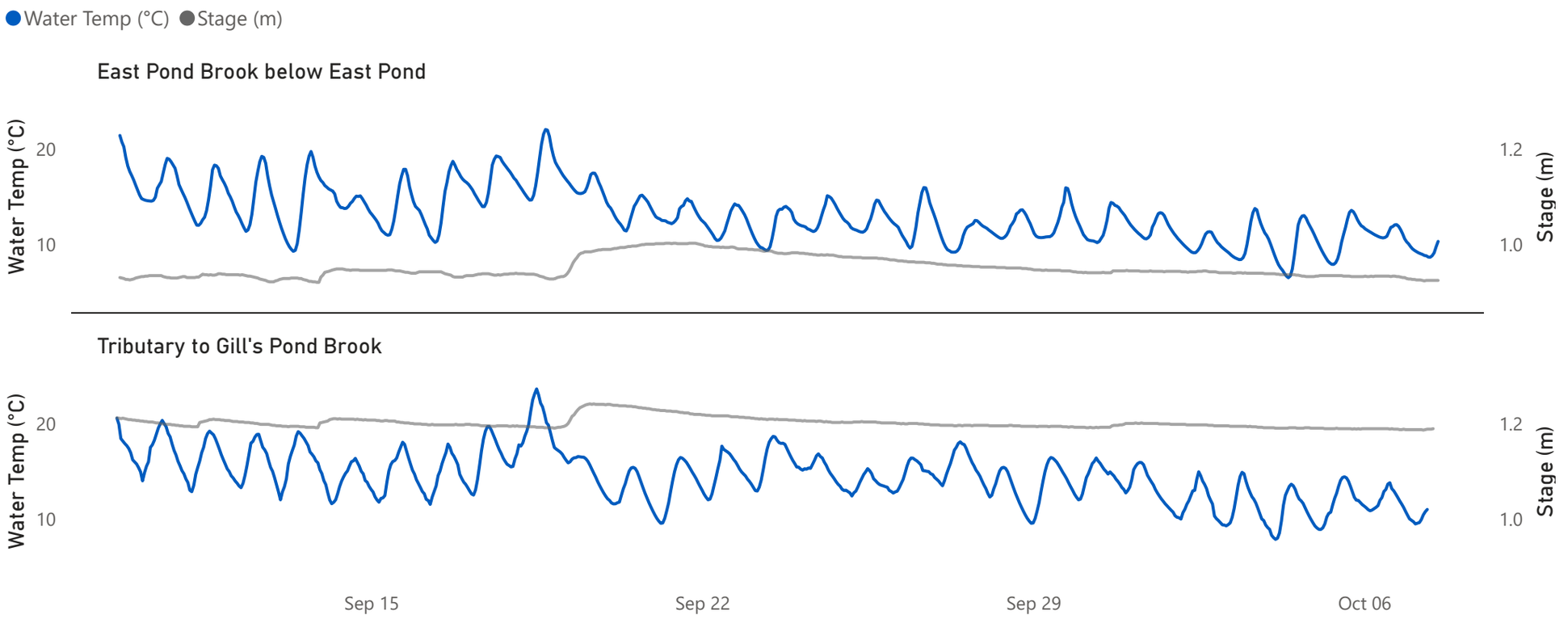
Throughout this deployment period, a natural diurnal pattern was evident, with warmer temperatures during daylight hours and cooler temperatures at night. A decreasing trend was observed at both stations, which would be expected during the seasonal transition to autumn.

East Pond Brook Below East Pond

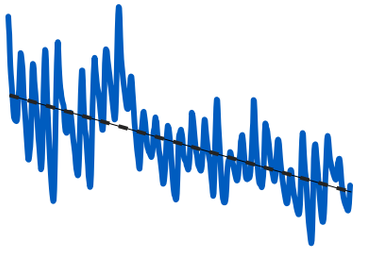
13.08 Average	12.62 Median
6.53 Minimum	22.08 Maximum

Tributary to Gill's Pond Brook

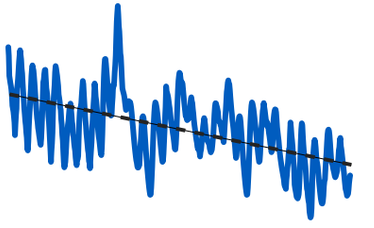
14.45 Average	14.46 Median
7.89 Minimum	23.67 Maximum



East Pond Brook Trendline



Tributary to Gill's Trendline



pH

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.

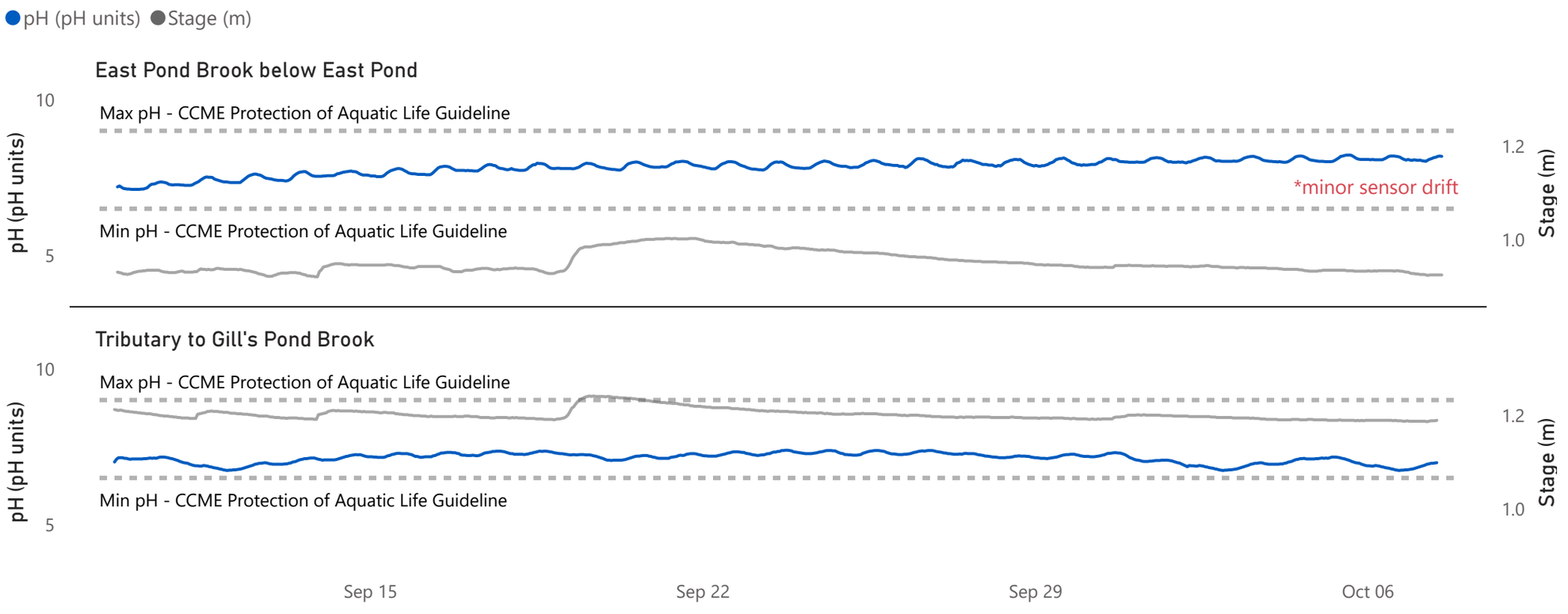
pH at East Pond Brook ranged between 7.12 to 8.22 pH units, while pH at Tributary to Gill's Pond Brook ranged between 6.74 to 7.39 pH units. pH at East Pond Brook was slightly higher than typical pH values, suggesting a minor sensor drift over the deployment period. Overall, pH levels at both stations remained stable and within the CCME Freshwater Aquatic Life Guidelines. Daily pH fluctuations are common and often result from temperature changes or aquatic plant respiration, particularly during summer. Small changes may also be linked to precipitation events. Rainwater, with its naturally lower pH, can briefly dilute the water, causing a temporary drop in pH, though levels typically return to baseline within a few days to weeks.

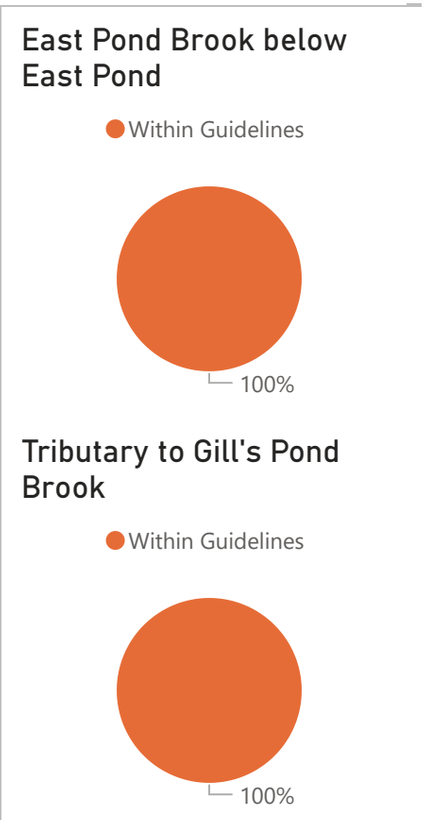
East Pond Brook Below East Pond

7.84 Average	7.89 Median
7.12 Minimum	8.22 Maximum

Tributary to Gill's Pond Brook

7.14 Average	7.17 Median
6.74 Minimum	7.39 Maximum





Specific Conductivity

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 27.40 µS/cm to 36.60 µS/cm, and remained generally low and stable across the deployment period. Small fluctuations can be associated with precipitation events. Conductivity displayed an overall decreasing trend.

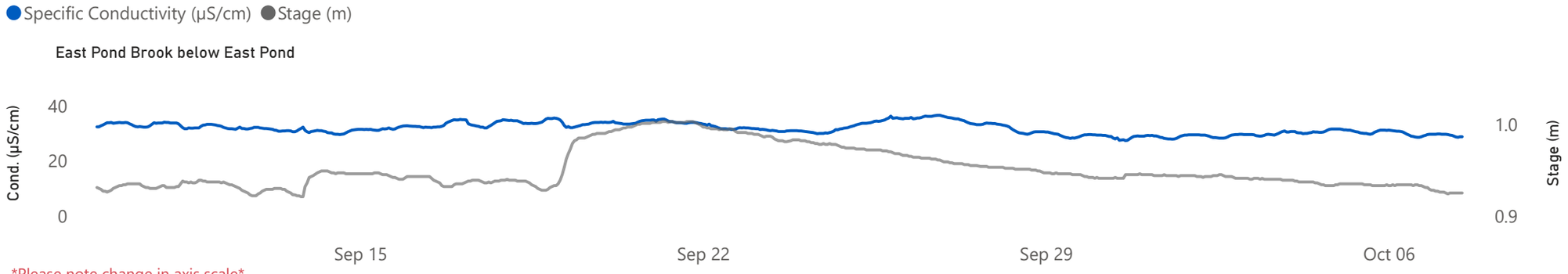
Specific conductivity at Tributary to Gill's Pond Brook ranged between 294.30 µS/cm and 310.20 µS/cm. Throughout the deployment period, conductivity remained stable, with the exception of brief decreases that coincided with stage increases, likely due to precipitation events. Rainwater and runoff temporarily diluted the water, but conductivity values gradually returned to background levels in the following days.

East Pond Brook Below East Pond

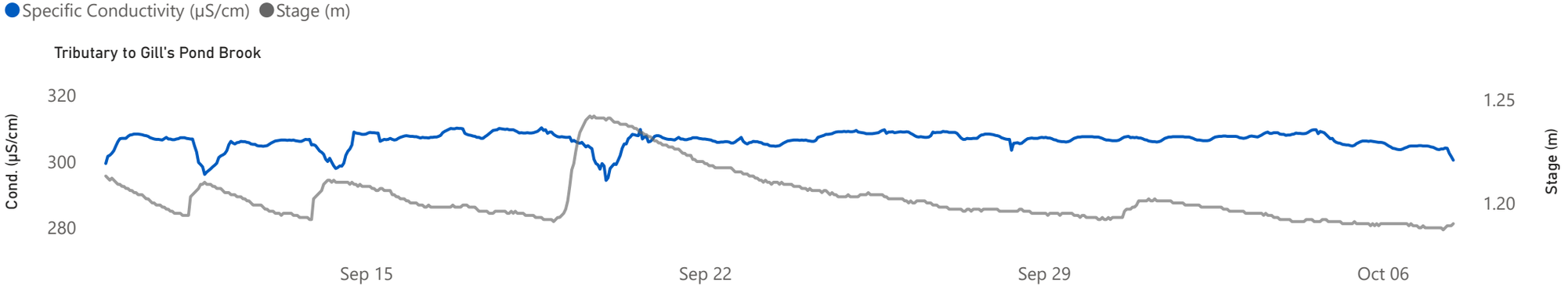
31.85 Average	31.70 Median
27.40 Minimum	36.60 Maximum

Tributary to Gill's Pond Brook

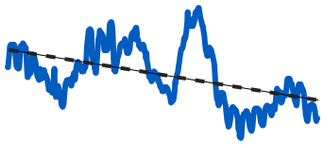
306.50 Average	307.00 Median
294.30 Minimum	310.20 Maximum



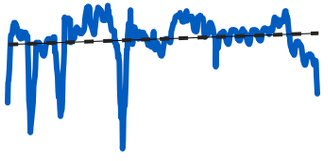
Please note change in axis scale



East Pond Brook Trendline



Tributary to Gill's Trendline



Dissolved Oxygen

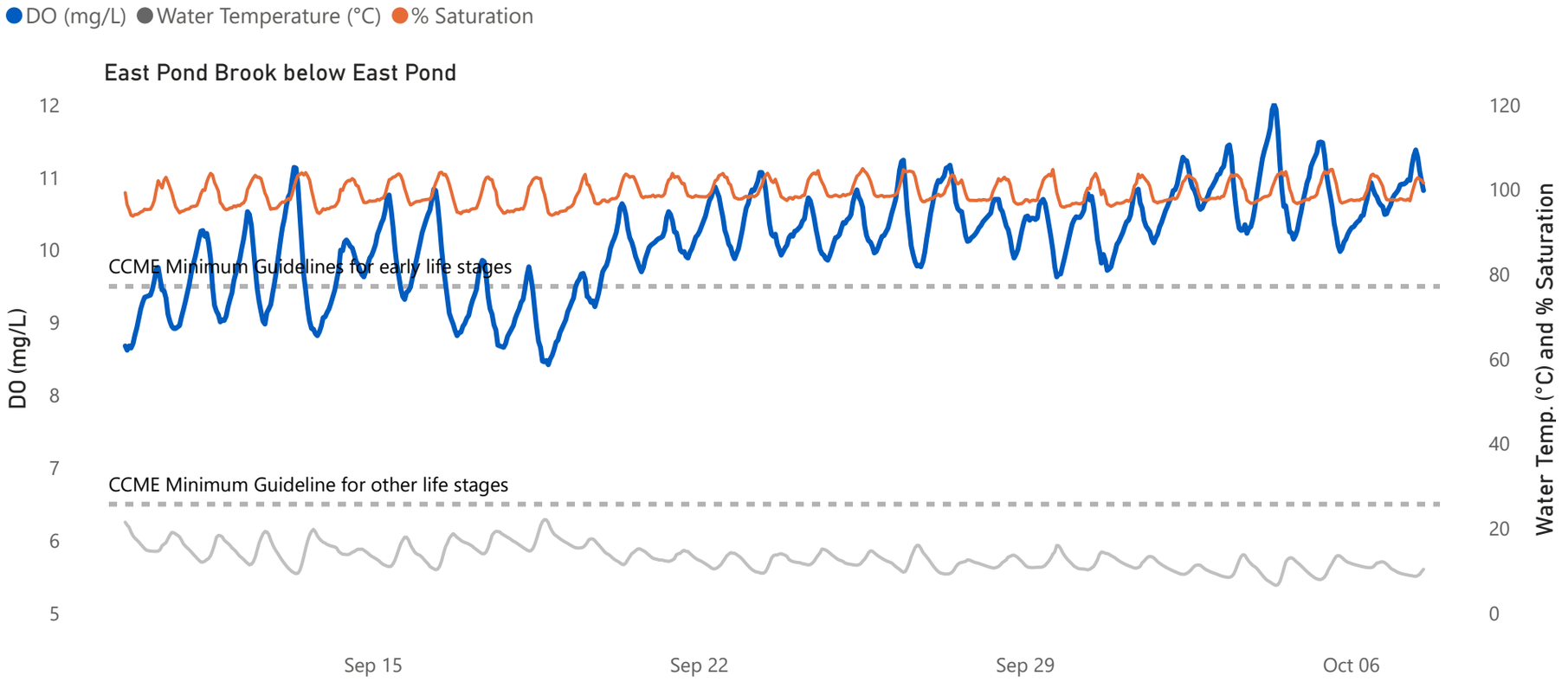
Dissolved oxygen (DO) in water is crucial for aquatic life. The CCME Freshwater Aquatic Life Guidelines provide benchmarks to assess waterway health, with the minimum DO guideline being 9.5 mg/L for early life stages in cold water and 6.5 mg/L for other life stages. DO levels are influenced by water 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.

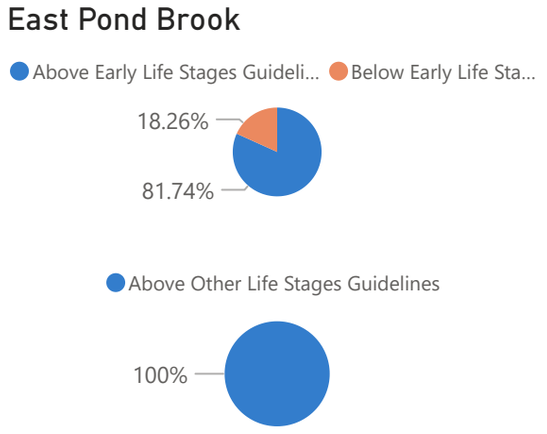
DO at East Pond Brook ranged between 8.42 mg/L and 12.01 mg/L. Values stayed above the CCME Guideline for the protection of other life stages for the entirity of the deployment. Values fluctuated around the minimum guideline for early life stages throughout beginning of the deployment period, but remained above 9.5 mg/L throughout the latter half. Overall, DO showed a slight increasing trend over time, which is typical as water temperatures drop.

There is no dissolved oxygen data for Tributary to Gill's Pond Brook this deployment period due to sensor failure.

East Pond Brook Below East Pond

10.13 Average	10.21 Median
8.42 Minimum	12.01 Maximum



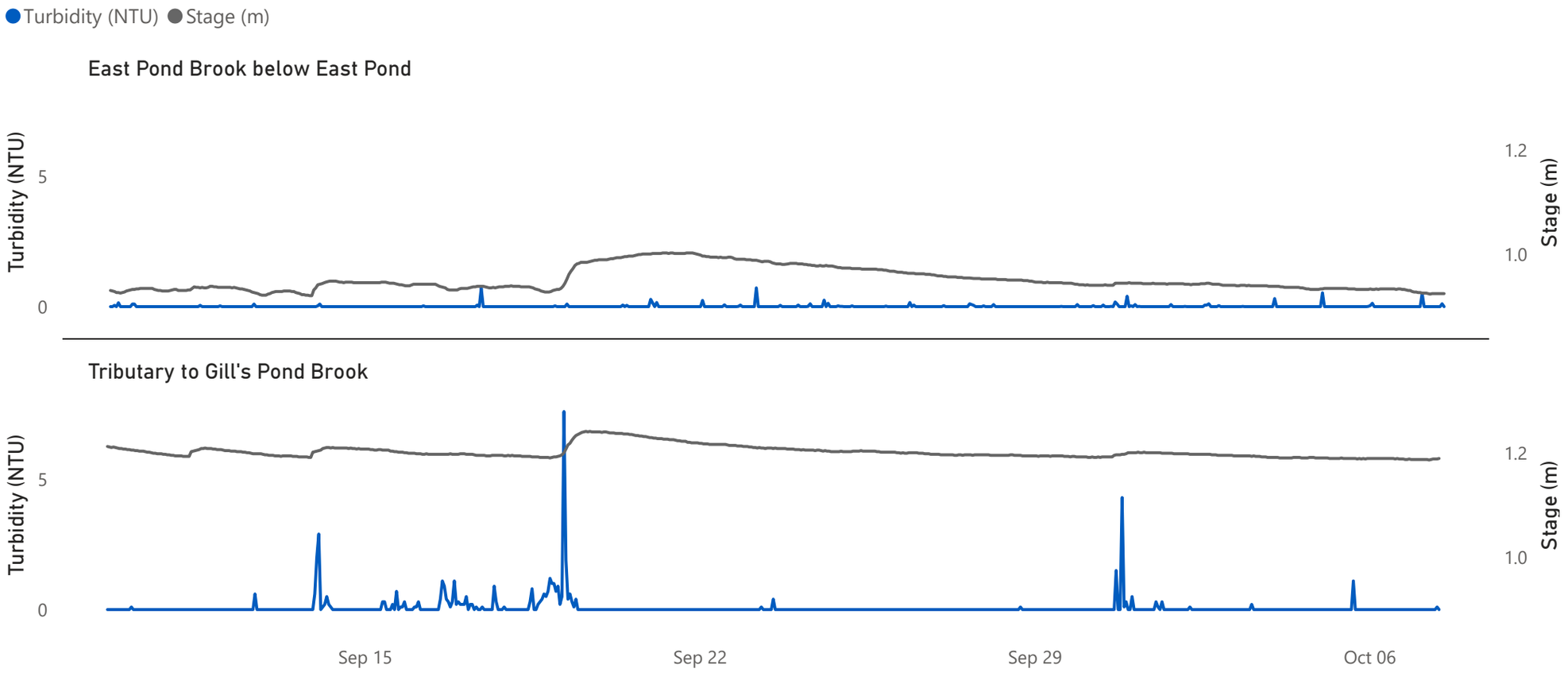


Turbidity

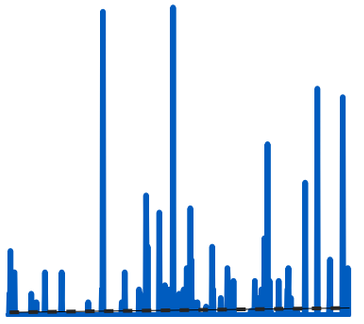
Turbidity, or water cloudiness, often increases during precipitation events when runoff carries silt and debris into the waterbody. Elevated turbidity can block light from reaching aquatic plants, disrupt benthic habitats, and harm fish gills or equipment.

Turbidity at East Pond Brook ranged between 0.00 NTU and 0.72 NTU. Turbidity at Tributary to Gill's Pond Brook ranged between 0.00 NTU and 7.60 NTU. Turbidity at both stations remained relatively low and stable throughout the deployment period, indicating clear and pristine water conditions. Tributary to Gill's Pond Brook is a small brook that is more noticeably impacted by precipitation events. Turbidity spikes are often associated with precipitation events or sediment passing by the sensor during measurements, but values returned to background levels.

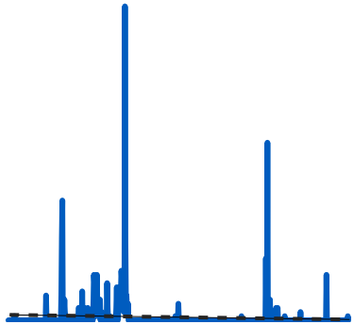
East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
0.01 Average	0.00 Median	0.07 Average	0.00 Median
0.00 Minimum	0.72 Maximum	0.00 Minimum	7.60 Maximum



East Pond Brook Trendline



Tributary to Gill's Trendline



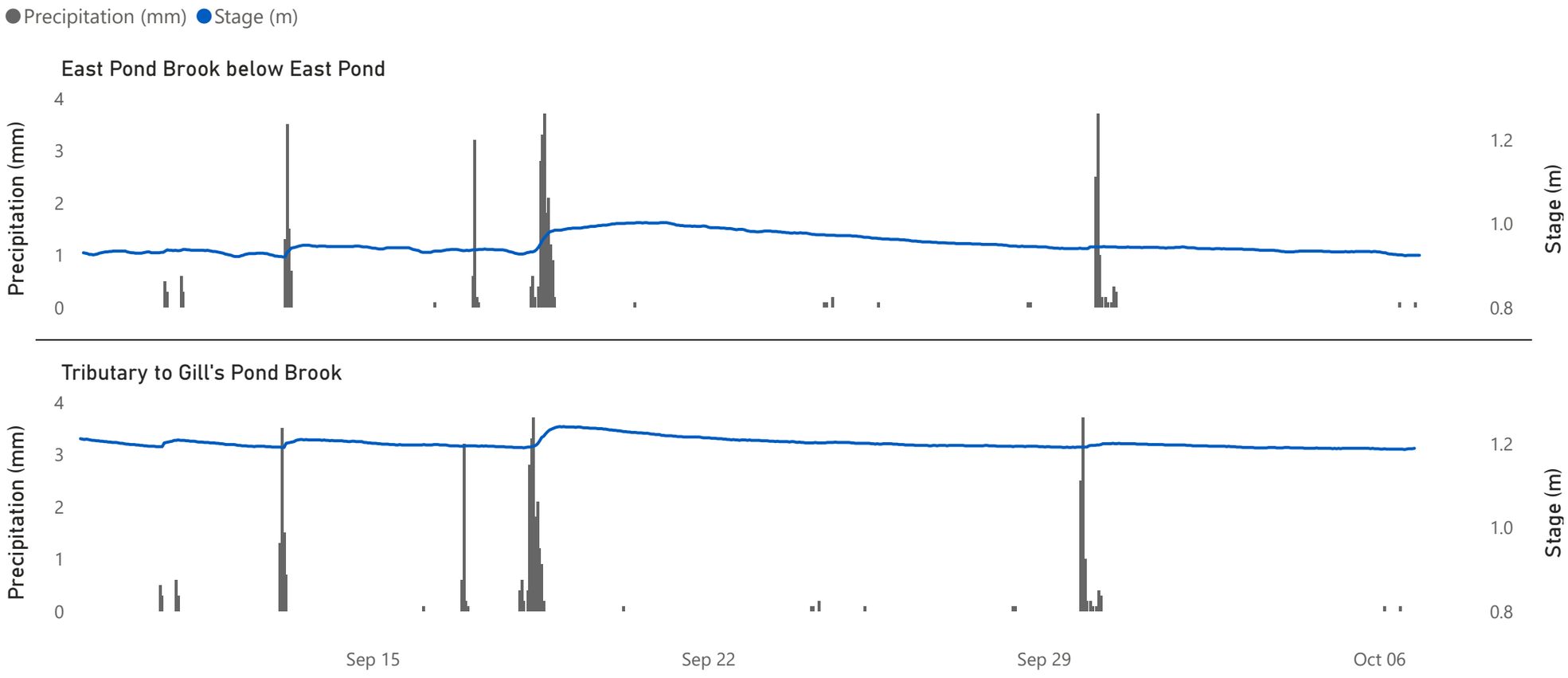
Stage (m)

Newfoundland Labrador

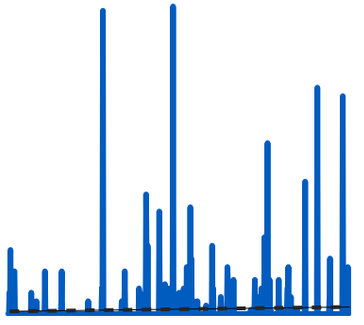
East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
0.95 Average	0.94 Median	1.20 Average	1.20 Median
0.92 Minimum	1.00 Maximum	1.19 Minimum	1.24 Maximum

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.

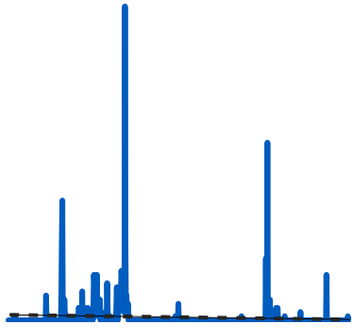
Stage ranged between 0.92 to 1.00 at East Pond Brook, and ranged between 1.19 to 1.24 at Tributary to Gill's Pond Brook. Stage remained stable across the deployment period, with small increases coinciding with precipitation events.



East Pond Brook Trendline



Tributary to Gill's Trendline

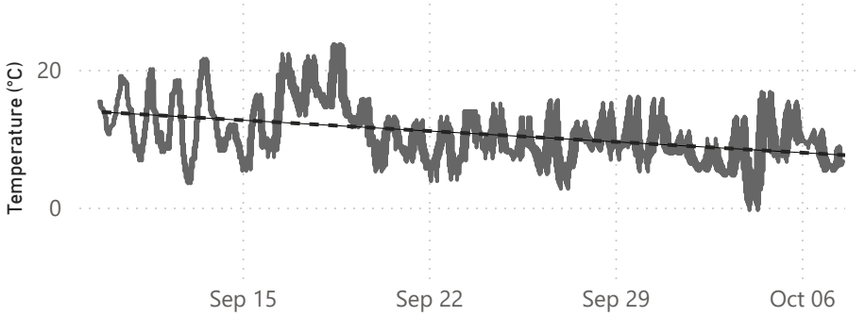


Meteorological Data

Millertown, NL MET Station Data

Newfoundland Labrador

Air Temperature Recorded at Millertown MET Station



Air Temperature Data Statistics

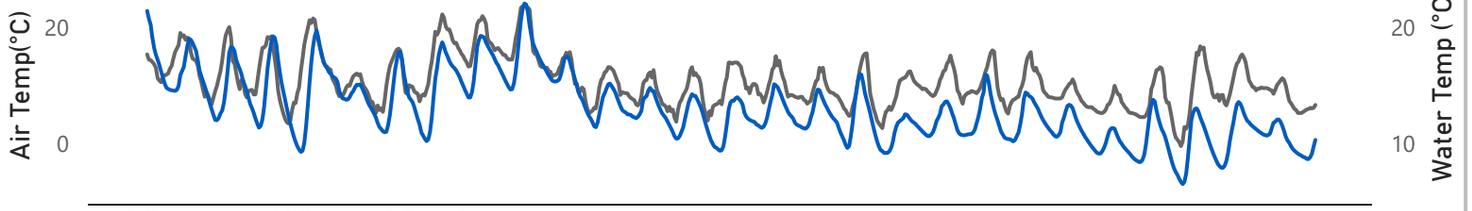
10.71	9.90
Average (°C)	Median (°C)
-0.40	23.70
Minimum (°C)	Maximum (°C)

Precipitation Data Statistics

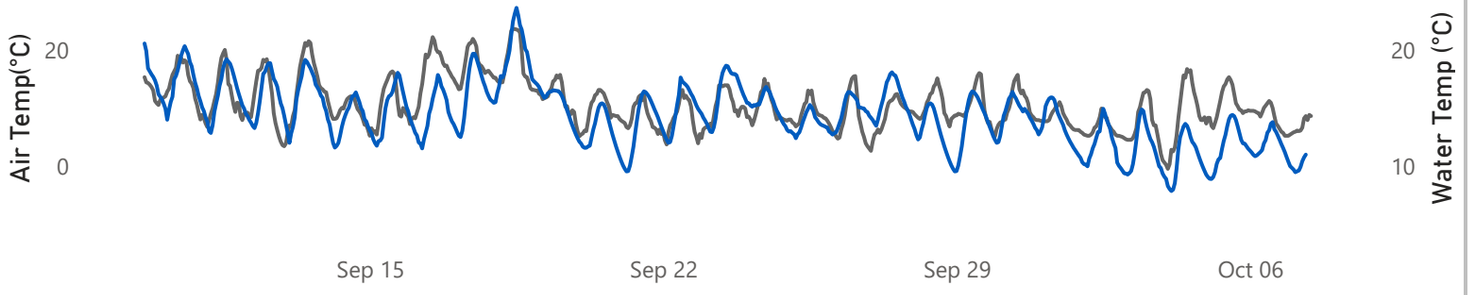
0.06	0.00
Average (mm/hr)	Median (mm/hr)
0.00	3.70
Minimum (mm/hr)	Maximum (mm/hr)

Air Temperature (°C) Water Temperature (°C)

East Pond Brook below East Pond



Tributary to Gill's Pond Brook



Precipitation Recorded at Millertown MET Station