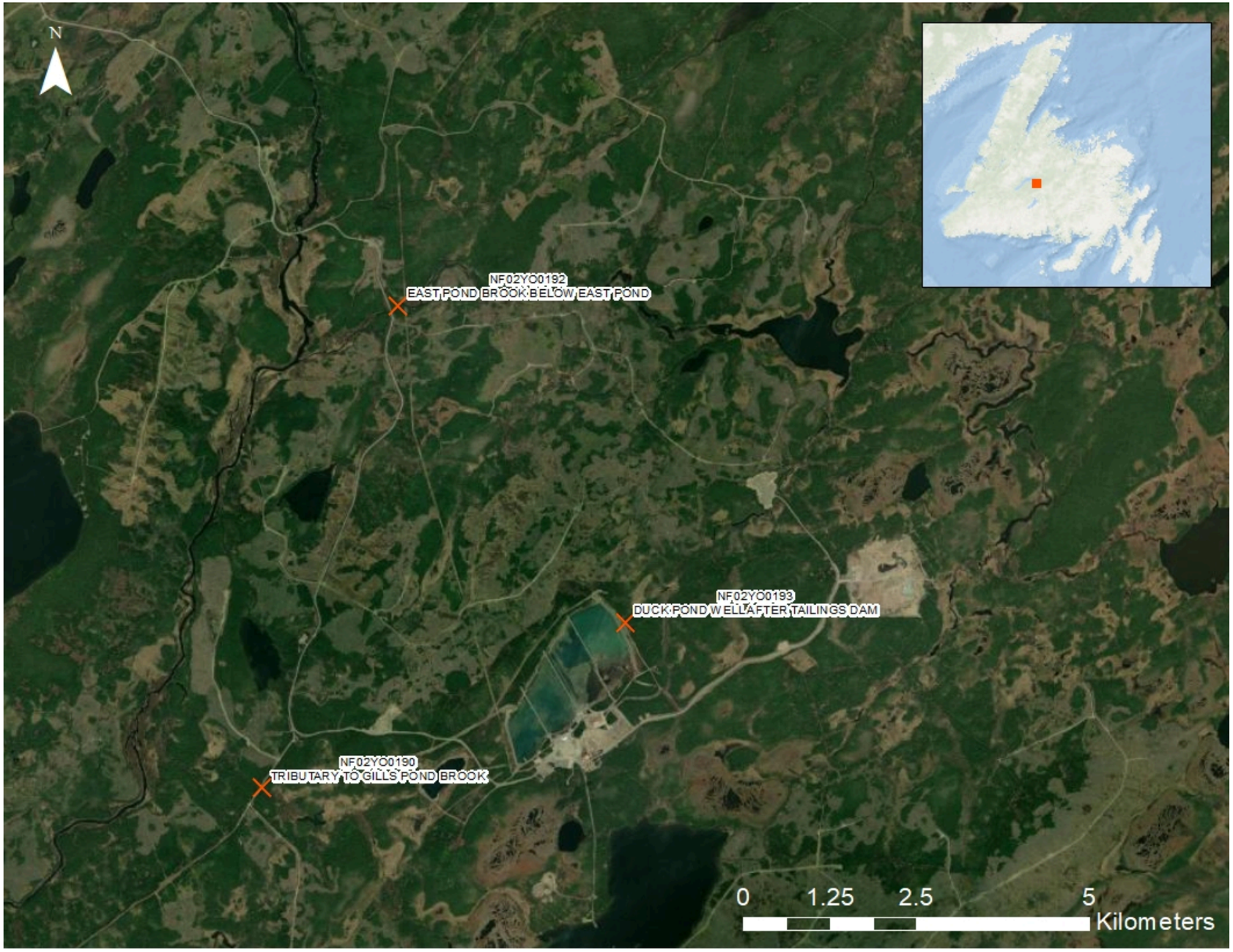
Real Time Water Quality Deployment Report
TECK: Duck Pond Operations
NF02YO0190 & NF02YO0192

2024-07-30 to 2024-09-09

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 2024-07-30 through to 2024-09-09.

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, all parameters ranked excellent or good at both stations. Upon removal, all parameters ranked excellent or good at both stations except for pH at Tributary to Gill's Pond Brook which ranked poor. The field sonde deployed at Tributary to Gill's experienced pH sensor drift throughout the deployment period, resulting in a difference in values between the QAQC and field sonde upon removal. Grab samples rankings at East Pond Brook ranged between excellent to poor. 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. Grab sample rankings at Tributary to Gill's ranged between excellent to good.

QAQC Rankings

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

Instrument Malfunction

The HL7 instrument that is normally deployed at Tributary to Gill's Pond Brook was sent back to the manufacturer after the previous May to July deployment due to sensor malfunction. The station did not transmit water quality data in real-time throughout this deployment period, however a DS5 instrument was deployed to log internally. The data for Tributary to Gill's Pond Brook was retrieved from the internal log file 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 2024-07-30 until 2024-09-09. The minimum water temperature at East Pond Brook was 10.72°C and occurred on 2024-09-05, while the maximum water temperature, 30.86 °C, occurred on 2024-07-30. The minimum water temperature at Tributary to Gill's Pond Brook was 10.89°C and occurred on 2024-09-05, while the maximum water temperature, 28.86°C, occurred on 2024-07-30. 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.

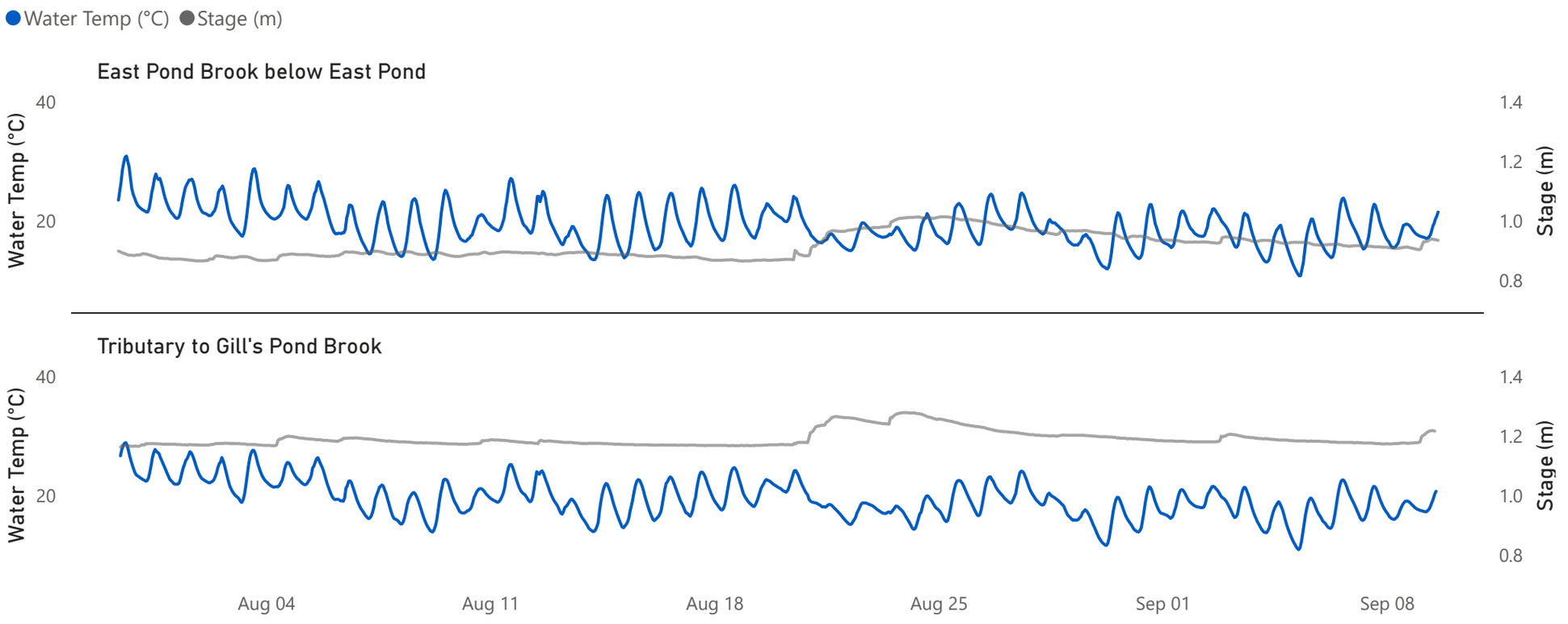
Throughout this deployment period, a natural diurnal pattern was evident, with warmer temperatures during daylight hours and cooler temperatures at night. A decreasing trend was observed at both stations, which would be expected during the seasonal transition from summer to autumn months.

East Pond Brook Below East Pond

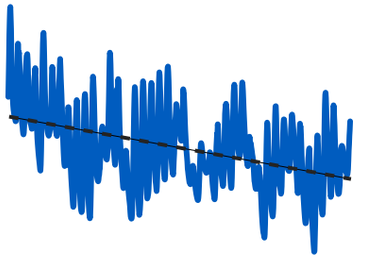
19.28 Average	18.90 Median
10.72 Minimum	30.86 Maximum

Tributary to Gill's Pond Brook

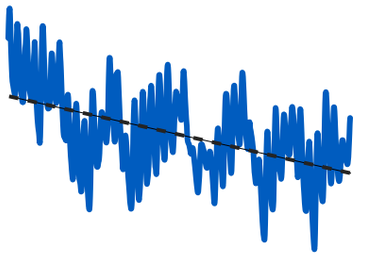
19.43 Average	19.10 Median
10.89 Minimum	28.86 Maximum



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 5.26 to 7.19 pH units, while pH at Tributary to Gill's Pond Brook ranged between 7.34 to 9.19 pH units. Daily pH fluctuations are common and often result from temperature changes and the respiration of aquatic plants, particularly in summer.

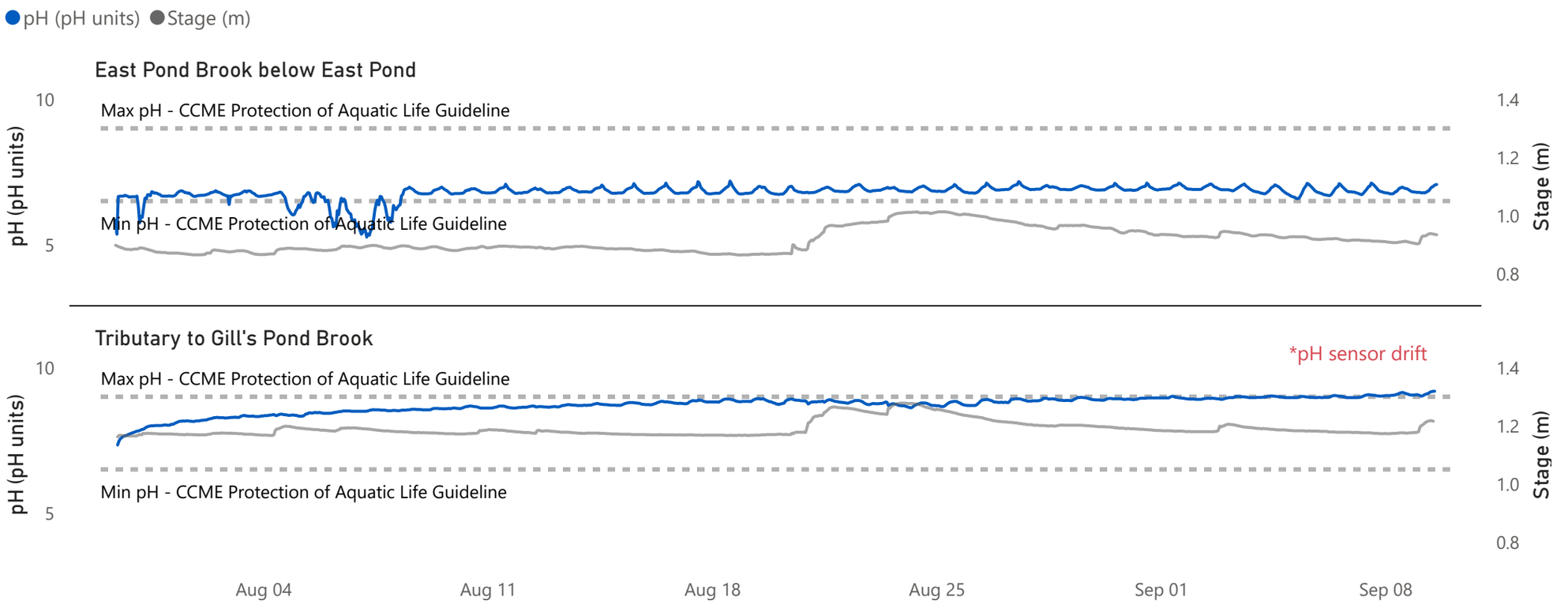
During the early stages of the deployment period, pH levels at East Pond Brook were unstable as the freshly calibrated sensor adjusted to its environment. By August 8, pH readings had stabilized and remained consistent for the rest of the period, staying within CCME guidelines after the first week. In contrast, pH levels at the Tributary to Gill's Pond Brook showed a continuous increase, suggesting sensor malfunction or drift. These readings are higher than the station's typical range of 6.5 to 7.5 pH units, indicating the data is likely inaccurate.

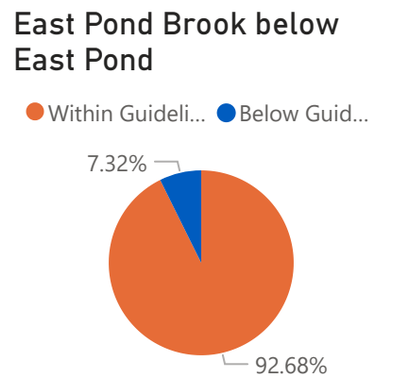
East Pond Brook Below East Pond

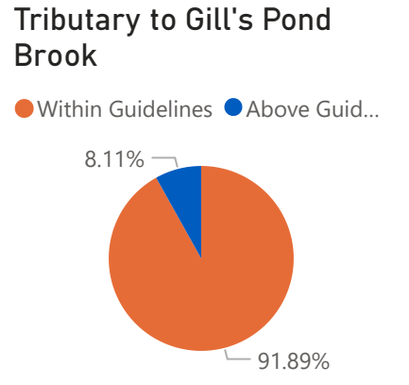
6.80 Average	6.84 Median
5.26 Minimum	7.19 Maximum

Tributary to Gill's Pond Brook

8.72 Average	8.79 Median
7.34 Minimum	9.19 Maximum







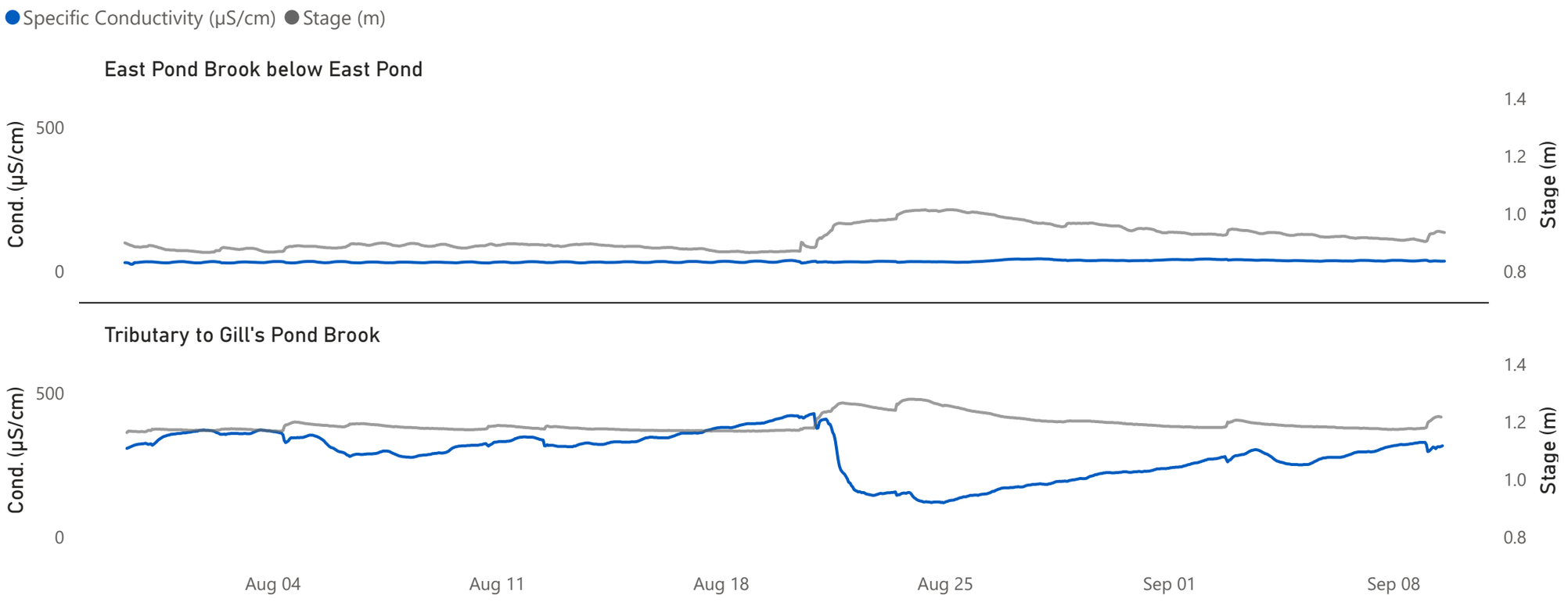
Specific Conductivity

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 23.40 µS/cm to 42.60 µS/cm, and remained generally low and stable across the deployment period. Small fluctuations can be associated with precipitation events.

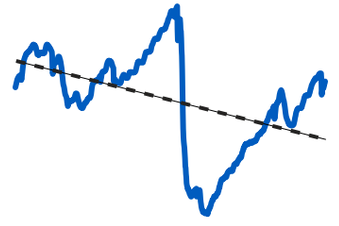
Specific conductivity at Tributary to Gill's Pond Brook ranged between 118.00 µS/cm and 428.00 µS/cm. Conductivity varied slightly which may be related to the discharge of effluent into the brook and/or precipitation events. One large decrease around August 21 coincides with a stage increase related to a precipitation event. After the substantial dip, conductivity started increasing back up to background levels but there was an overall downward trend throughout the period.

East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
33.37 Average	32.30 Median	287.88 Average	302.00 Median
23.40 Minimum	42.60 Maximum	118.00 Minimum	428.00 Maximum



East Pond Brook Trendline

Tributary to Gill's Pond Brook 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 6.90 mg/L and 10.51 mg/L, while DO at Tributary to Gill's Pond Brook ranged between 7.07 mg/L and 10.74 mg/L. Values stayed above the CCME Guideline for the protection of other life stages at both stations. However, values stayed below the minimum guideline for early life stages at both stations for the majority of the period. These DO levels would be expected given the water temperatures.

East Pond Brook Below East Pond

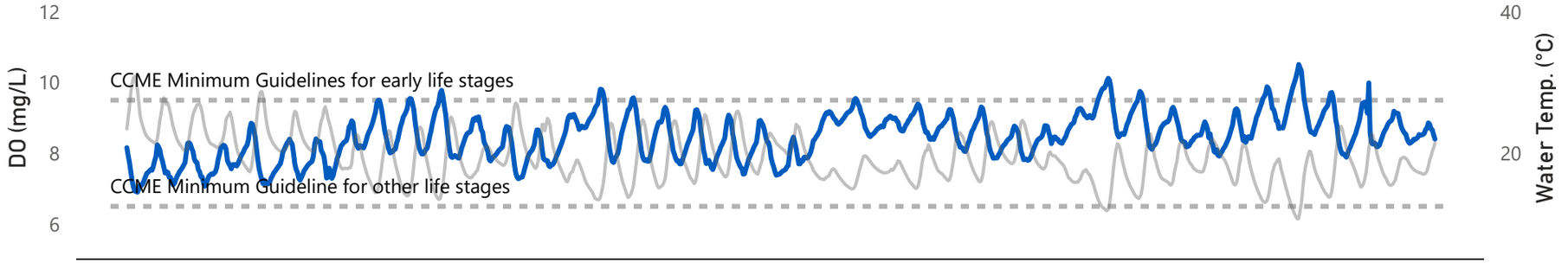
8.46 Average	8.46 Median
6.90 Minimum	10.51 Maximum

Tributary to Gill's Pond Brook

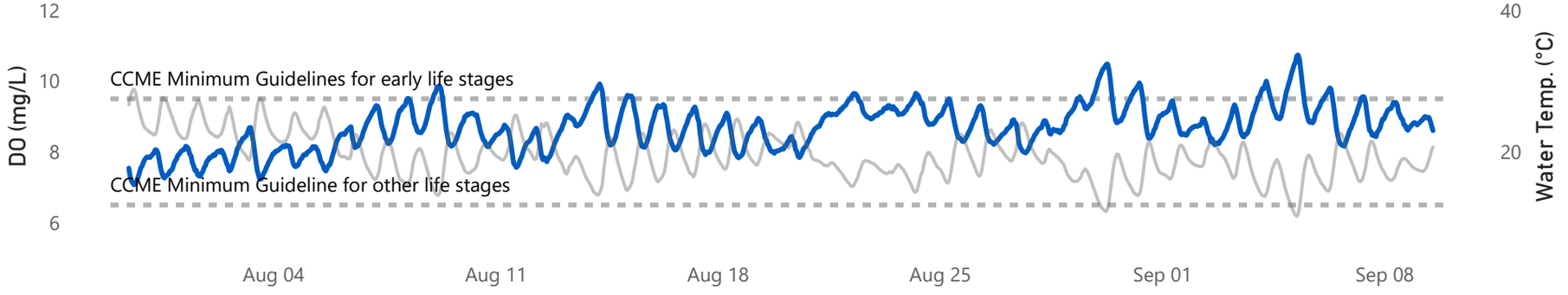
8.68 Average	8.69 Median
7.07 Minimum	10.74 Maximum

DO (mg/L) Water Temperature (°C)

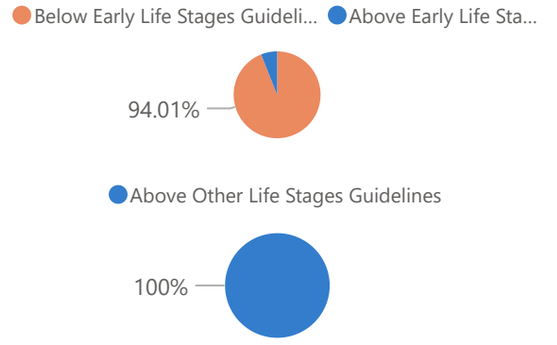
East Pond Brook below East Pond



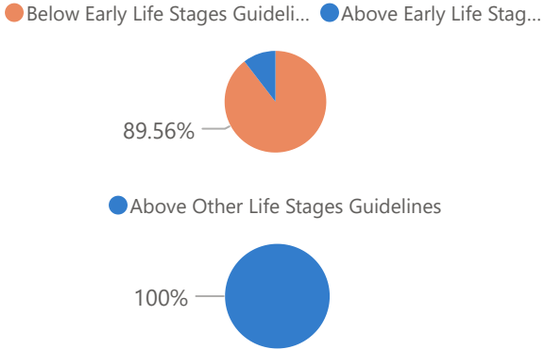
Tributary to Gill's Pond Brook



East Pond Brook



Tributary to Gill's Pond Brook

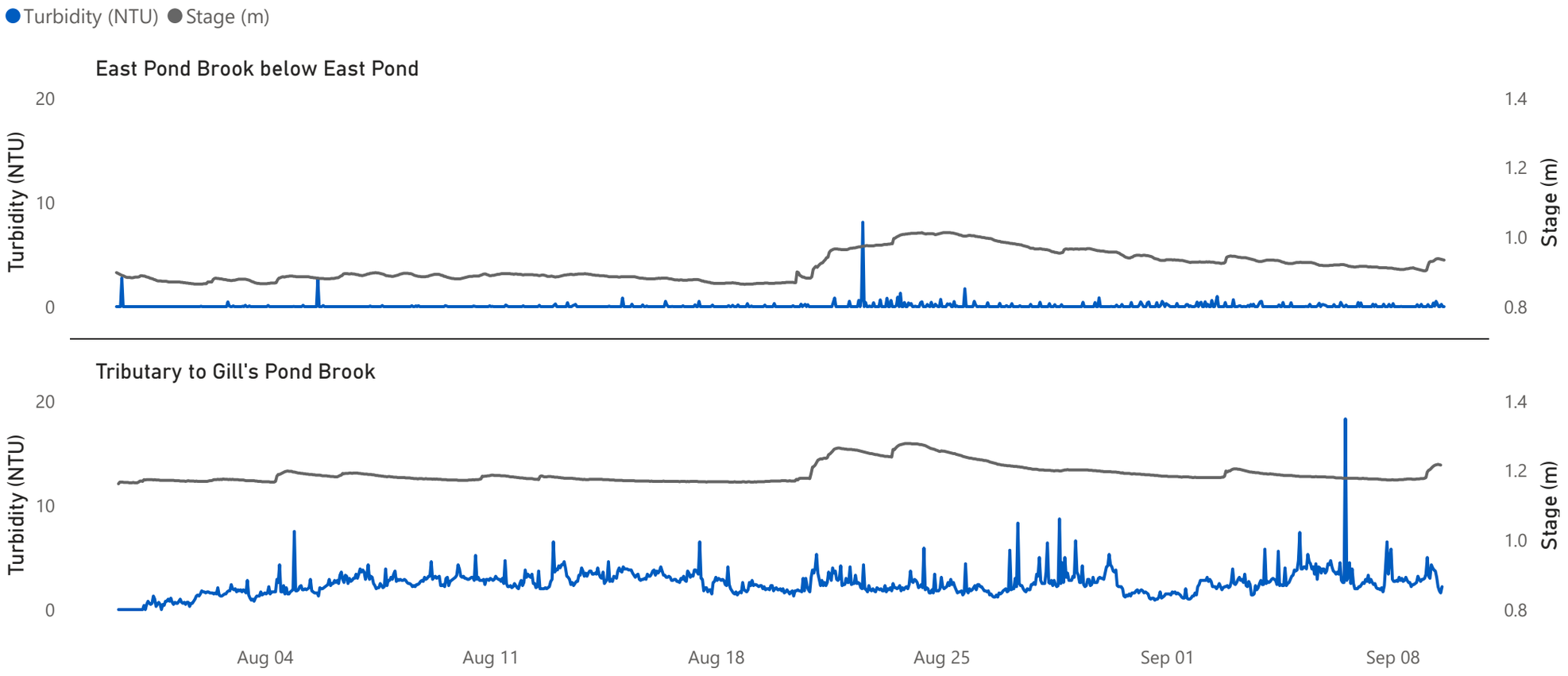


Turbidity

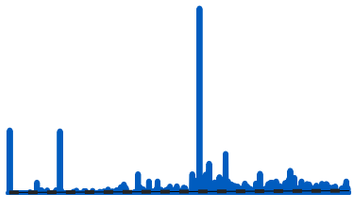
Turbidity, or water cloudiness, often increases during precipitation events when runoff carries silt and debris into the waterbody. Elevated turbidity can block light from reaching aquatic plants, disrupt benthic habitats, and harm fish gills or equipment.

Turbidity at East Pond Brook ranged between 0.00 NTU and 8.10 NTU. Turbidity at Tributary to Gill's Pond Brook ranged between 0.00 NTU and 18.30 NTU. Turbidity at both stations remained relatively low and stable throughout the deployment period, with a slightly increasing trend. Tributary to Gill's Pond Brook is a small brook that is more noticeably impacted by precipitation events which attributed to the higher fluctuation compared to East Pond Brook. Turbidity spikes are often associated with precipitation events or sediment passing by the sensor during measurements, but values generally returned to background levels.

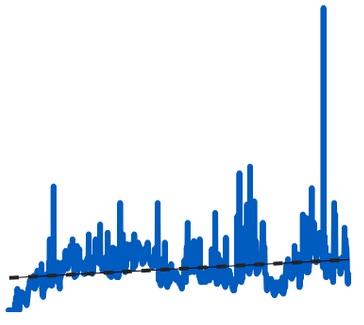
East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
0.06 Average	0.00 Median	2.51 Average	2.40 Median
0.00 Minimum	8.10 Maximum	0.00 Minimum	18.30 Maximum



East Pond Brook Trendline



Tributary to Gill's Trendline

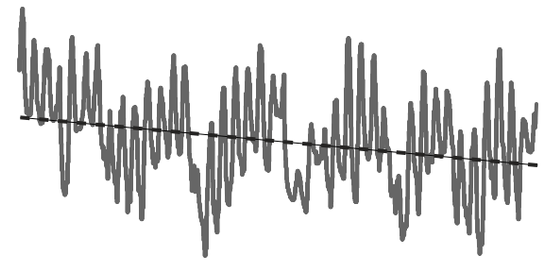


Meteorological and Hydrometric Data

Millertown, NL MET Station Data

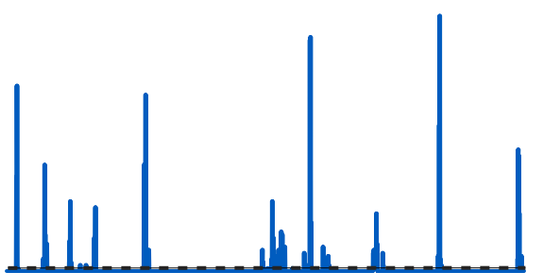
Newfoundland Labrador

Air Temperature Trendline



17.80	17.60
Average (°C)	Median (°C)
6.50	30.90
Minimum (°C)	Maximum (°C)

Precipitation Trendline



0.10	0.00
Average (mm/hr)	Median (mm/hr)
0.00	8.40
Minimum (mm/hr)	Maximum (mm/hr)