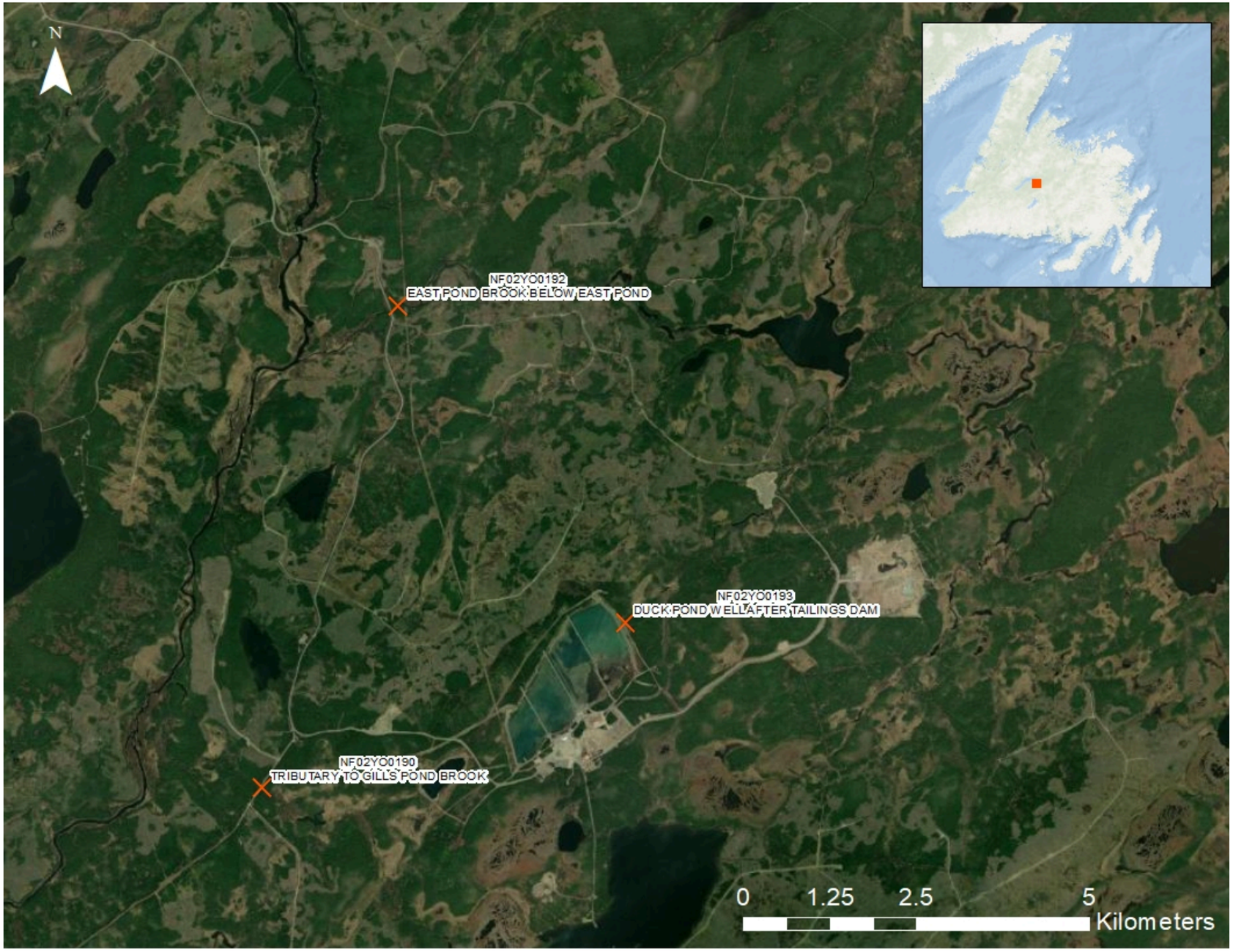
Real Time Water Quality Deployment Report
TECK: Duck Pond Operations
NF02YO0190 & NF02YO0192

2022-11-15 to 2023-05-16

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 Gills Pond Brook and East Pond Brook below East Pond, for the duration of 2022-11-15 through to 2023-05-16.

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
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.

East Pond Brook QAQC Rankings

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

Tributary to Gills Pond Brook QAQC

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

QAQC Notes:

East Pond Brook had an unscheduled removal on January 25th, 2023 to prevent damage due to excessive ice conditions.

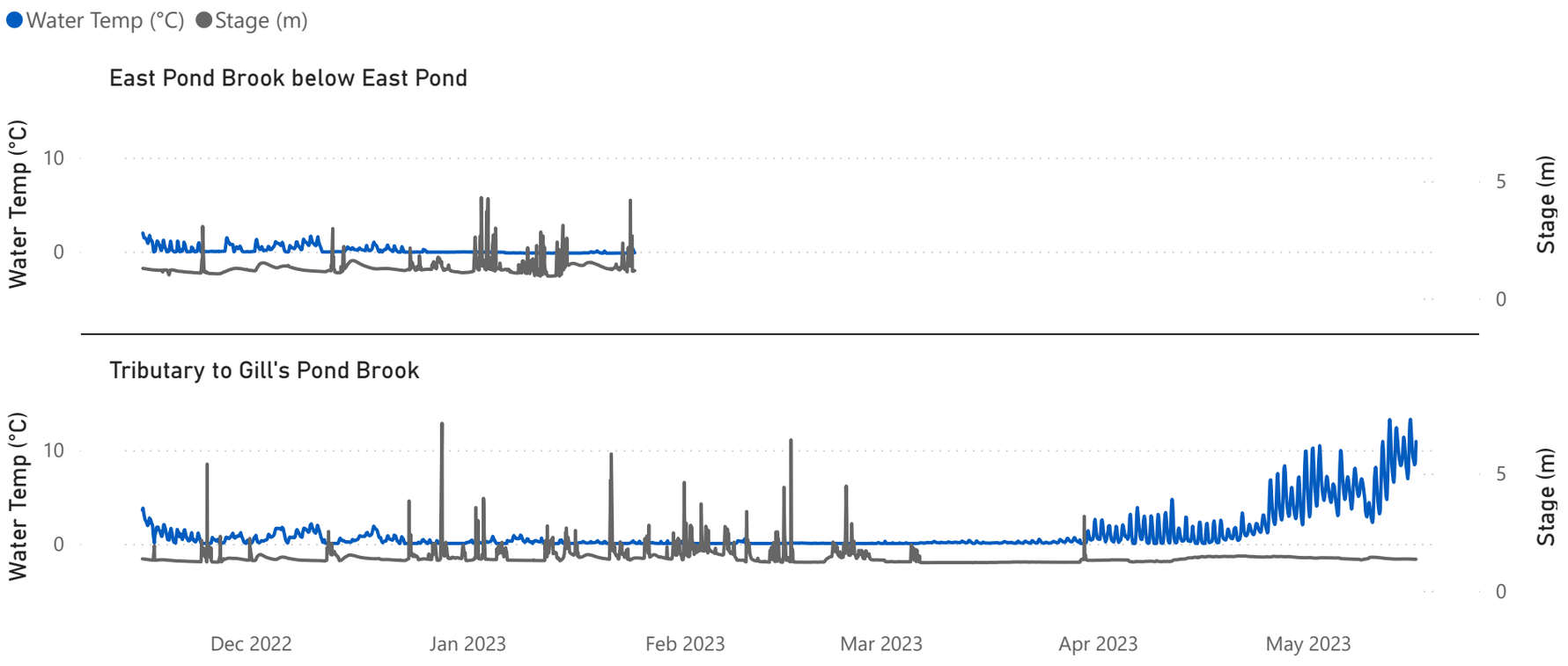
The pH sensor at East Pond Brook was not fully acclimated by the end of deployment; however, the first transmission when compared to the QAQC and Grab Sample provided an Excellent and Good results respectively.

Water Temperature

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.

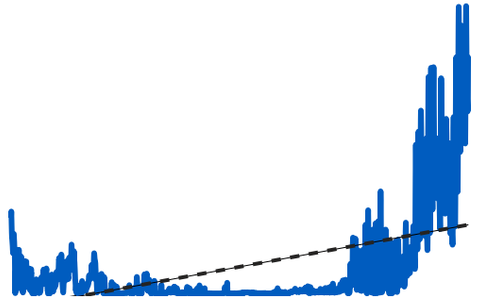
Water temperature data for this deployment was collected from 2022-11-15 until 2023-05-16. The minimum water temperature at East Pond Brook, -0.19°C, occurred on 2023-01-20. and the maximum water temperature, 1.97°C, occurred on 2022-11-15. The minimum water temperature at Tributary to Gill's Pond Brook, -0.19°C, occurred on 2023-01-20. The maximum water temperature, 1.97°C, occurred on 2022-11-15. Water temperature usually falls overnight and rises during the day. 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 the tree canopy. East Pond Brook had a slight decreasing trend because it was removed before waters began warming. Overall Tributary to Gill's Pond Brook had a warming trend due to the warming air and water temperatures in April and May.

East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
0.14 Average	-0.04 Median	1.12 Average	0.19 Median
-0.19 Minimum	1.97 Maximum	0.01 Minimum	13.27 Maximum



East Pond Brook Trendline

Tributary to Gill's Trendline



pH

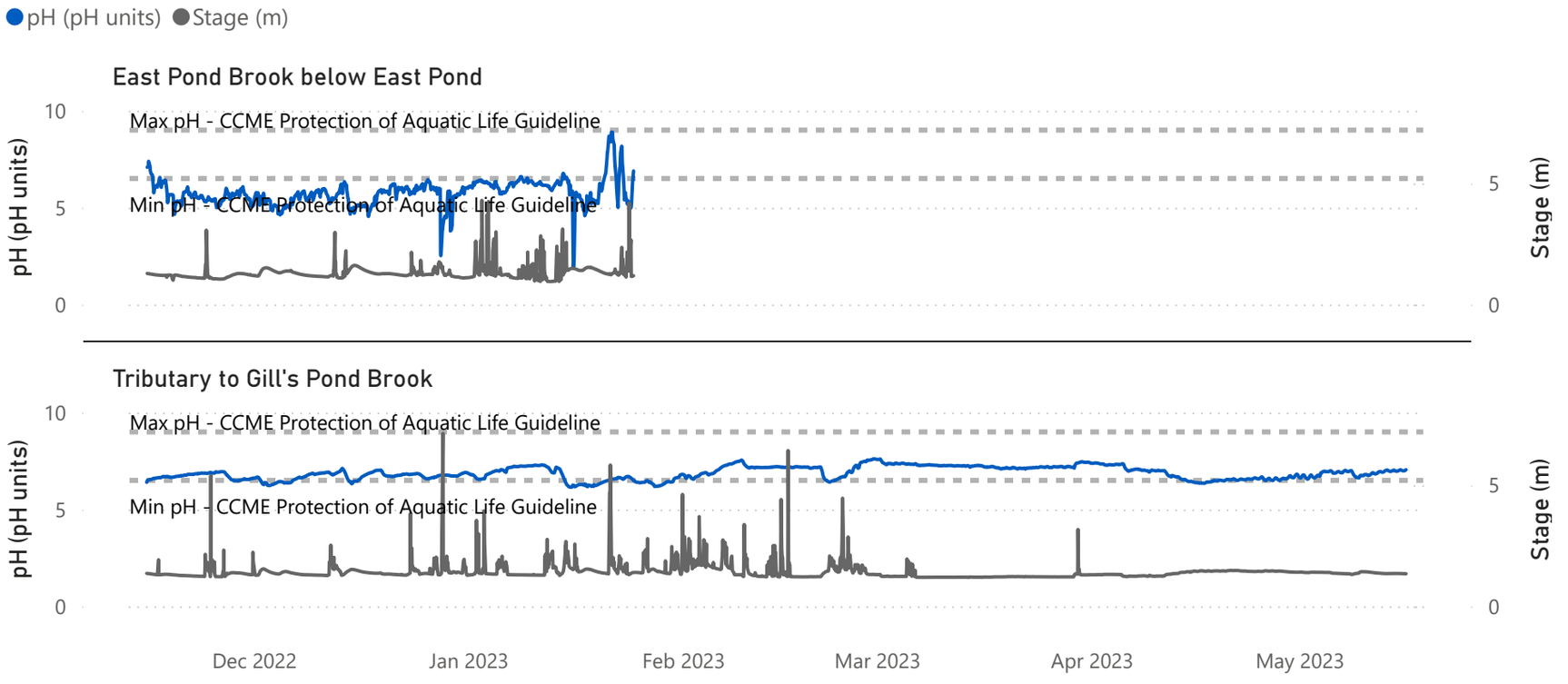
pH relates to the free hydrogen ions in water and it is a measure of acidity in water. A pH of 7 indicates a neutral pH, below 7 is considered acidic, and above 7 is considered basic. The Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life guideline provides a basis by which 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 2022-11-15 until 2023-05-16. The min pH at East Pond Brook was, 1.90 pH units, occurred on 2023-01-16. and the max pH, 9.07 pH units, occurred on 2023-01-21. The min pH at Tributary to Gill's Pond Brook was, 6.12 pH units, occurred on 2023-01-15 and the max pH, 7.61pH units, occurred on 2023-02-28. Daily fluctuations are common due to changes in temperature and respiration of aquatic plants. During this deployment period, pH in East Pond Brook was below the guidelines 93.2% of the time and within guidelines 6.69% of the time and above guidelines 0.11% of the time. The sonde was removed early because it was not properly secured to the bottom of the river so it may have been exposed to the air causing erroneous pH fluctuations. During this deployment period, pH in Tributary to Gill's Pond Brook was below the guidelines 13.97% of the time and within guidelines 86.03% of the time.

East Pond Brook Below East Pond

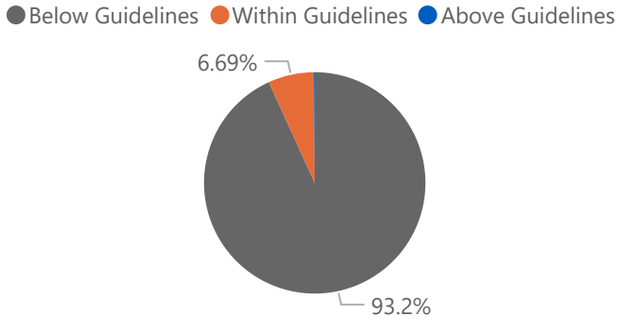
5.77 Average	5.78 Median
1.90 Minimum	9.07 Maximum

Tributary to Gill's Pond Brook

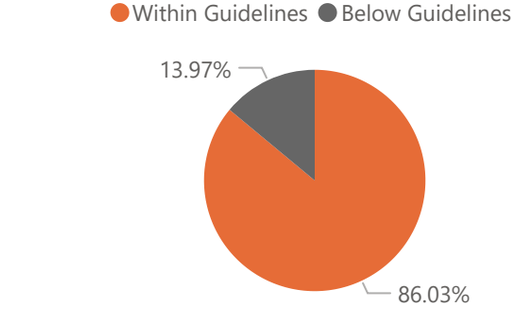
6.88 Average	6.87 Median
6.12 Minimum	7.61 Maximum



East Pond Brook below East Pond



Tributary to Gill's Pond Brook



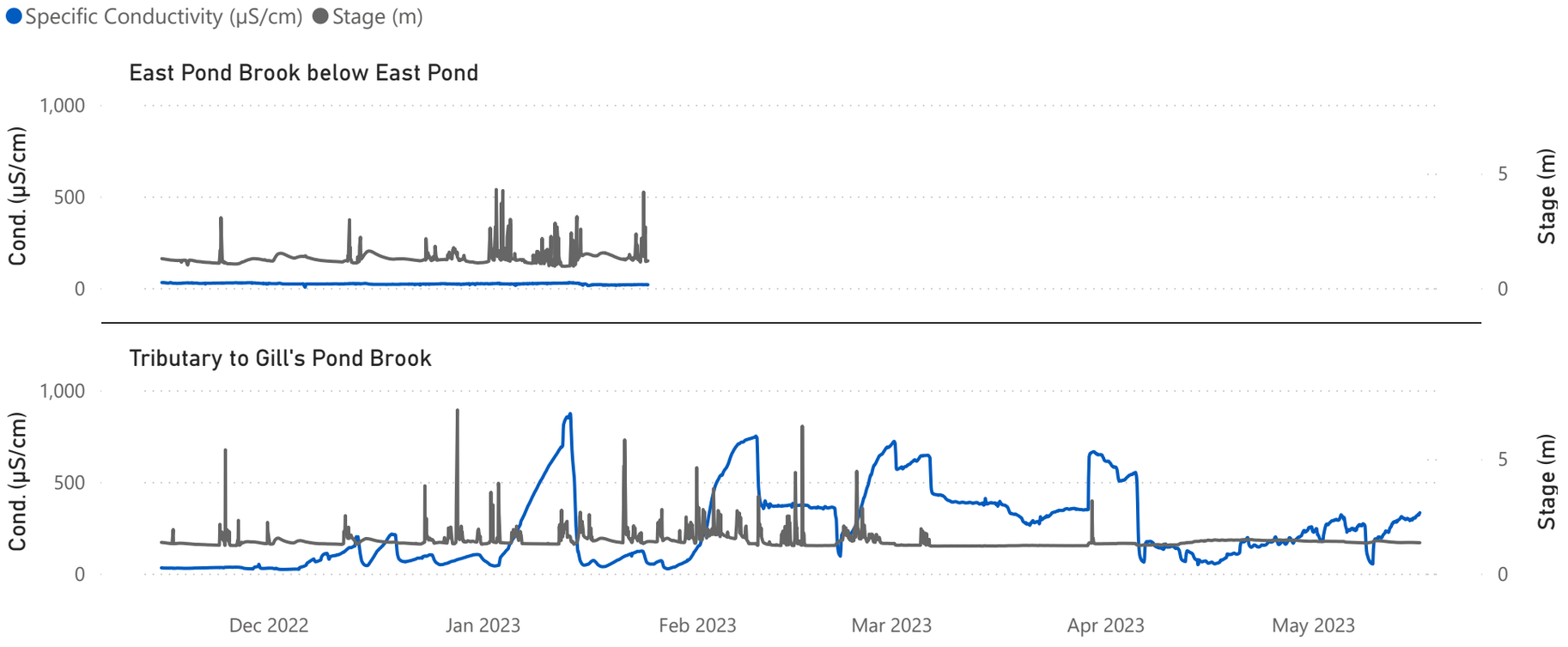
Specific Conductivity

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 conductance data for this deployment was collected from 2022-11-15 until 2023-05-16. The minimum specific conductance at East Pond Brook, 4.00 µS/cm, occurred on 2022-12-06, and the maximum specific conductance, 30.00 µS/cm, occurred on 2022-11-15. The minimum specific conductance at Tributary to Gill's Pond Brook, 22.50 µS/cm, occurred on 2022-12-02, and the maximum specific conductance, 874.00 µS/cm, occurred on 2023-01-13. Precipitation and specific conductivity are corelated. Rain water generally has a lower specific conductivity than surface water.

The specific conductivity at East Pond Brook remained consistent throughout the deployment period. The specific conductivity at Tributary to Gill's Pond Brook increased throughout the deployment.

East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
22.95	23.00	246.18	183.20
Average	Median	Average	Median
4.00	30.00	22.50	874.00
Minimum	Maximum	Minimum	Maximum



Dissolved Oxygen

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 2022-11-15 until 2023-05-16. The minimum DO reading at East Pond Brook, 12.21 mg/L, occurred on 2023-01-14, and the maximum DO reading, 13.50 mg/L, occurred on 2022-12-06. The minimum DO reading at Tributary to Gill's Pond Brook, 9.76 mg/L, occurred on 2023-05-15, and the maximum DO reading, 13.74 mg/L, occurred on 2022-12-23. Daily fluctuations are common due to changes in temperature and respiration of aquatic plants.

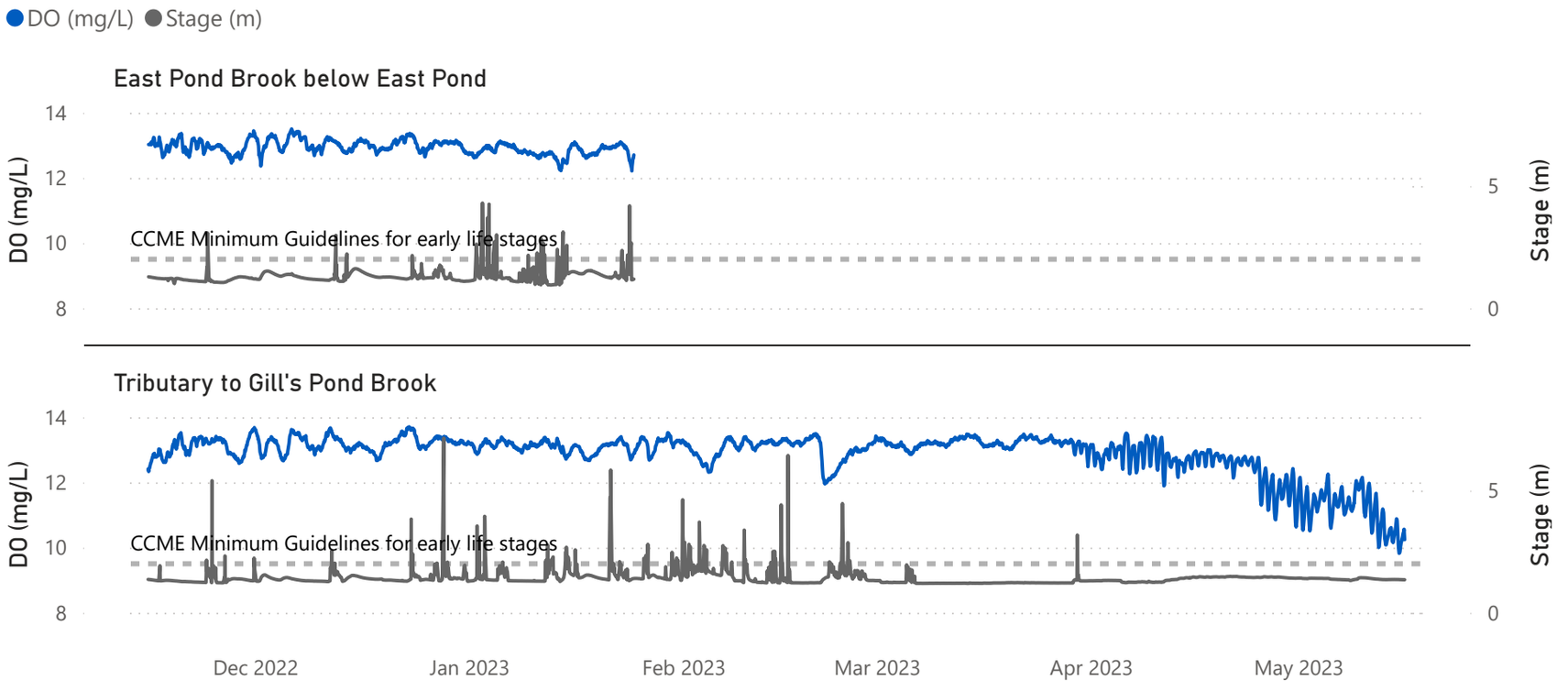
The DO at both stations was above minimum guidelines 100% of the time. This is expected for this time of year when colder waters can hold higher concentrations of DO.

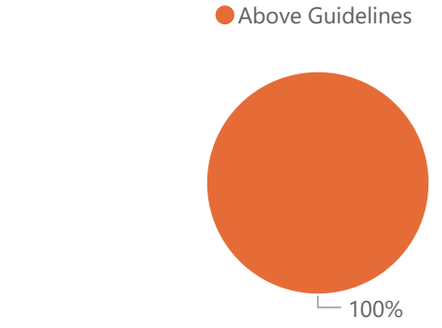
East Pond Brook Below East Pond

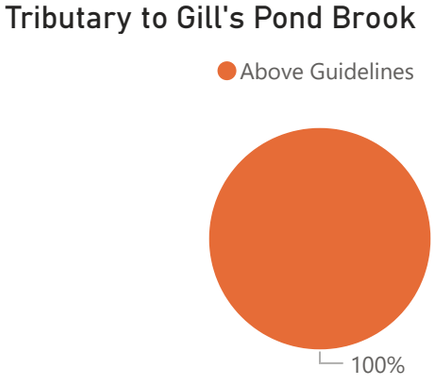
12.94 Average	12.94 Median
12.21 Minimum	13.50 Maximum

Tributary to Gill's Pond Brook

12.87 Average	13.10 Median
9.76 Minimum	13.74 Maximum







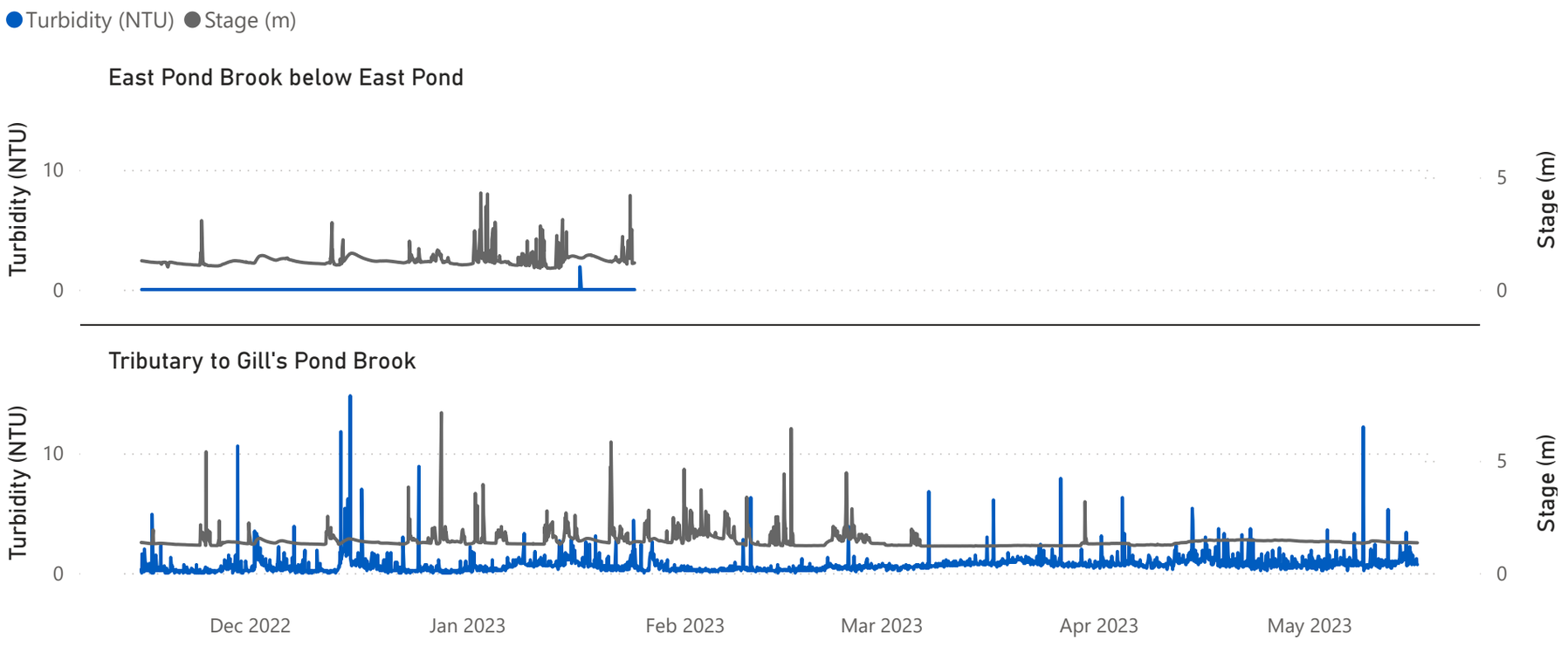
Turbidity

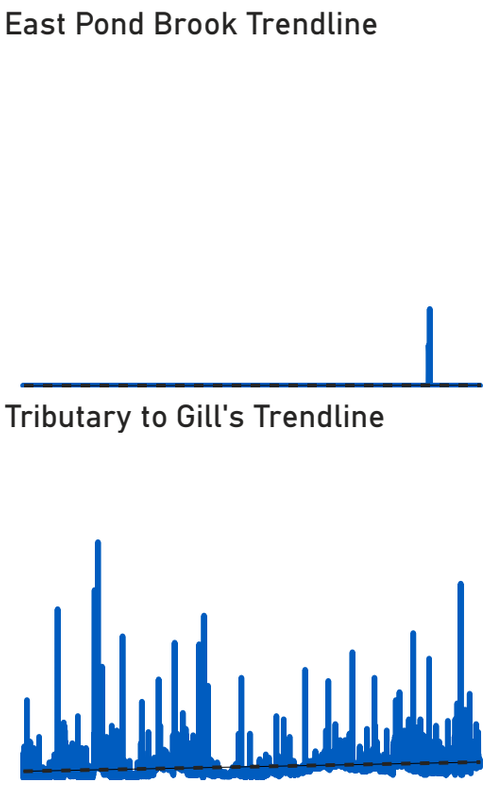
Increases in turbidity (cloudiness) are often caused by increased runoff during precipitation events. Runoff carries silt and other debris into the waterbody. Turbid conditions can prevent light from reaching plants, negatively impact benthic habitats, and clog or damage fish gills and equipment.

Turbidity data for this deployment was collected from 2022-11-15 until 2023-05-16. The minimum turbidity at East Pond Brook was 0.00 NTU, and the maximum turbidity, 3.60 NTUs, occurred on 2023-01-17. The minimum turbidity at Tributary to Gill's Pond Brook was 0.00 NTU, and the maximum turbidity, 14.80 NTU, occurred on 2022-12-15.

The turbidity at East Pond Brook was consistent throughout this deployment period. The turbidity at Gill's Pond Brook increased slightly during this time, which may be a result of snow melt in the spring, or biofouling after the extended six month deployment.

East Pond Brook Below East Pond		Tributary to Gill's Pond Brook	
0.00 Average	0.00 Median	0.69 Average	0.60 Median
0.00 Minimum	3.60 Maximum	0.00 Minimum	14.80 Maximum

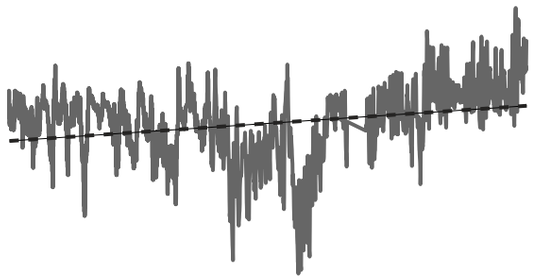




Meteorological and Hydrometric Data

Newfoundland Labrador

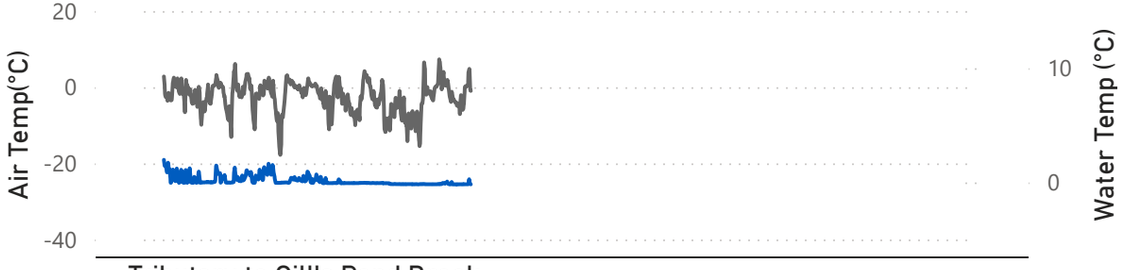
Air Temperature Trendline



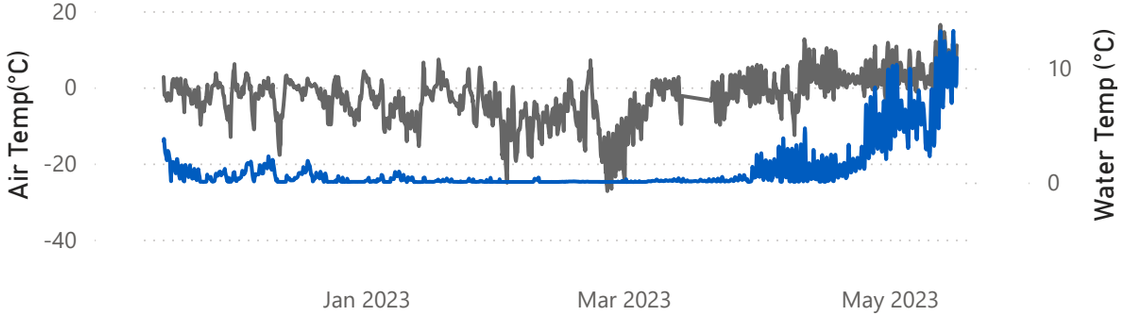
-2.63	-1.80
Average (°C)	Median (°C)
-27.30	16.40
Minimum (°C)	Maximum (°C)

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

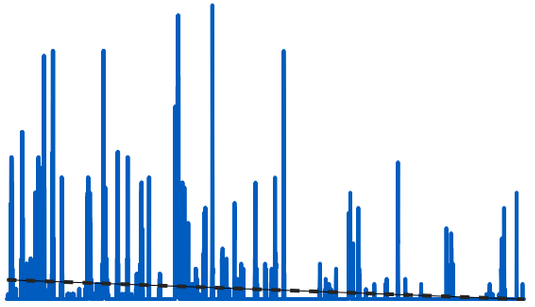
East Pond Brook below East Pond



Tributary to Gill's Pond Brook



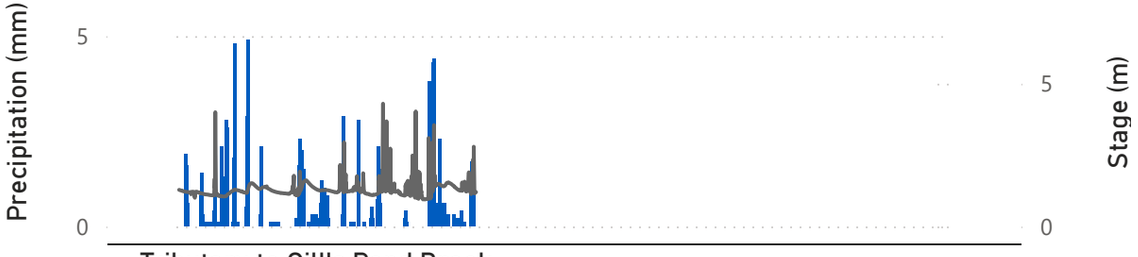
Precipitation Trendline



0.15	0.00
Average (mm/hr)	Median (mm/hr)
0.00	5.80
Minimum (mm/hr)	Maximum (mm/hr)

● Precipitation (mm) ● Stage (m)

East Pond Brook below East Pond



Tributary to Gill's Pond Brook