



# Real-Time Water Quality Deployment Report

## Teck: Duck Pond Operations

November 18, 2020 to May 03, 2021



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

This report will review the water quality data for the following two real-time water quality monitoring stations at TECK Duck Pond, Tributary to Gills Pond Brook and East Pond Brook below East Pond for the duration of November 18, 2020 through to May 3, 2021.

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 the real-time website:

<https://www.gov.nl.ca/ecc/waterres/rti/rtwg/>

The length of the deployment, 165 days, was a result of the instruments remaining in the brook over the winter season. This is a common occurrence at these sites during this time of year. The instruments remain protected under the ice and continue to provide data throughout the deployment.

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/climate\\_data/daily\\_data\\_e.html?hlyRange=2013-01-21%7C2020-05-28&dlyRange=2013-01-21%7C2020-05-28&mlyRange=%7C&StationID=50678&Prov=NL&urlExtension=e.html&searchType=stnName&optLimit=yearRange&StartYear=2020&EndYear=2020&selRowPerPage=25&Line=0&searchMethod=contains&Month=5&Day=28&txtStationName=Millertown&timeframe=2&Year=2020](https://climate.weather.gc.ca/climate_data/daily_data_e.html?hlyRange=2013-01-21%7C2020-05-28&dlyRange=2013-01-21%7C2020-05-28&mlyRange=%7C&StationID=50678&Prov=NL&urlExtension=e.html&searchType=stnName&optLimit=yearRange&StartYear=2020&EndYear=2020&selRowPerPage=25&Line=0&searchMethod=contains&Month=5&Day=28&txtStationName=Millertown&timeframe=2&Year=2020)

## Maintenance and Calibration of Instrument

As part of the Quality Assurance and Quality Control protocol (QAQC), 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.

Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.

At the end of a deployment period, a freshly cleaned and calibrated QAQC Sonde is placed *in situ*, adjacent to the Field Sonde. Values are compared between all parameters and differences are ranked for placement in Table 1.

Table 1: Qualitative QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Tributary to Gill's Pond Brook	Nov 18 2020	Deployment	Good	Fair	Good	Excellent	Good
	May 3 2021	Removal	Excellent	Fair	Good	Good	Excellent
East Pond Brook below East Pond	Nov 18 2020	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	May 3 2021	Removal	Excellent	Fair	Excellent	Excellent	Excellent

## Data Interpretation

### Water Temperature

Water Temperature is a major factor used to describe water quality. Temperature has major implications on both the ecology and chemistry of a water body, governing processes such as the metabolic rate of aquatic plants and animals and the degree of dissolved oxygen saturation.

The statistical data for Tributary to Gills Pond Brook recorded a temperature range of -0.02°C to 10.95°C during this deployment period. The water temperature at East Pond Brook ranged from 0.0°C to 11.40°C (Table 2).

At both stations, water temperature was low over the course of the deployment until late March, when the temperatures started to increase. This change in water temperature is a natural process as the seasons change from winter into spring temperatures. Water temperature has a natural diurnal pattern with higher temperatures in the day light hours and lower temperatures after dark.

Stage Level data is raw data, and the data has not been corrected (Appendix II). Corrected and finalized data may be retrieved from the Environment Climate Change Canada, Water Survey of Canada website <https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html>

**Table 2. Table of the statistical data for East Pond Brook and Tributary to Gills Pond Brook for November 2020 to May 2021**

<b>Station</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>
East Pond Brook	1.65	0.06	0.00	11.40
Tributary to Gills Pond Brook	1.55	0.26	-0.02	10.95

### Water Temperature (C) and Stage Level (m) at East Pond Brook Below East Pond

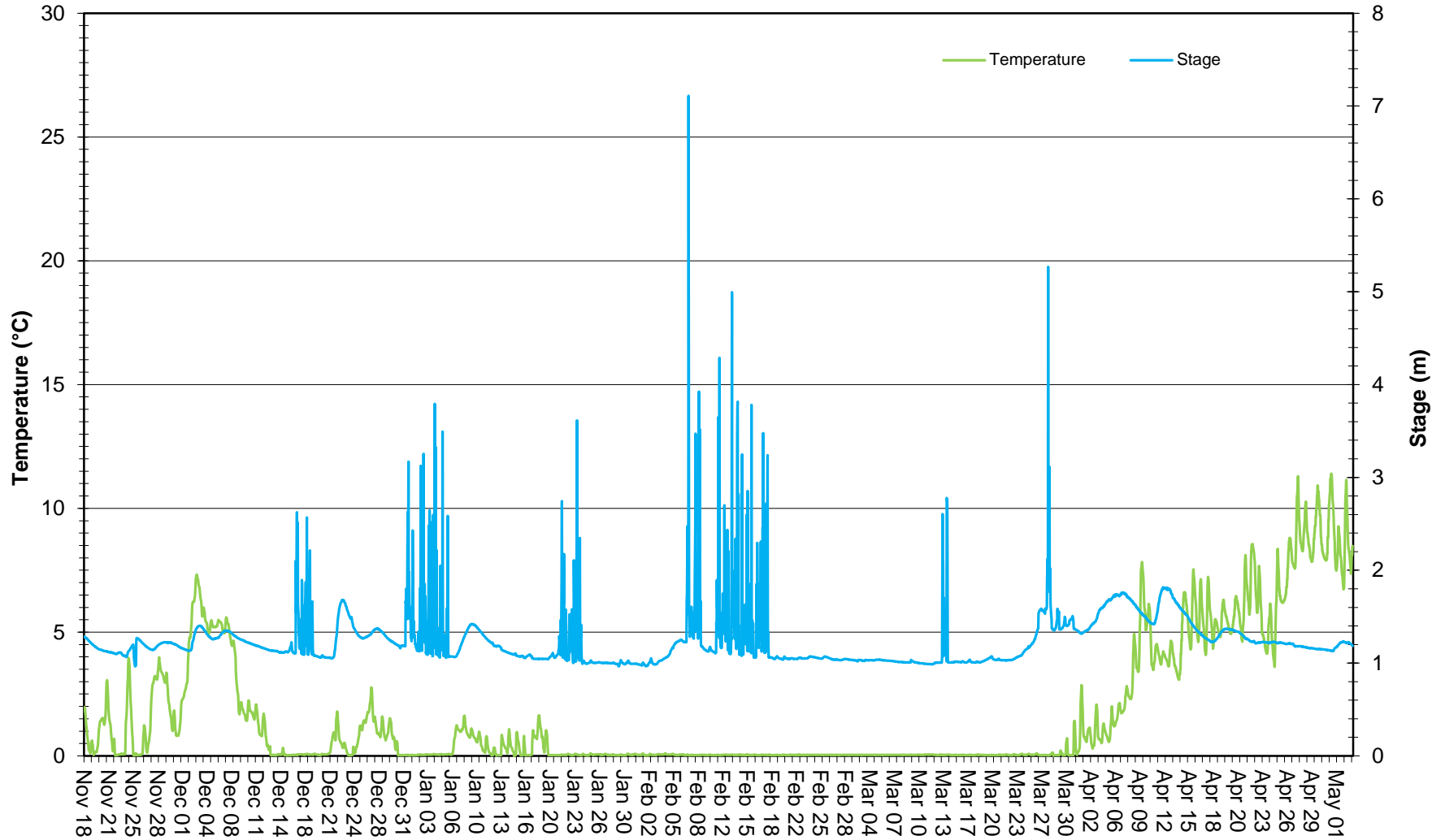


Figure 1. Water Temperature (°C) and Stage (m) at East Pond Brook

# Water Temperature (C) and Stage Level (m) at Tributary to Gill's Pond Brook

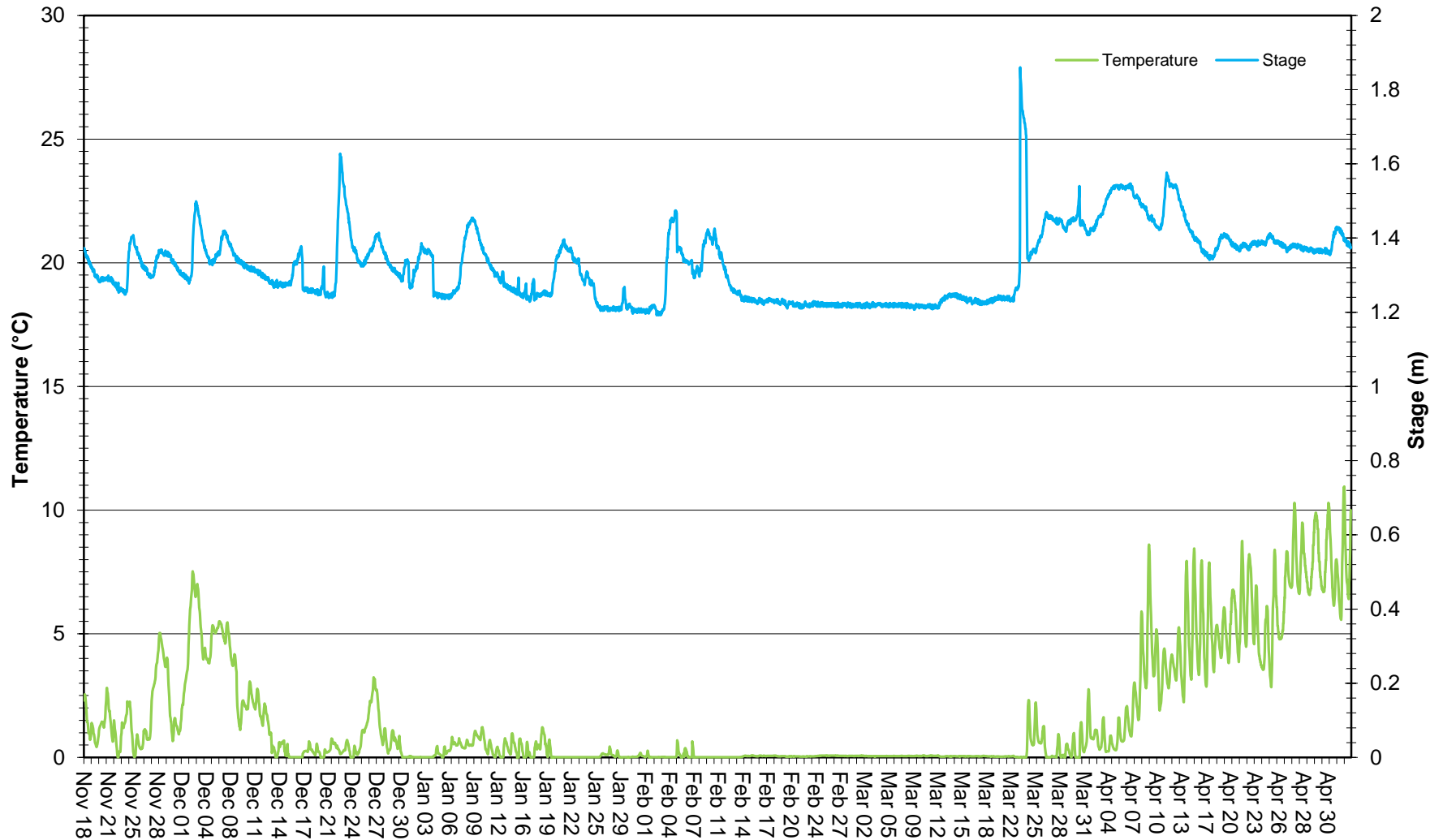


Figure 2. Water Temperature (°C) and Stage (m) at Tributary at Gills Pond Brook

## **pH**

pH indicates the acidity or alkalinity of a solution. A value of 7.00 pH units denotes a neutral solution while lower values are acidic and higher values are basic. The pH levels at Tributary to Gills Pond Brook ranged within a minimum of 5.77 (pH units) to a maximum of 7.36 (pH units) (Table 3). pH at East Pond Brook ranged from 5.75 pH units to 6.86 pH units at this time.

This was a long deployment and the data captures pH changes during the winter and through the spring. pH is influenced by precipitation runoff and snowmelt and tends to fall slightly as stage increases. During periods of drier and/or colder weather, water levels decline and pH increases slightly as dissolved ions are not as diluted.

The CCME guideline noted on the pH graph is a range by which to compare pH levels across Canada. It does not indicate the health of the brook. Due to the soil composition and natural geology of Newfoundland and Labrador, many of the brooks and waterways in the province have naturally lower pH ranges.

Stage Level data is raw data. This data has not been corrected. Corrected and finalized data, can be retrieved from the Environment Climate Change Canada, Water Survey of Canada website <https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html>

**Table 3. Table of the statistical data for East Pond Brook and Tributary to Gills Pond Brook for November 2020 to May 2021**

<b>Station</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>
East Pond Brook	6.47	6.55	5.75	6.86
Tributary to Gills Pond Brook	6.70	6.76	5.77	7.36

### pH (pH units) and Stage Level (m) at East Pond Brook below East Pond

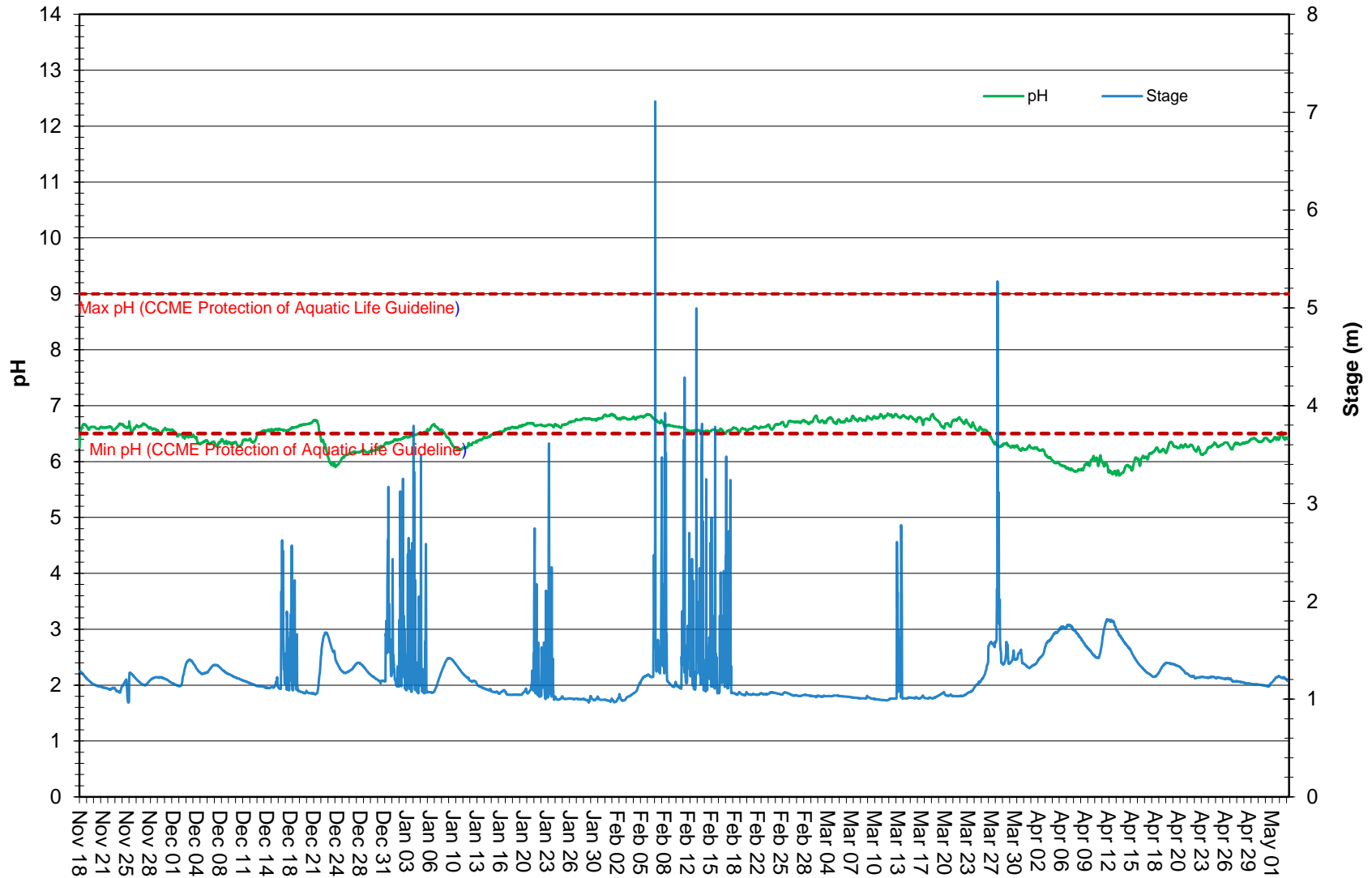


Figure 3. pH (pH units) and Stage Level (m) at East Pond Brook



# pH (pH units) and Stage Level (m) at Tributary to Gill's Pond Brook

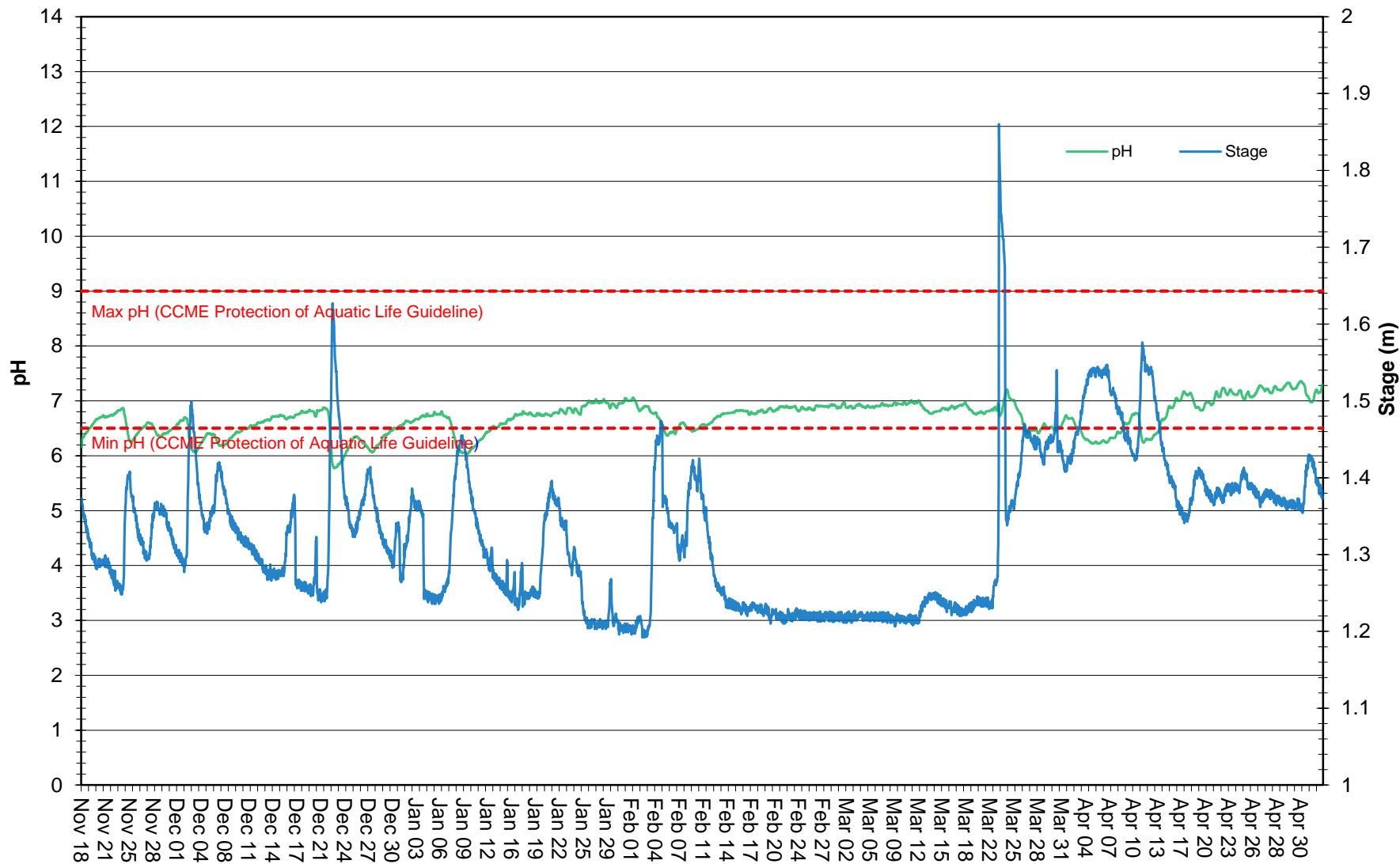


Figure 4. pH (pH units) and Stage Level (m) at Tributary at Gills Pond Brook

### **Specific Conductivity**

Conductivity relates to the ability of an electric charge – or resistance – to pass through a solution. Conductivity is highly influenced by the concentration of dissolved ions in solution: distilled water has zero conductivity (infinite resistance) while salty solutions have high conductivity (low resistance). Specific Conductivity is corrected to 25°C to allow comparison across variable temperatures.

This deployment captured the change across the winter season into the spring. Conductivity increased at Tributary to Gills Pond Brook as effluent discharge volumes increased in spring. Conductivity at Tributary to Gill's Pond Brook ranged from 15.3  $\mu\text{S}/\text{cm}$  to 560  $\mu\text{S}/\text{cm}$ . (Figures 6 and 7).

Specific conductivity at East Pond Brook ranged from 12.1 $\mu\text{S}/\text{cm}$  to 33.7 $\mu\text{S}/\text{cm}$ .

Stage Level data is raw data (Appendix II). This data has not been corrected. Corrected and finalized data may be retrieved from the Environment Climate Change Canada, Water Survey of Canada website <https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html>

**Table 4. Table of the statistical data for East Pond Brook and Tributary to Gills Pond Brook for November 2020 to May 2021**

<b>Station</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>
East Pond Brook	22.6	22.3	12.1	33.7
Tributary to Gills Pond Brook	140.1	97.6	15.3	560.0

### Specific Conductivity ( $\mu\text{S}/\text{cm}$ ) and Stage Level (m) at East Pond Brook

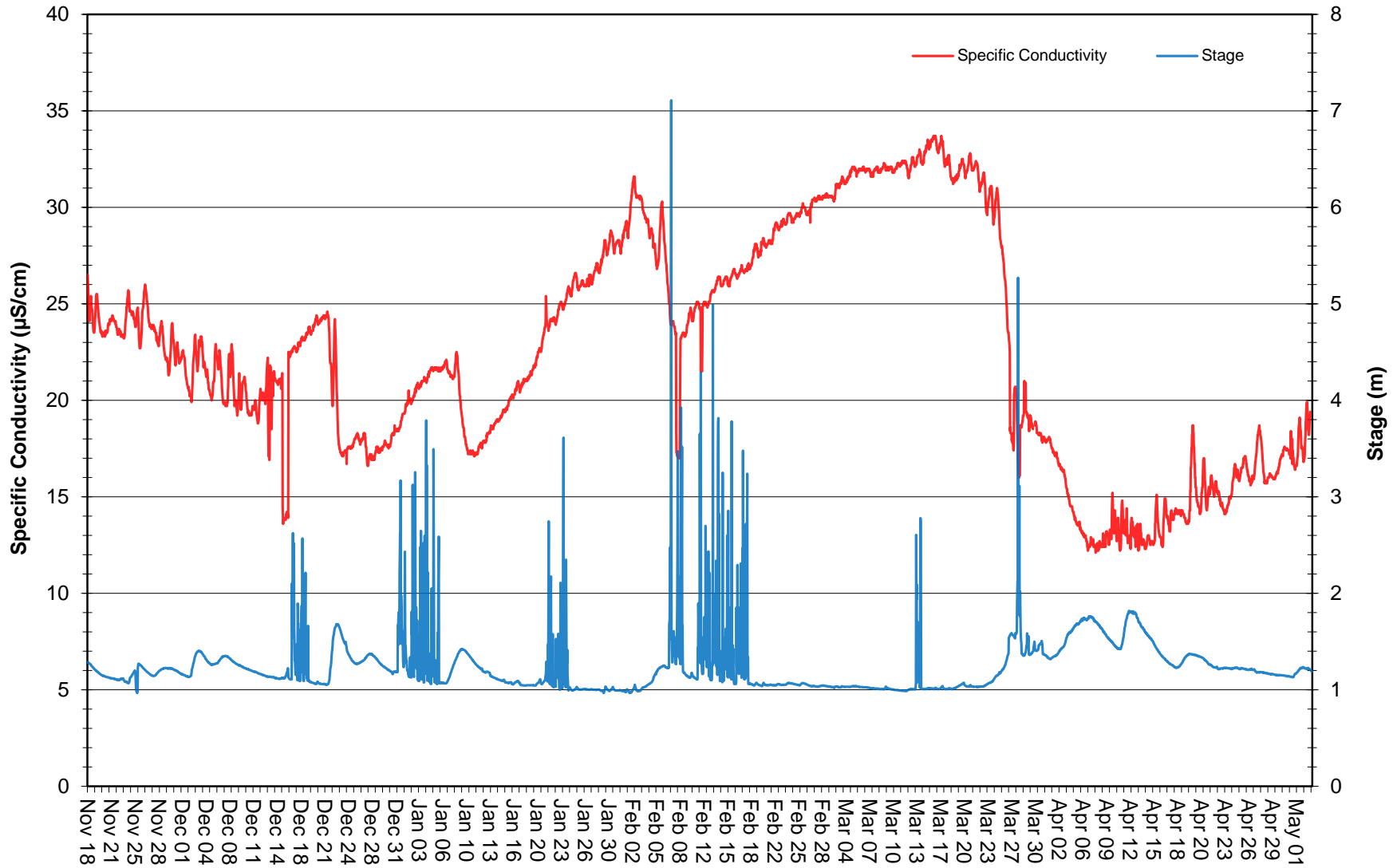


Figure 5. Specific Conductivity ( $\mu\text{S}/\text{cm}$ ) and Stage Level (m) at East Pond Brook

### Specific Conductivity ( $\mu\text{S}/\text{cm}$ ) and Stage Level (m) at Tributary to Gill's Pond Brook

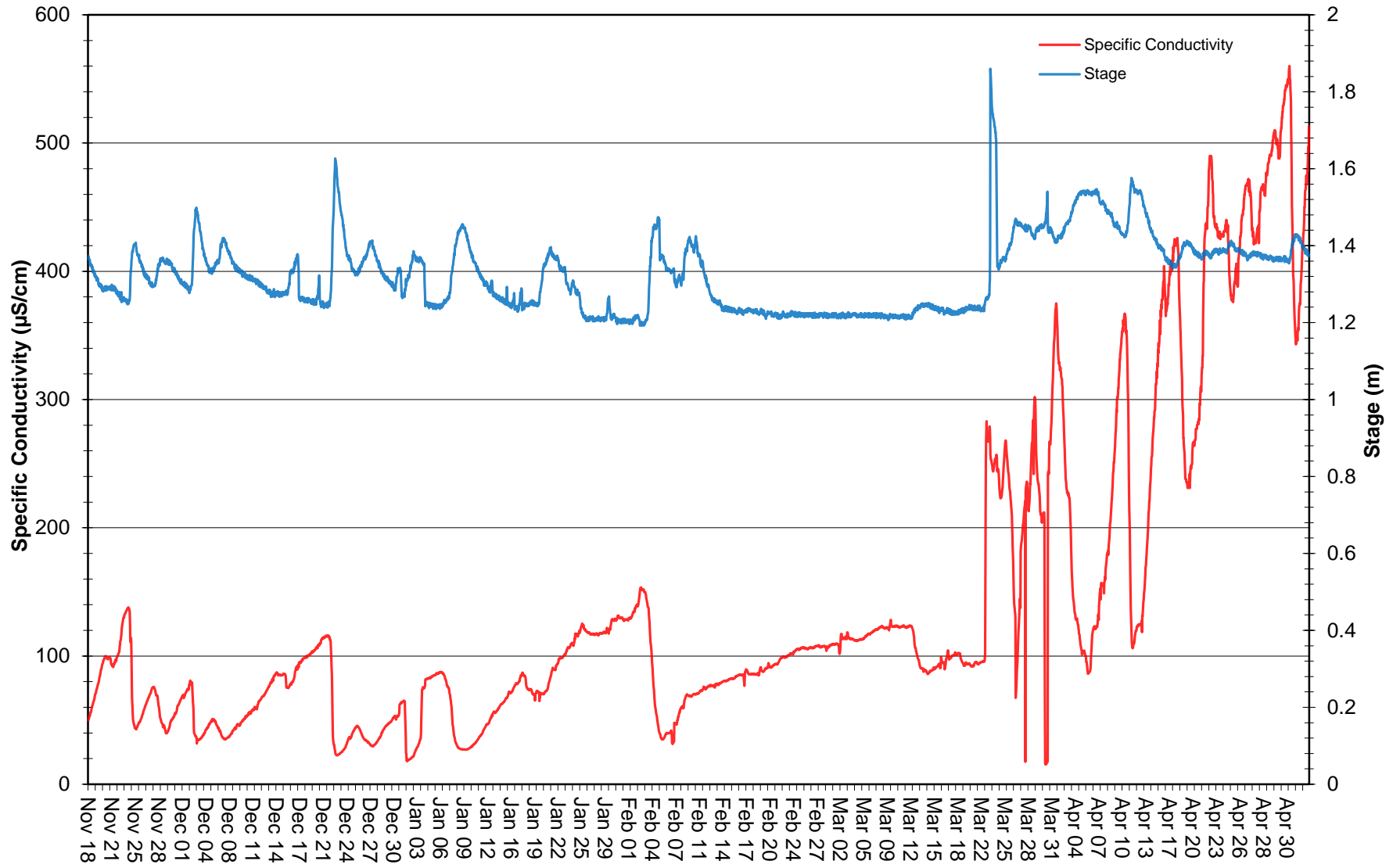
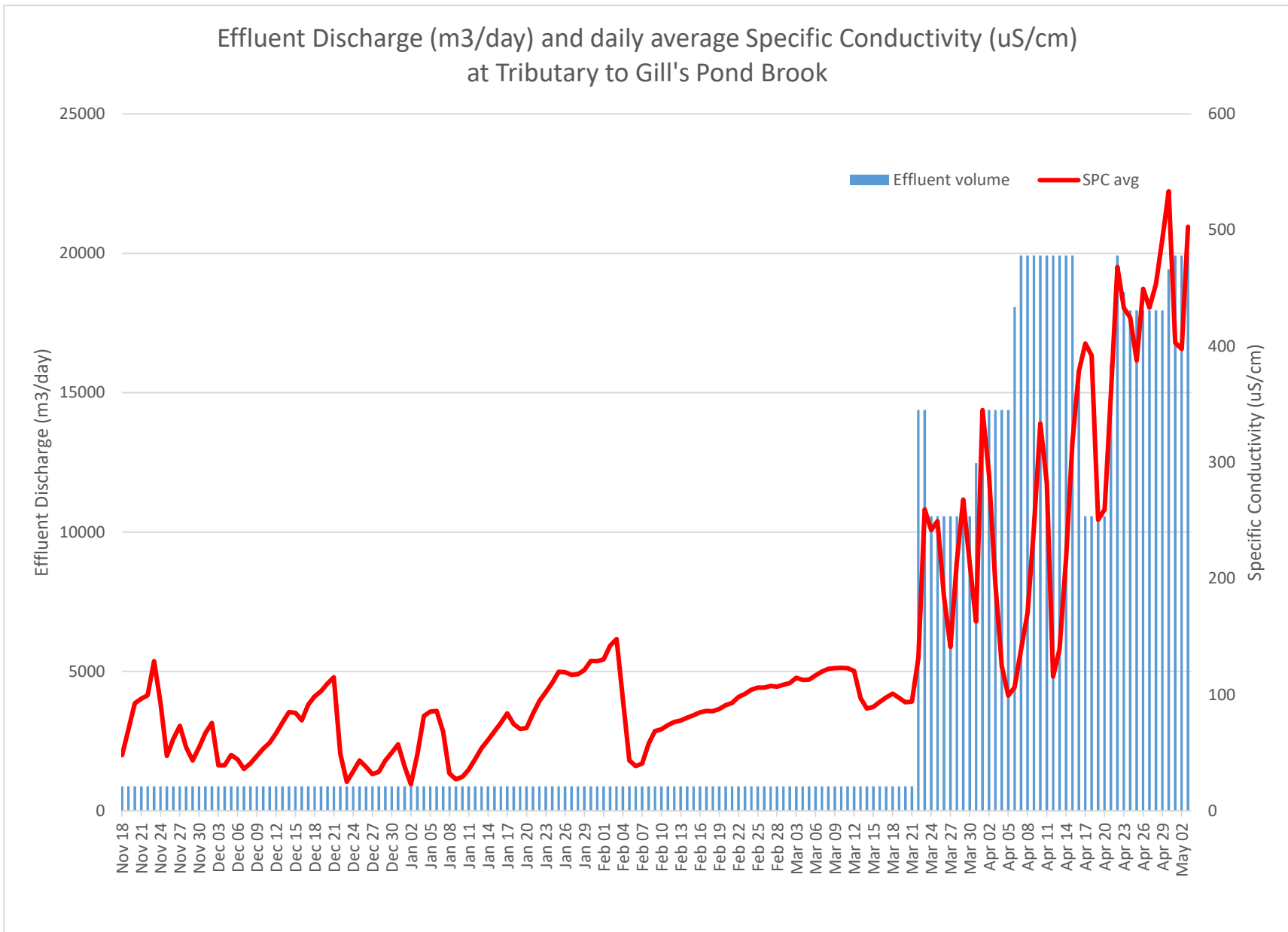


Figure 6. Specific Conductivity ( $\mu\text{S}/\text{cm}$ ) and Stage Level (m) at Tributary at Gills Pond Brook



**Figure 7. Effluent Discharge (m<sup>3</sup>/day) and Specific Conductivity (µS/cm) at Tributary at Gills Pond Brook**

## **Dissolved Oxygen**

Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The amount of dissolved oxygen in water depends on several factors, particularly temperature. The saturation of oxygen in water is inversely proportional to water temperature of the water body. Cooler water can hold more dissolved oxygen. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.

Dissolved oxygen at both stations remained above the CCME guidelines for aquatic life during this deployment. As the water temperature increased near the end of deployment, the dissolved oxygen concentration started to decrease (Figure 8 & 9). This natural process occurs in every water body (Appendix I).

Tributary to Gills Pond Brook had a minimum dissolved oxygen concentration of 10.12mg/L which occurred in May as the water temperatures increased. The brook had a maximum dissolved oxygen concentration of 13.81mg/L which was recorded when the water temperature was at 0°C in early November. At East Pond brook below East Pond, the dissolved oxygen concentration data ranged from 10.16mg/L to 14.30mg/L.

**Table 5. Table of the statistical data for East Pond Brook and Tributary to Gills Pond Brook for November 18 2020 to May 3 2021**

<b>Station</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>
Dissolved Oxygen (mg/L)				
East Pond Brook	13.14	13.45	10.16	14.30
Tributary to Gills Pond Brook	12.70	13.02	10.12	13.81
Dissolved Oxygen (%Sat)				
East Pond Brook	92.5	92.7	86.8	96.9
Tributary to Gills Pond Brook	90.4	90.8	81.2	95.2

### Dissolved Oxygen Concentration (mg/L), Saturation (%Sat) and water temperature at East Pond Brook below East Pond

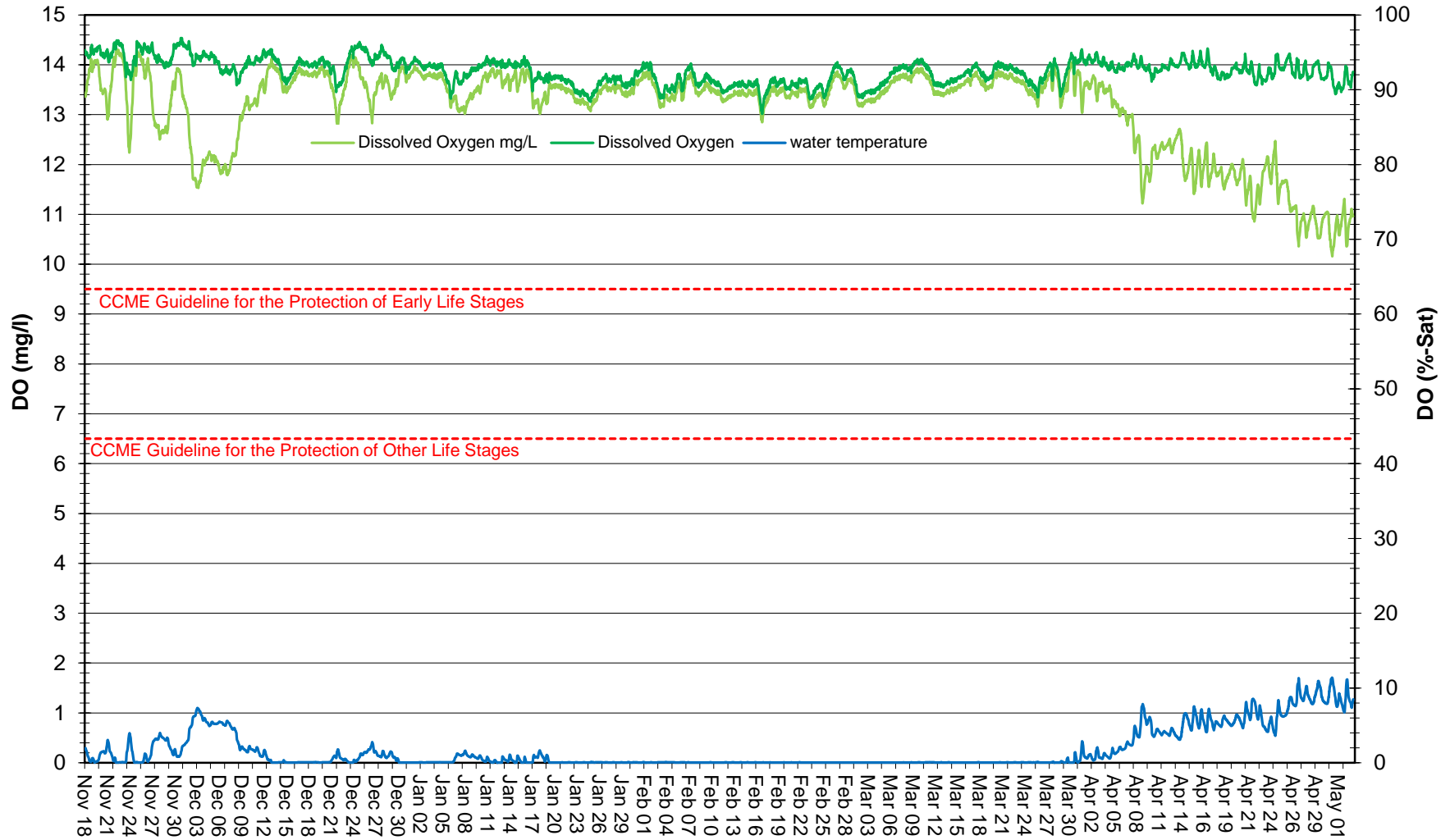


Figure 8. Dissolved Oxygen (mg/L & sat %) and Stage Level (m) at East Pond Brook

## Dissolved Oxygen Concentration (mg/L), Saturation (%Sat) and Water Temperature at Tributary to Gill's Pond Brook

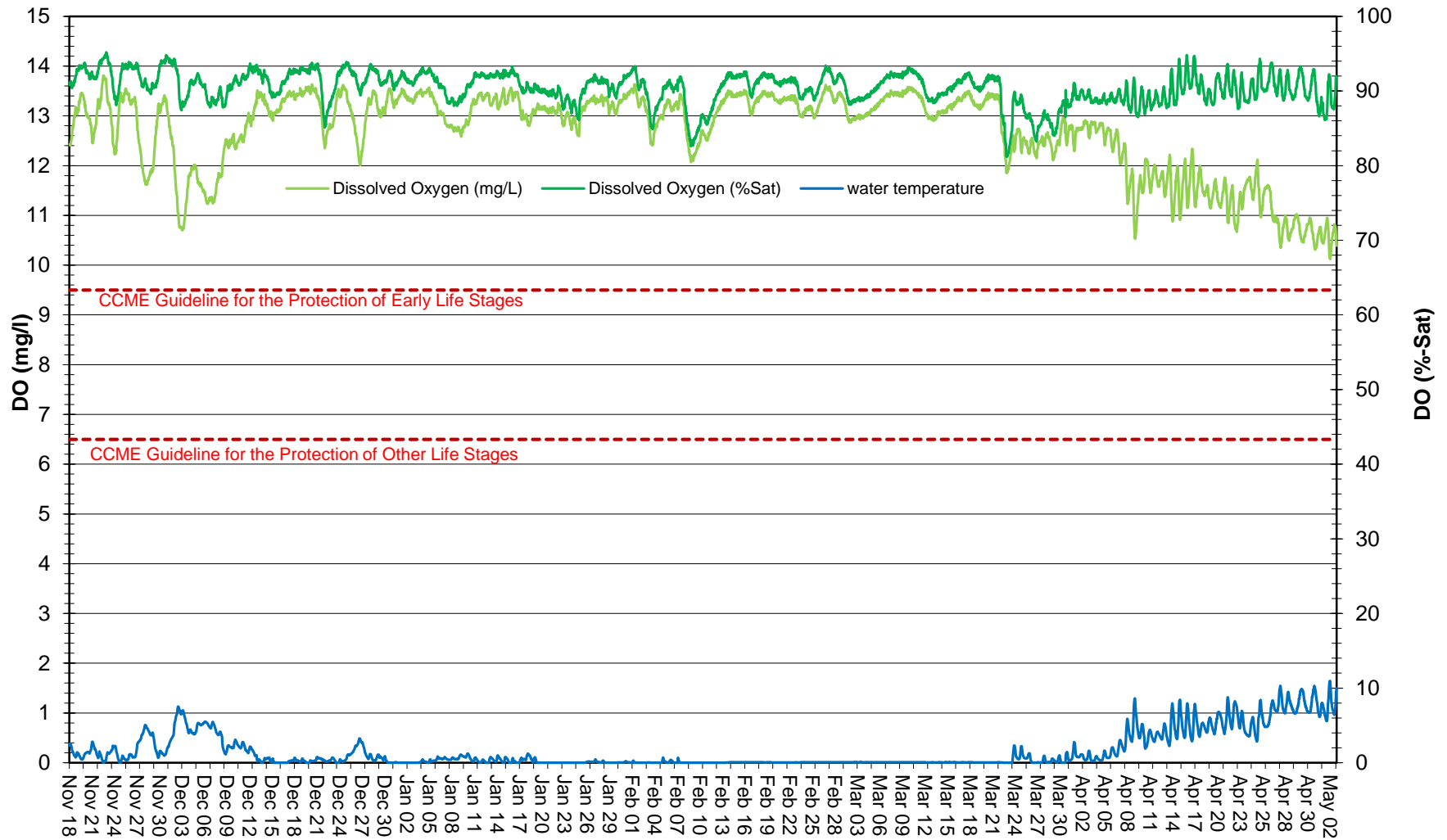


Figure 9. Dissolved Oxygen (mg/L & % Sat) at Tributary at Gills Pond Brook



## **Turbidity**

Turbid or cloudy water is typically caused by fine suspended solids, such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, harming plant and phytoplankton growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and sediment can cover critical spawning areas.

Turbidity levels are generally low at Tributary to Gills Pond Brook (Figure 11) and are influenced by precipitation and associated runoff as well as effluent discharges. Turbidity peaked on March 27 during a period of increased flow.

East Pond Brook displayed high spikes in turbidity on February 8 to April 14 as stage increased rapidly during heavy precipitation and runoff.

Stage Level data is raw data. This data has not been corrected. Corrected and finalized data may be retrieved from the Environment Climate Change Canada, Water Survey of Canada website <https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey.html>

**Table 6. Table of the statistical turbidity data for East Pond Brook and Tributary to Gills Pond Brook for December 2019 to May 2020**

<b>Station</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>
East Pond Brook	0.3	0.0	0.0	176.6
Tributary to Gills Pond Brook	3.4	2.3	0.0	324.2

### Water Turbidity (ntu) and Stage Level (m) at East Pond Brook below East Pond

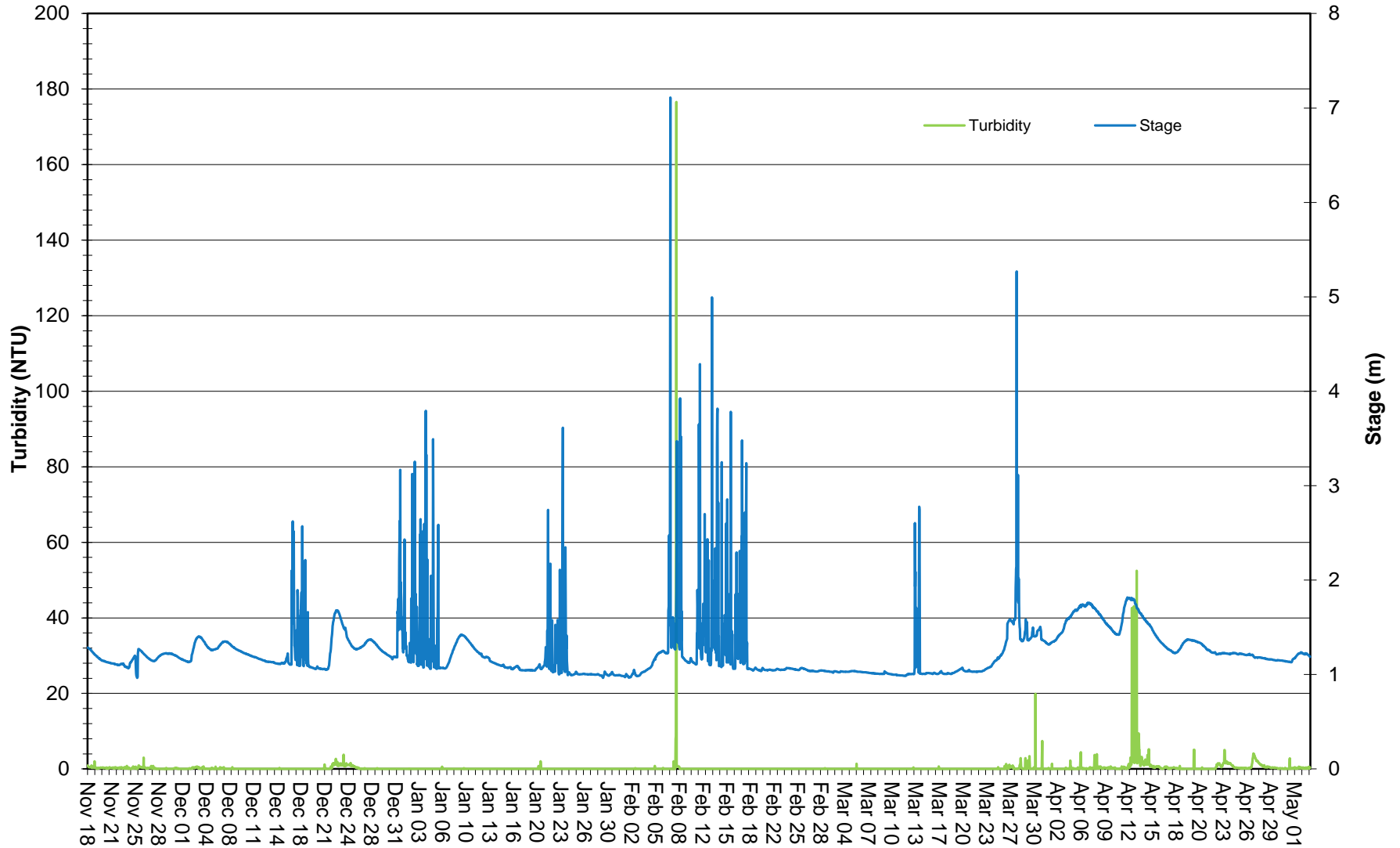


Figure 10. Turbidity (NTU) and Stage Level (m) at East Pond Brook

### Water Turbidity (ntu) and Stage Level (m) at Tributary To Gill's Pond Brook

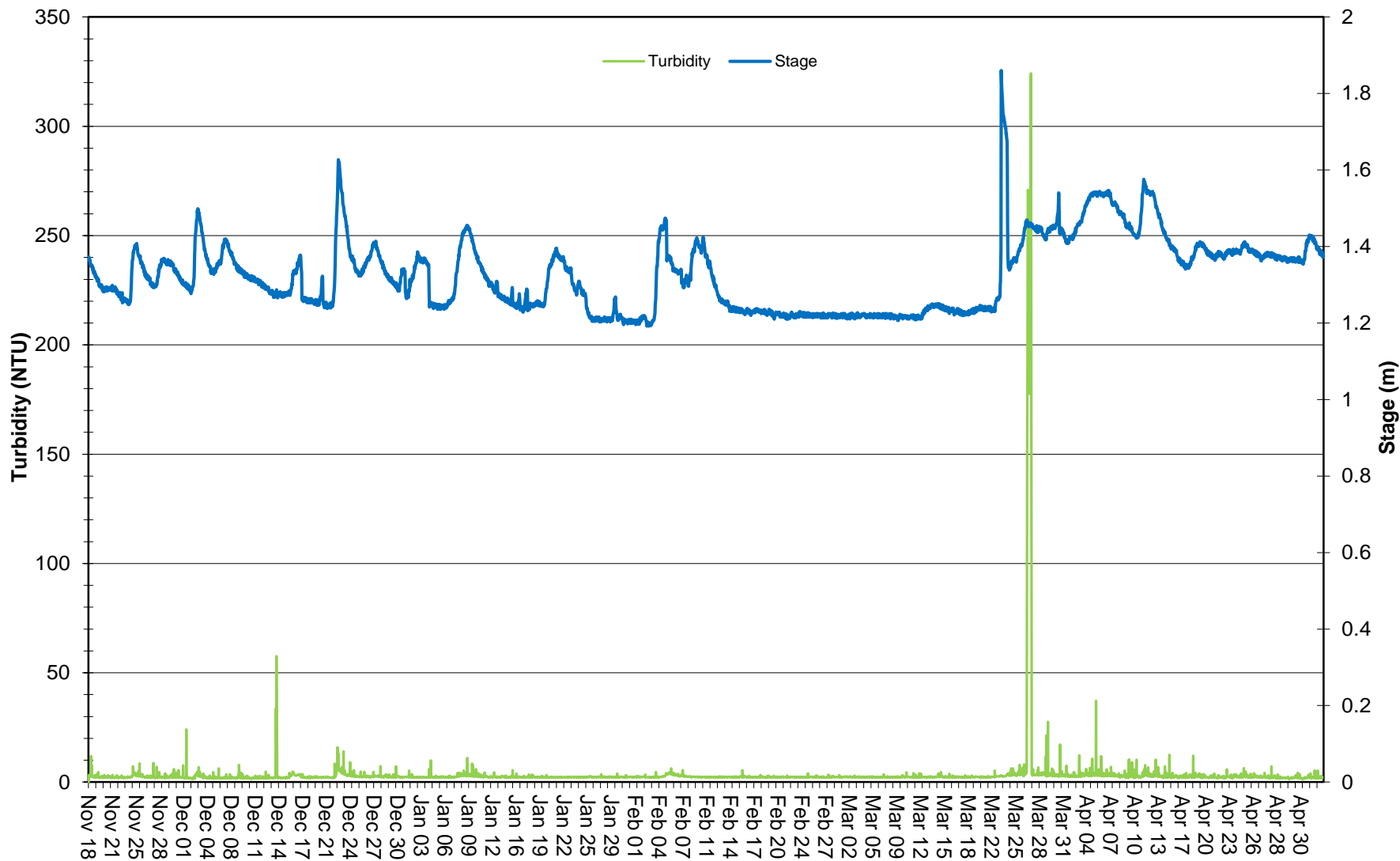


Figure 11. Turbidity (NTU) and Stage Level (m) at Tributary to Gills Pond Brook

## APPENDIX I

# Precipitation and Mean Air Temperature at Millertown

