



Real-Time Water Quality Deployment Report

Teck: Duck Pond Operations

August 26, 2021 to October 27, 2021



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

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 August 26, 2021 through to October 27, 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/>

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=year

[Range&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=year&Range&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	August 26	Deployment	Good	Excellent	Excellent	Excellent	Excellent
	October 27	Removal	Good	Excellent	Good	Good	Excellent
East Pond Brook below East Pond	August 26	Deployment	Good	Good	Good	Excellent	Excellent
	October 27	Removal	Good	Good	Excellent	Good	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 data for Tributary to Gills Pond Brook recorded a temperature range of 4.78°C to 22.3°C during this deployment period. The water temperature at East Pond Brook ranged from 6.06°C to 25.00°C (Table 2).

At both stations, water temperature showed a typical natural diurnal pattern with higher temperatures in the day light hours and lower temperatures after dark. Highest temperatures were recorded at both stations on August 26th in the mid-afternoon. Temperatures at both stations were gradually decreasing into the fall as winter approached.

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 temperature data for East Pond Brook and Tributary to Gills Pond Brook for August 26 to October 27 2021

Station	Mean	Median	Min	Max
East Pond Brook	12.84	12.78	6.06	25.00
Tributary to Gills Pond Brook	12.33	12.25	4.78	22.30

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

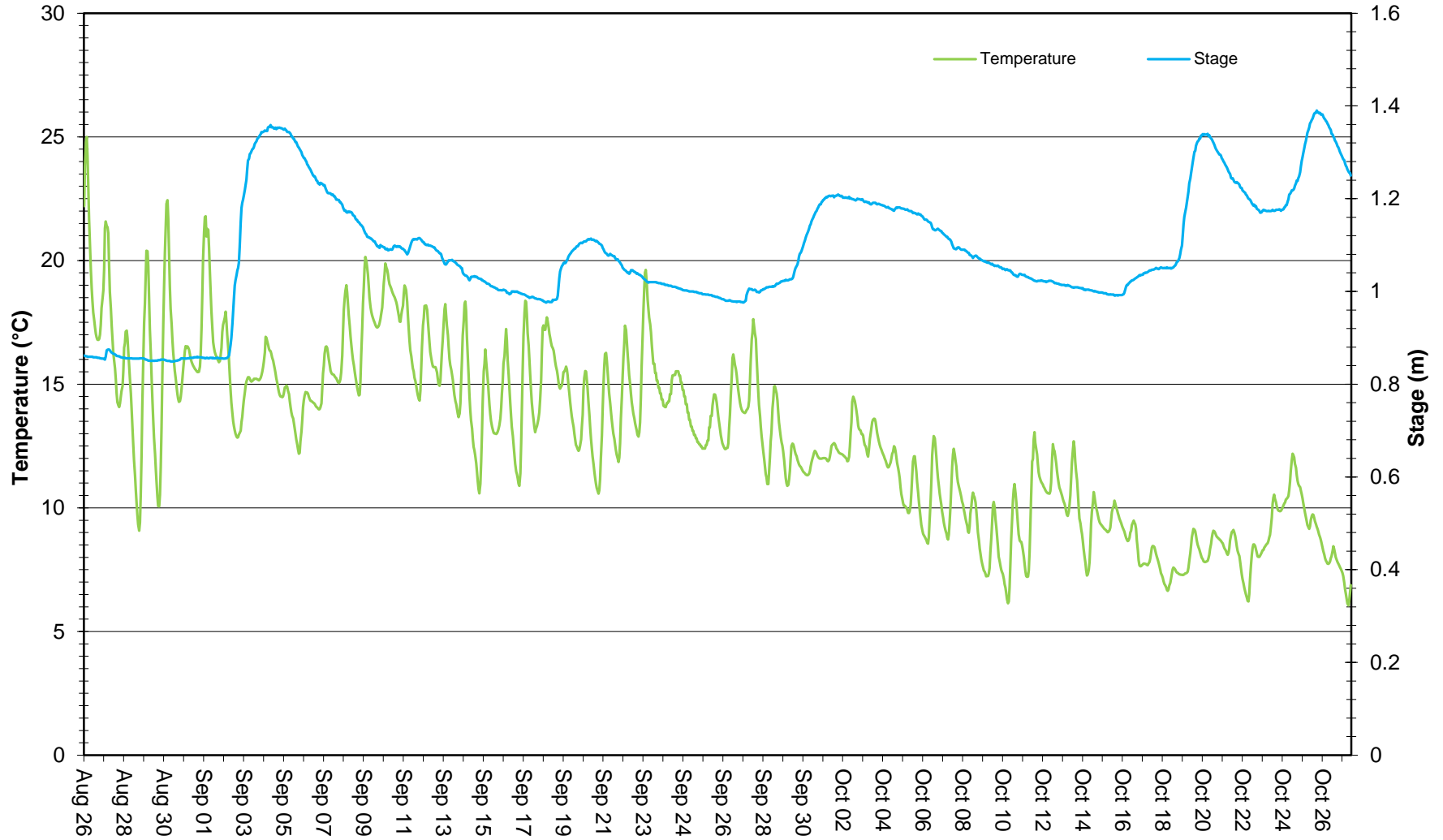


Figure 1. Water Temperature (°C) and Stage (m) at East Pond Brook

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

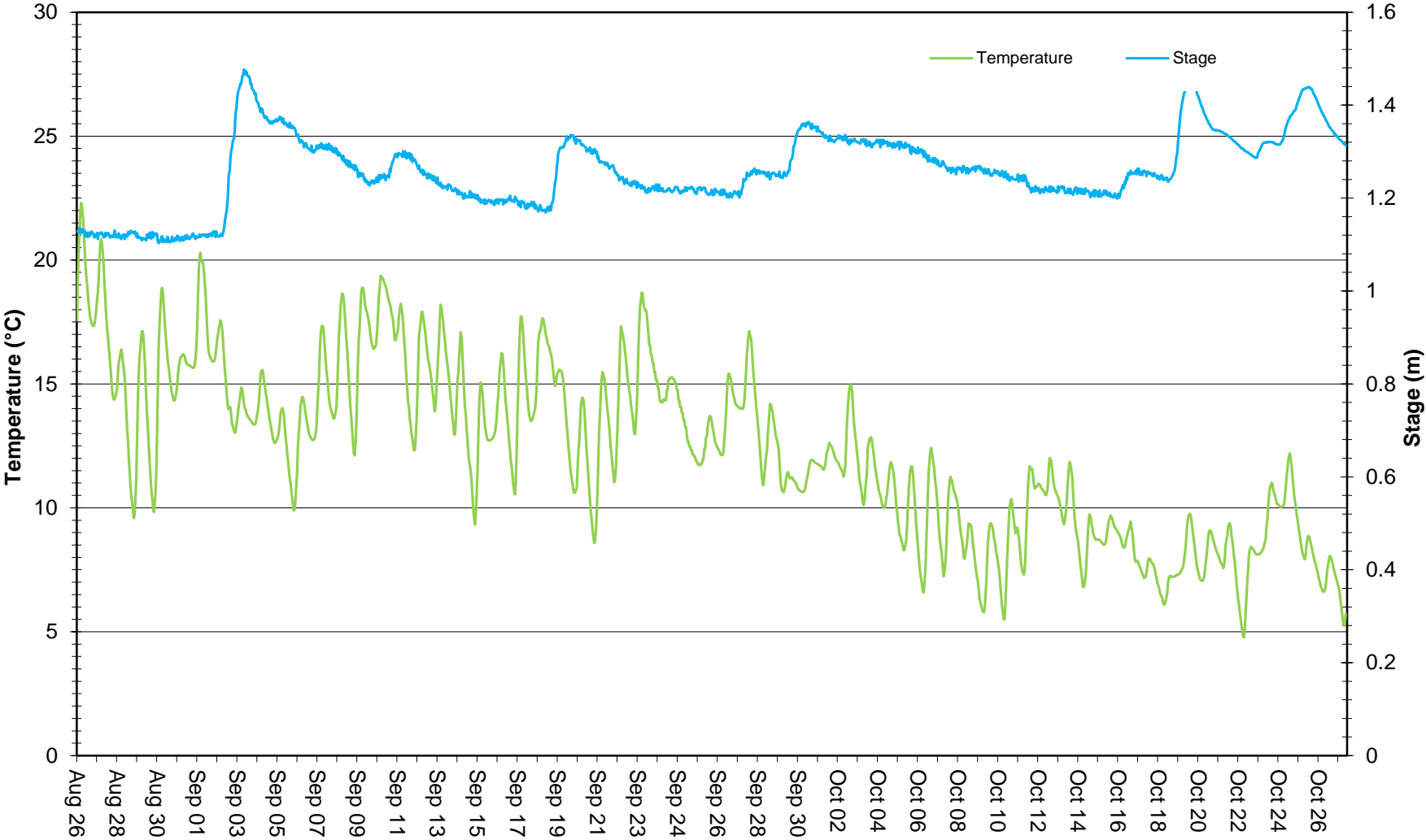


Figure 2. Water Temperature (°C) and Stage (m) at Tributary to Gills Pond Brook

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 6.13 pH units to a maximum of 7.46 pH units (Table 3). pH at East Pond Brook ranged from 6.51 pH units to 7.22 pH units at this time.

pH is influenced by precipitation runoff 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. pH levels at both locations showed a gradual decline throughout the deployment period.

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 pH data for East Pond Brook and Tributary to Gills Pond Brook for August 26 to October 27 2021

Station	Mean	Median	Min	Max
East Pond Brook	6.83	6.82	6.51	7.29
Tributary to Gills Pond Brook	6.81	6.87	6.13	7.46

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

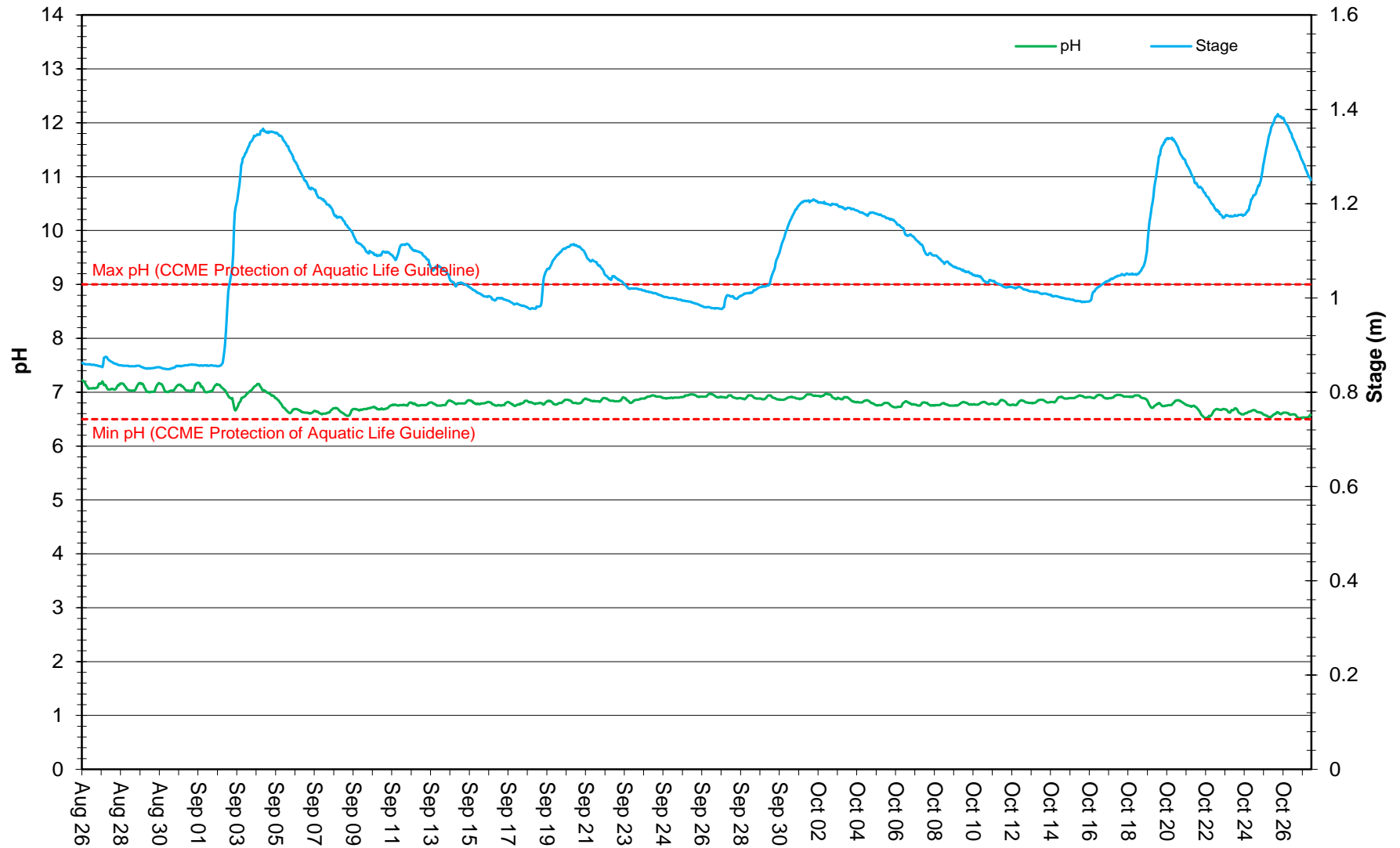


Figure 3. pH (pH units) and Stage Level (m) at East Pond Brook

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

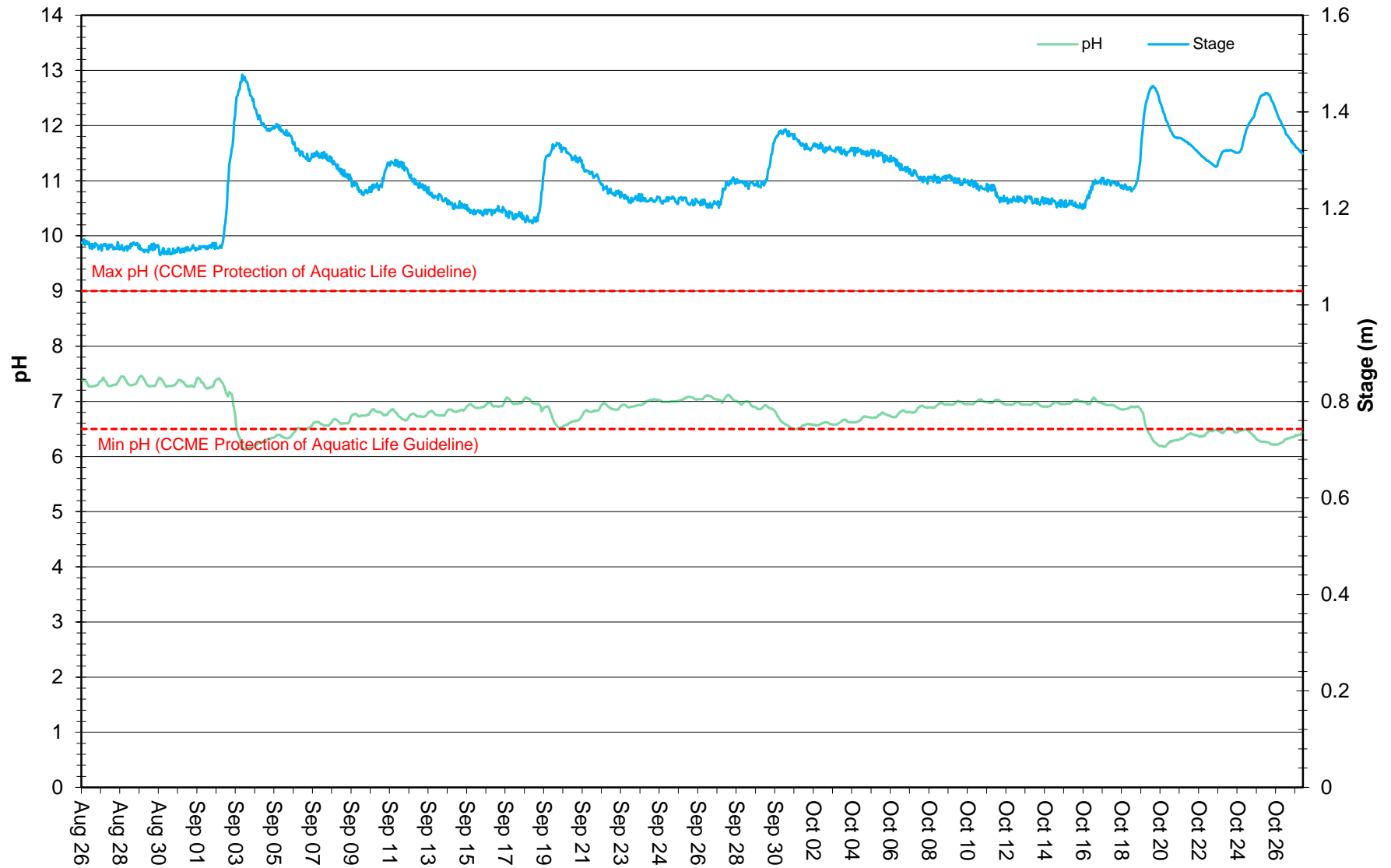


Figure 4. pH (pH units) and Stage Level (m) at Tributary to Gill's Pond Brook

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.

Conductivity generally decreased at Tributary to Gills Pond Brook during periods of increased stage. Conductivity at Tributary to Gill’s Pond Brook ranged from 32.7 µS/cm to 720.0 µS/cm. (Figure 6).

Specific conductivity at East Pond Brook ranged from 24.6 µS/cm to 50.4 µS/cm, generally increasing as water levels declined with warm and dry weather.

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 conductivity data for East Pond Brook and Tributary to Gills Pond Brook for August 26 to October 27 2021

Station	Mean	Median	Min	Max
East Pond Brook	34.0	32.5	24.6	50.4
Tributary to Gills Pond Brook	202.3	129.7	32.7	720.0

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

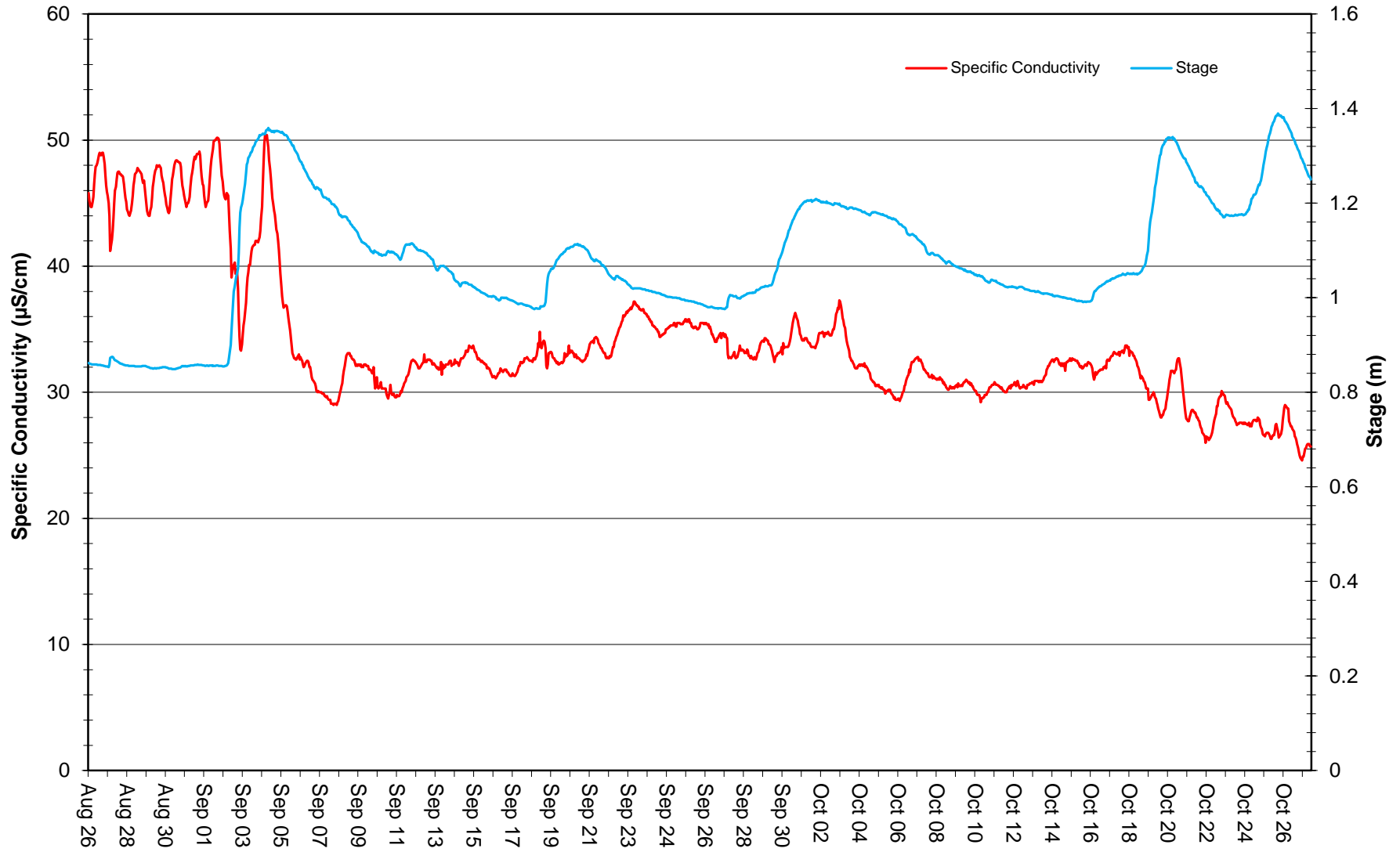


Figure 5. Specific Conductivity ($\mu\text{S}/\text{cm}$) and Stage Level (m) at East Pond Brook

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

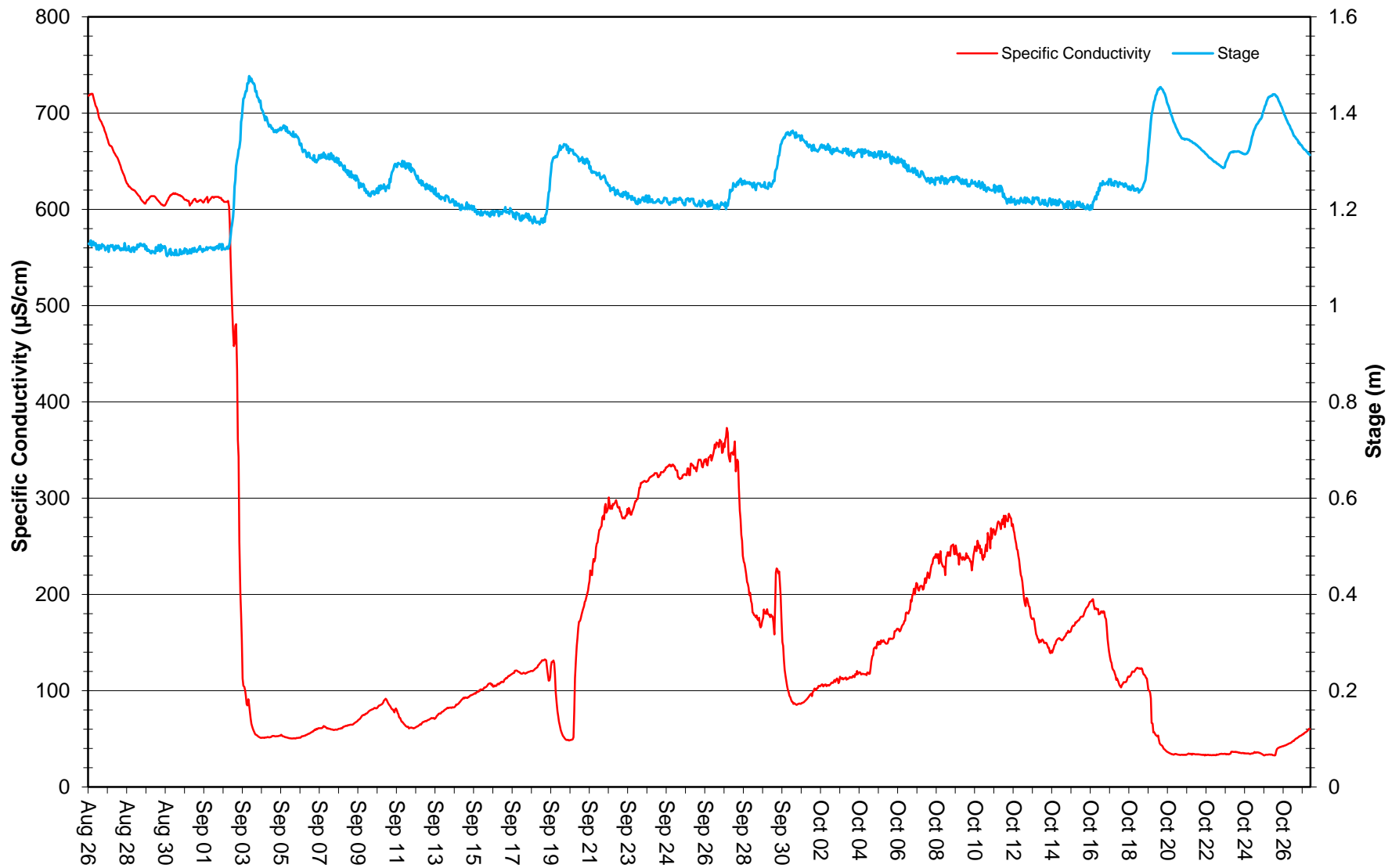


Figure 6. Specific Conductivity ($\mu\text{S}/\text{cm}$) and Stage Level (m) at Tributary to Gill's Pond Brook

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 or riverine pools. 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 near or below the CCME guideline for the protection of early life stages for the first half of the deployment, before rising in the second half. Values at both stations remained above the CCME guideline for the protection of other life stages throughout the entirety of this deployment. (Figure 8 & 9).

Tributary to Gill's Pond Brook had a minimum dissolved oxygen concentration of 8.04 mg/L, which occurred on August 26th as the water temperature reached 25.00°C. The brook had a maximum dissolved oxygen concentration of 12.16 mg/L. At East Pond brook below East Pond, the dissolved oxygen concentration data ranged from 8.03 mg/L to 11.89 mg/L.

Table 5. Table of the statistical dissolved oxygen data for East Pond Brook and Tributary to Gills Pond Brook for August 26 to October 27 2021

Station	Mean	Median	Min	Max
Dissolved Oxygen (mg/L)				
East Pond Brook	10.09	10.10	8.03	11.89
Tributary to Gills Pond Brook	10.15	10.17	8.04	12.16
Dissolved Oxygen (%Sat)				
East Pond Brook	93.9	94.1	85.6	100.2
Tributary to Gills Pond Brook	93.2	93.5	82.4	98.2

Dissolved Oxygen Concentration (mg/L) and Saturation (%Sat) at East Pond Brook

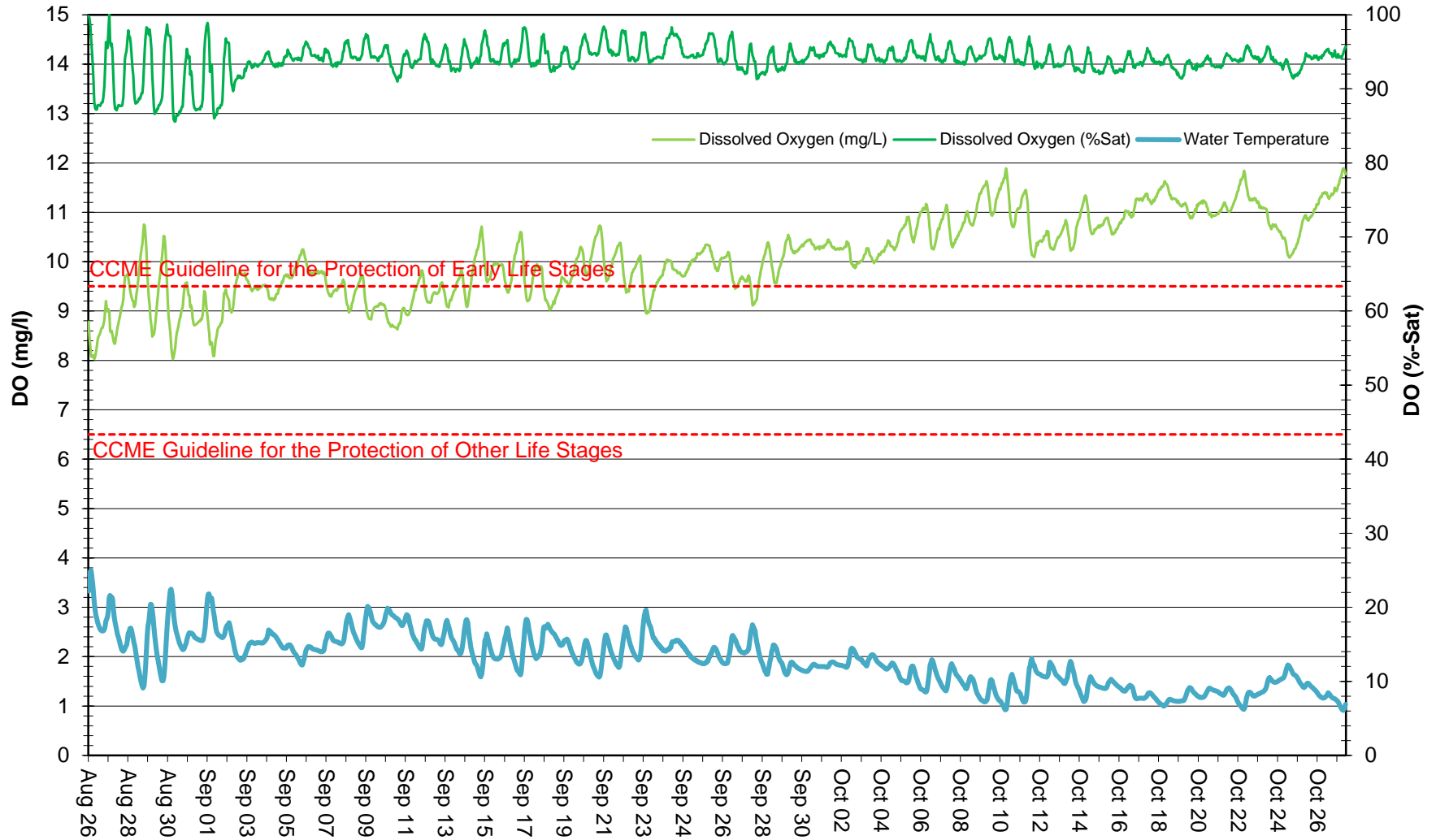


Figure 8. Dissolved Oxygen (mg/L & sat %) and Stage Level (m) at East Pond Brook

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

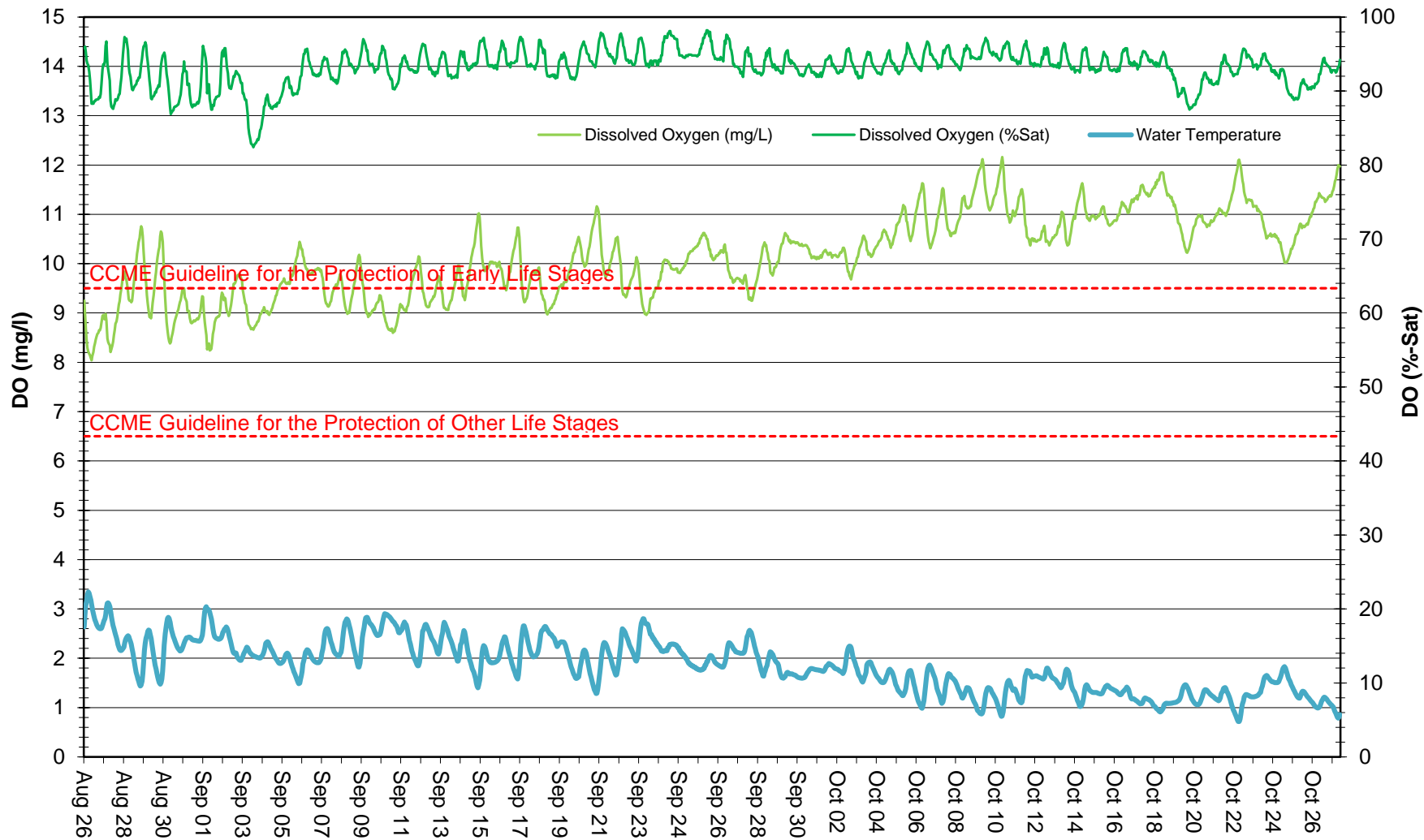


Figure 9. Dissolved Oxygen (mg/L & % Sat) at Tributary to Gill's Pond Brook

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 levels at East Pond Brook during this deployment were also low, with a few fluctuations associated with high stage events.

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 August 26 to October 27, 2021

Station	Mean	Median	Min	Max
East Pond Brook	0.1	0.0	0.0	51.9
Tributary to Gills Pond Brook	0.2	0.0	0.0	23.7

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

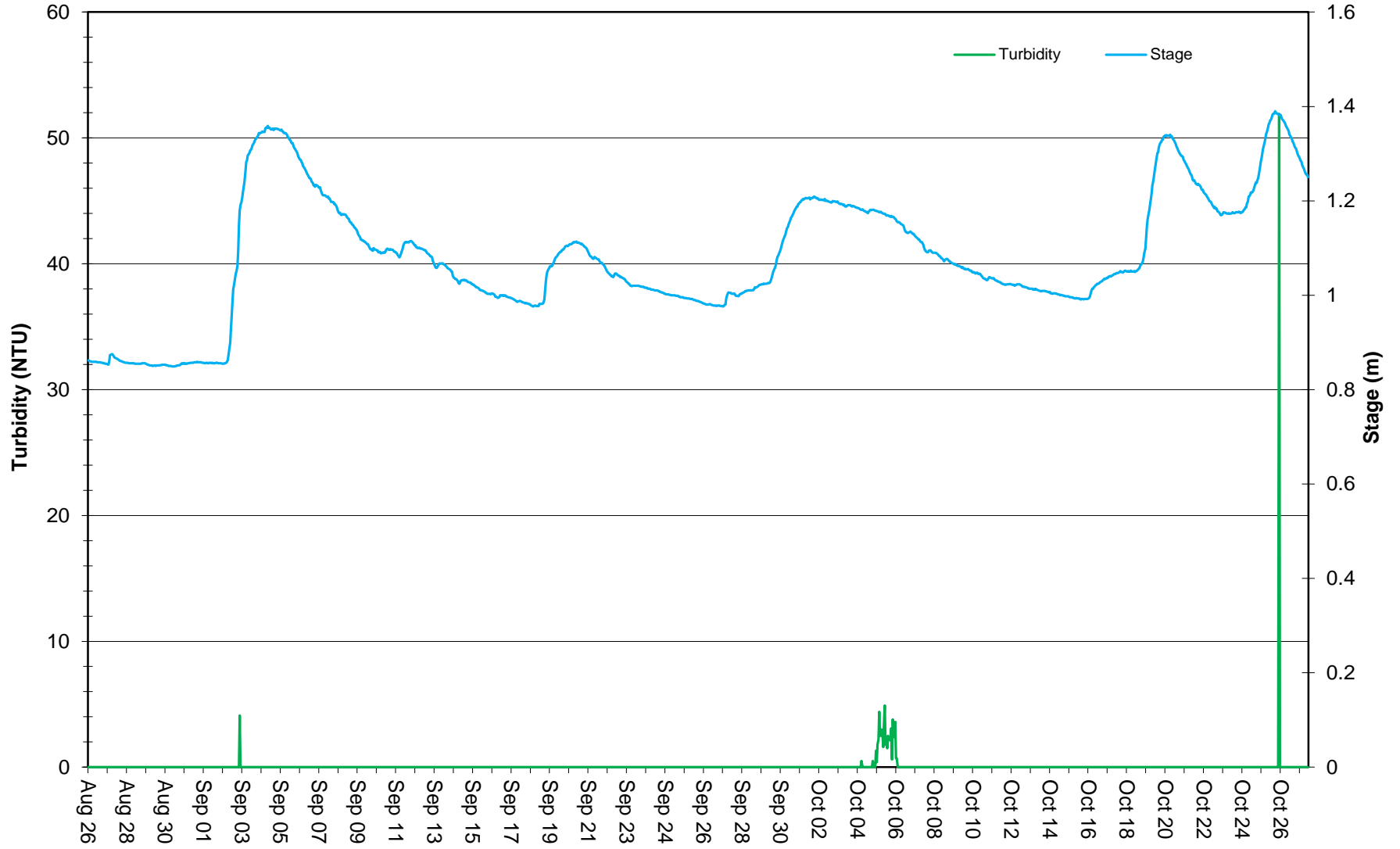


Figure 10. Turbidity (NTU) and Stage Level (m) at East Pond Brook

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

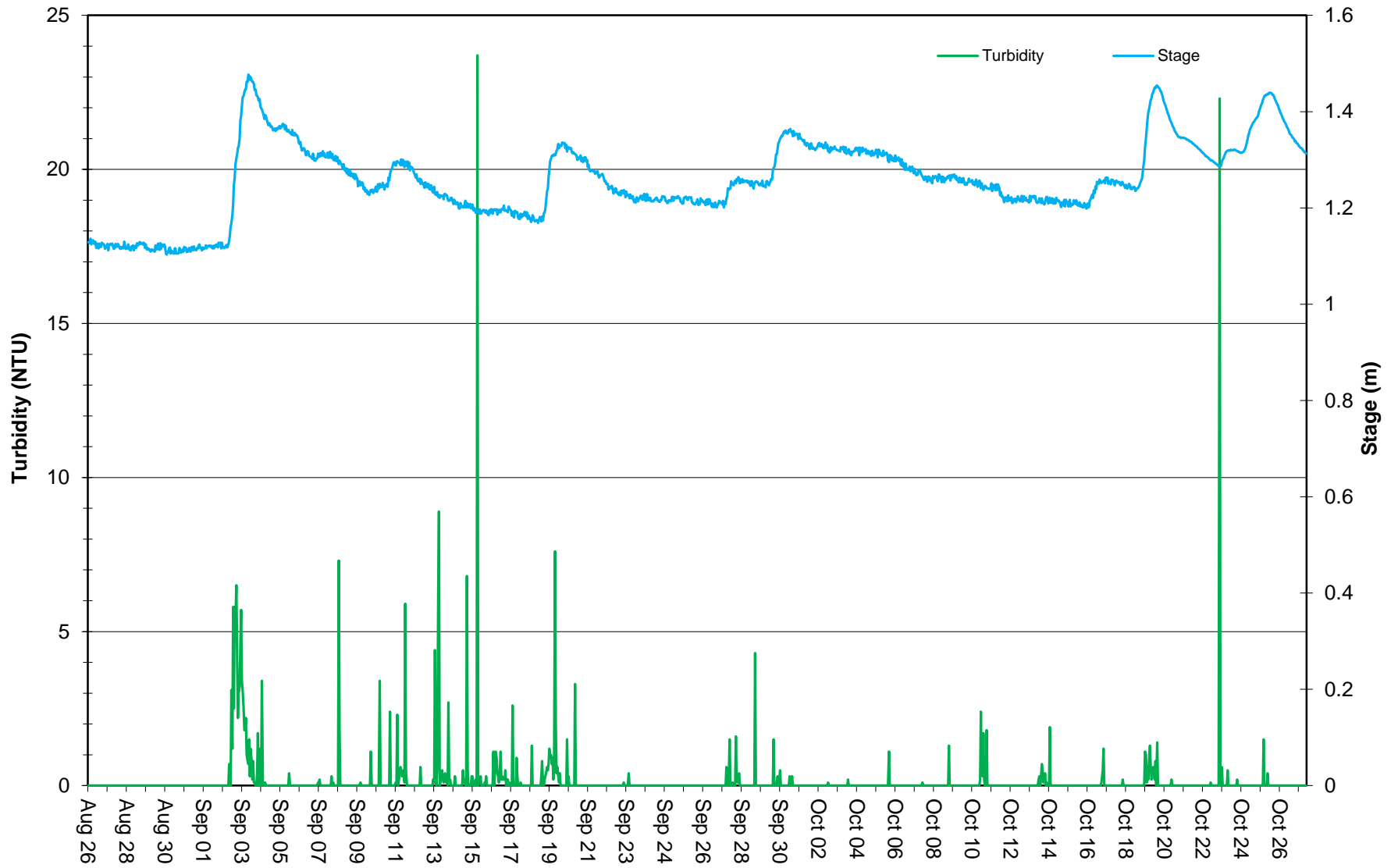


Figure 11. Turbidity (NTU) and Stage Level (m) at Tributary to Gills Pond Brook

APPENDIX I

