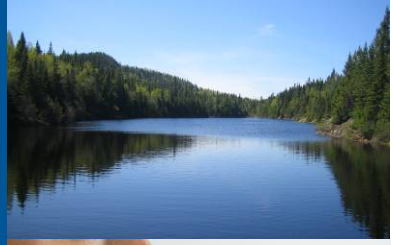
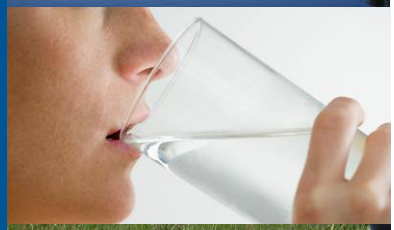



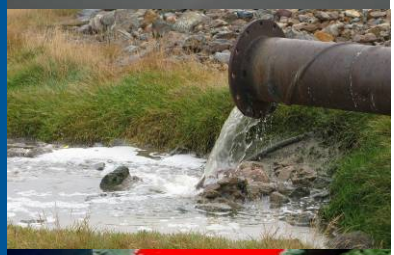


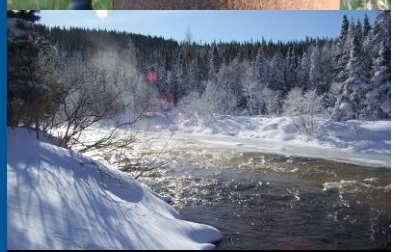

# Real Time Water Quality Report
# Teck Duck Pond Operations

## Deployment Period 2011-07-14 to 2011-08-08

**2011-08-16**


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

## General

- Water Resources Management Division (WRMD) staff monitors the real-time web page on a daily basis. Any unusual observations are investigated, with site visits being carried out as warranted.
- Management at Teck Duck Pond Operations are informed of any significant water quality events or instrumentation problems by WRMD.
- There was effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) episodically throughout the deployment period.

## Maintenance and Calibration of Instrumentation

- After being cleaned and freshly calibrated the regular **DataSondes®**(s/n 43245) for Tributary to Gills Pond Brook and (s/n 43794) for East Pond Brook were installed in on July 14, 2011, and remained deployed continuously until August 8, 2011 a 24 day period.

- The regular **Quanta G®** (s/n 00035) was deployed during this period, however, it failed immediately and had to be returned the factory for servicing. No spare instrument was available as a replacement. Thus there is no data for Monitoring Well After Tailings Dam Station (MW1) for this deployment period.

## Quality Assurance / Quality Control (QA/QC) Measures

- As part of the QA/QC protocol, 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. See **Table 1**.

| | Rank | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Excellent** | **Good** | **Fair** | **Marginal** | **Poor** |
| Temperature (oC) | <=+/-0.2 | >+/-0.2 to 0.5 | >+/-0.5 to 0.8 | >+/-0.8 to 1 | <+/-1 |
| pH (unit) | <=+/-0.2 | >+/-0.2 to 0.5 | >+/-0.5 to 0.8 | >+/-0.8 to 1 | >+/-1 |
| Sp. Conductance (µS/cm) | <=+/-3 | >+/-3 to 10 | >+/-10 to 15 | >+/-15 to 20 | >+/-20 |
| Sp. Conductance > 35 µS/cm (%) | <=+/-3 | >+/-3 to 10 | >+/-10 to 15 | >+/-15 to 20 | >+/-20 |
| Dissolved Oxygen (mg/L) (% Sat) | <=+/-0.3 | >+/-0.3 to 0.5 | >+/-0.5 to 0.8 | >+/-0.8 to 1 | >+/-1 |
| Turbidity <40 NTU (NTU) | <=+/-2 | >+/-2 to 5 | >+/-5 to 8 | >+/-8 to 10 | >+/-10 |
| Turbidity > 40 NTU (%) | <=+/-5 | >+/-5 to 10 | >+/-10 to 15 | >+/-15 to 20 | >+/-20 |

**Table 1**

- For the Surface Water Stations, upon deployment and removal, a QA/QC **MiniSonde®** is temporarily deployed along side the Field **DataSonde®**. Values for each recorded parameter are compared between the two instruments. Based upon the difference between the parameters recorded by the Field **DataSonde®** and QAQC **MiniSonde®** a qualitative statement (Ranking) is usually made on the data.

- The ranking at the beginning and end of the deployment period are shown in **Table 2** for Tributary to Gill's Pond Brook and **Table 3** for East Pond Brook.
- Because the deployment set-up for Well After Tailings Dam (MW1) is different, comparison with another instrument is not possible. In this case, a grab sample is usually collected at the beginning and end of the deployment period, and the deployment is ranking calculated for pH and Specific Conductance based upon live data and laboratory data. However, in during this deployment period, since the instrument failed, no comparisons or rankings are possible.

- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent Quality Assurance and Quality Control (QA/QC) protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

| **Tributary to Gills Pond Brook Station (NF02YO0190)** | | |
|---|---|---|
| **Date (yyyy-mm-dd)** | **Parameter** | **Ranking** |
| 2011-07-14 Deployment | Temp ($^{o}$C) | Good |
| | pH (units) | Excellent |
| | Sp. Conductivity (uS/cm) | Excellent |
| | Dissolved Oxygen (mg/L) | Excellent |
| | Turbidity (NTU) | Excellent |
| 2011-08-08 Removal | Temp ($^{o}$C) | Fair |
| | pH (units) | Excellent |
| | Sp. Conductivity (uS/cm) | Excellent |
| | Dissolved Oxygen (%) | Excellent |
| | Turbidity (NTU) | Excellent |

**Table 2**

| **East Pond Brook Station (NF02YO0192)** | | |
|---|---|---|
| **Date (yyyy-mm-dd)** | **Parameter** | **Ranking** |
| 2011-07-14 Deployment | Temp ($^{o}$C) | Excellent |
| | pH (units) | Excellent |
| | Sp. Conductivity (uS/cm) | Excellent |
| | Dissolved Oxygen (mg/L) | Excellent |
| | Turbidity (NTU) | Excellent |
| 2011-08-08 Removal | Temp ($^{o}$C) | Excellent |
| | pH (units) | Excellent |
| | Sp. Conductivity (uS/cm) | Excellent |
| | Dissolved Oxygen (%) | Excellent |
| | Turbidity (NTU) | Excellent |

**Table 3**

## Data Interpretation

### TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of 11.13 ˚C to a maximum of 22.47 ˚C.
- There appears to be little correlation with stage.

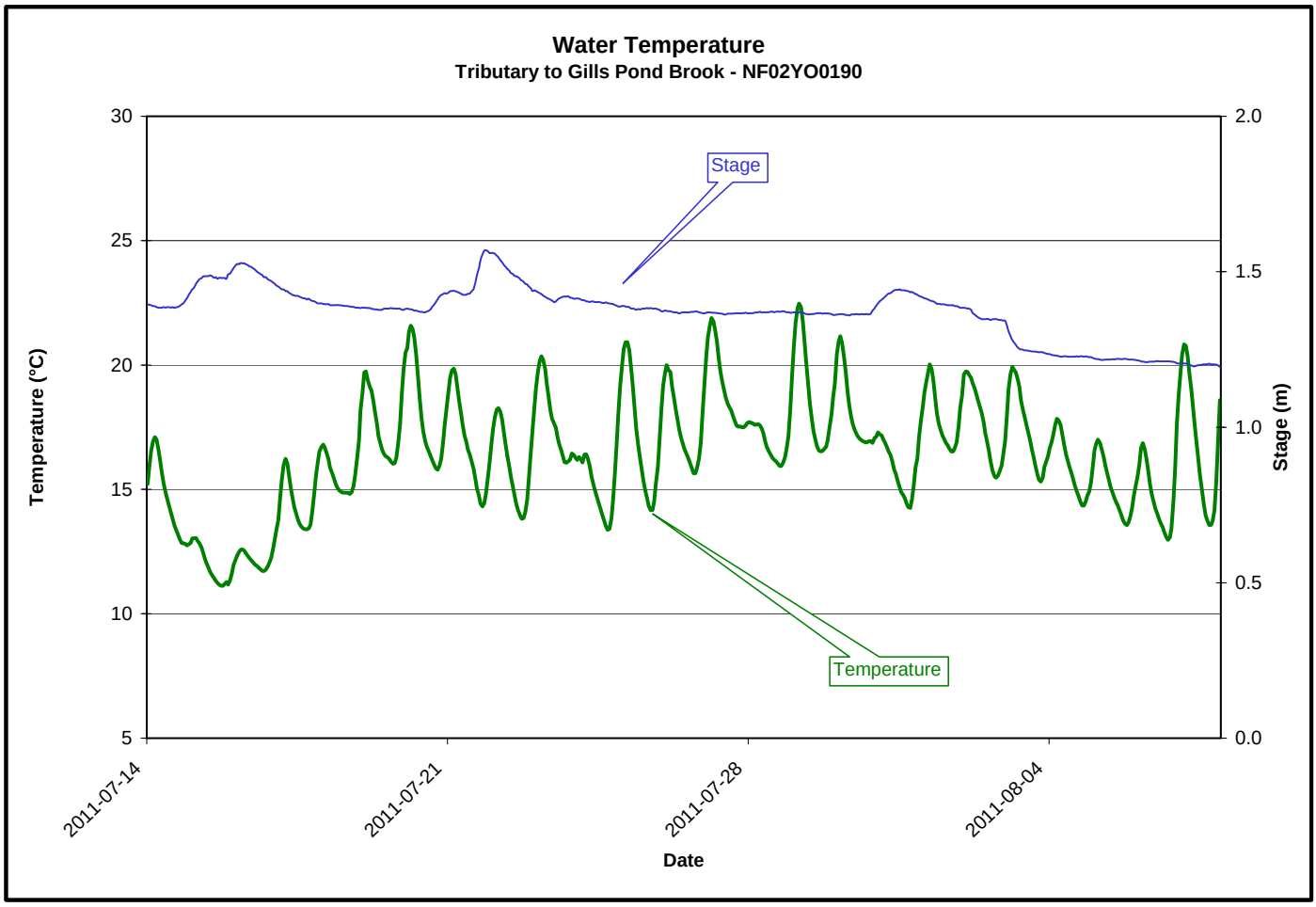


**Figure 1**

- Throughout the deployment period pH values (**Figure 2**) ranged from a minimum of 5.87 to a maximum of 7.11 with some of the values falling below the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- The background pH of this stream is normally around the lower limit of the recommended range. pH varies with periods of discharge from Polishing Pond, as discharge water has a slightly higher pH than the background water quality.
- There is an obvious inverse relationship between pH and Stage.

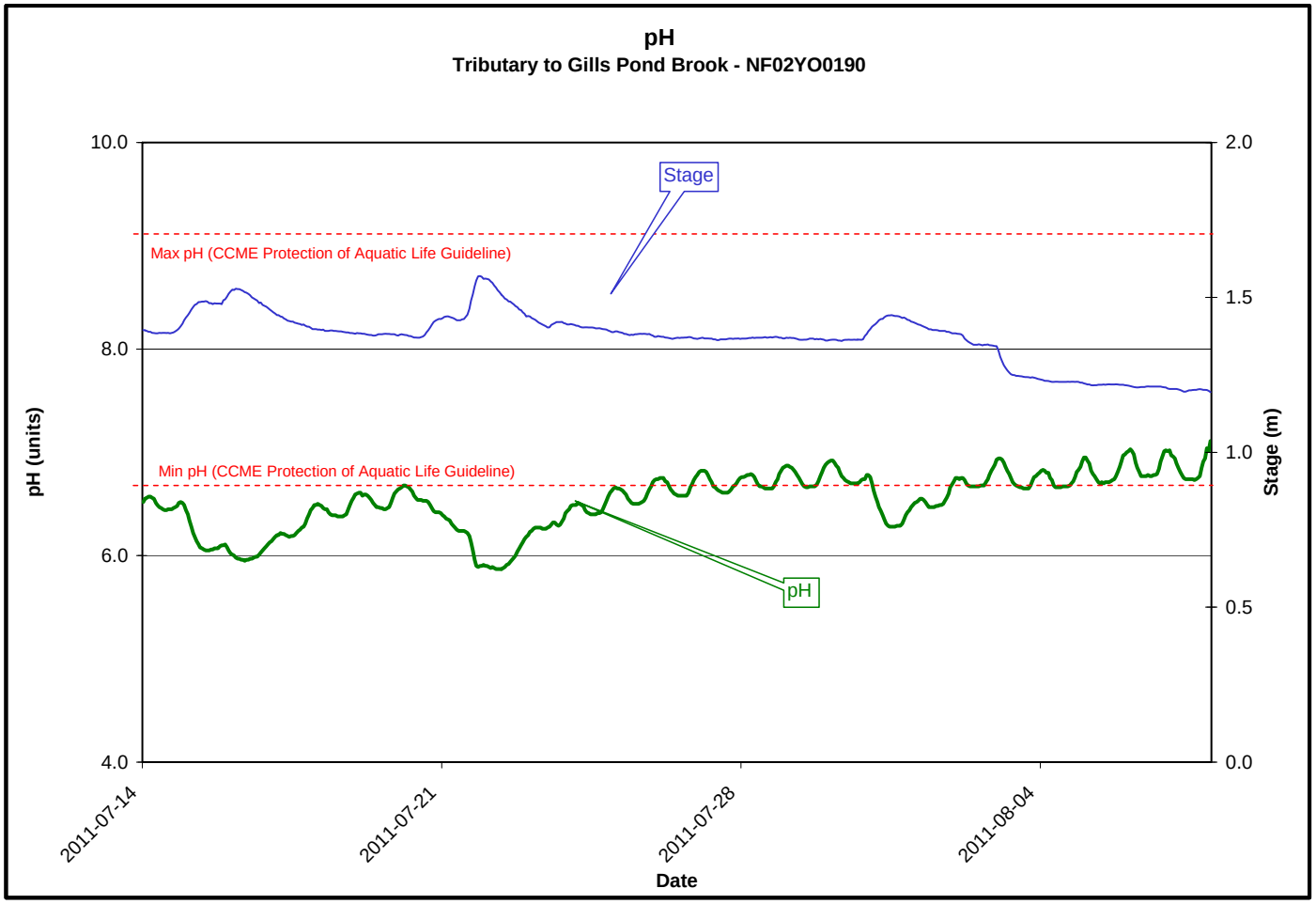


**Figure 2**

- The specific conductivity **(Figure 3)** ranged from a minimum of 112.5 µS/cm to a maximum of 992.0 µS/cm over the deployment period.
- The highest specific conductance readings correspond with periods of discharge from the Polishing Pond.
- The several 'V' shaped dips are the result of dilution caused by precipitation events, indicated by peaks in the stage.

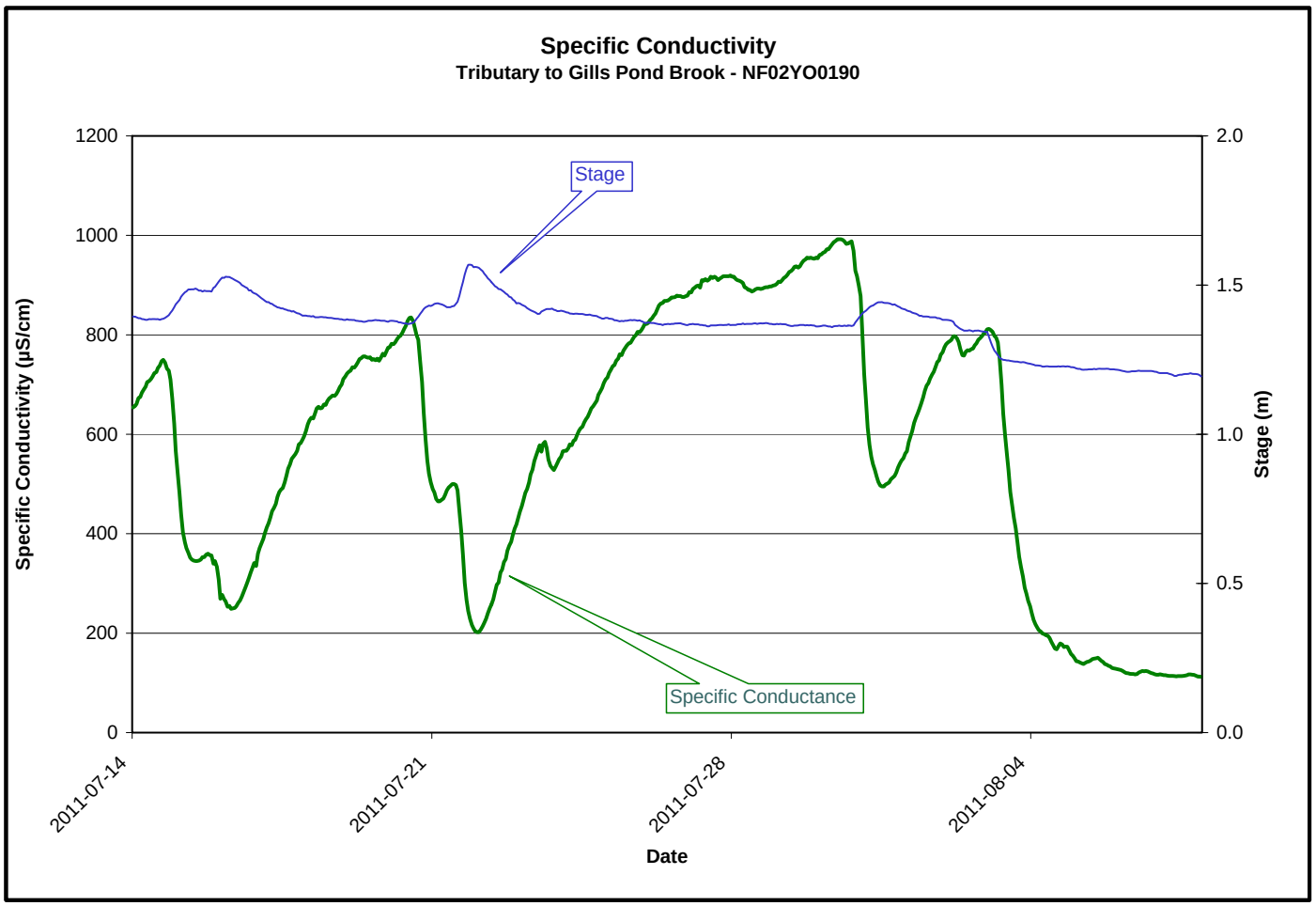


**Figure 3**

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 7.91 mg/L to a maximum of 10.08 mg/L over the deployment period, with the percent saturation ranging between 80.8 and 100.0.
- Dissolved oxygen is generally inversely proportional to water temperature.
- All the dissolved oxygen values fell above the lower limit recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (cold water/other life stages – above 6.5 mg/L; cold water/early life stages – above 9.5 mg/L).
- Based upon the fact that Dissolved Oxygen % saturation had minimal change over the deployment period, we can be confident that the Dissolved Oxygen mg/L values are accurate.

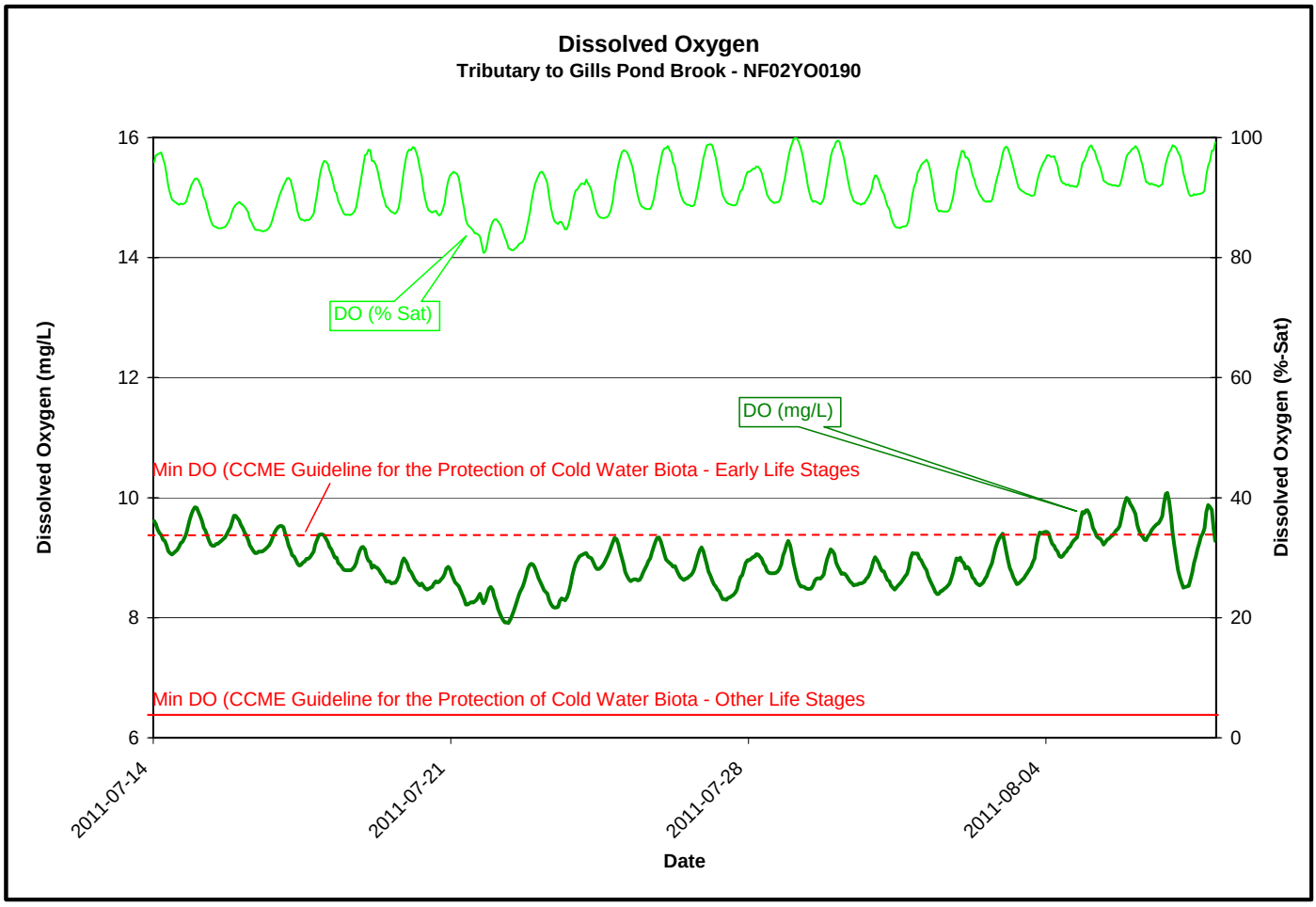


**Figure 4**

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 271.1 NTU.
- Based upon previous investigation, it has been determined that turbidity values may be artificially increased due to air entrainment during high flows.
- The higher turbidity values likely correspond to natural in-stream debris and/or air bubbles from turbulent flow passing over the sensor.
- Periods of sustained high turbidity values on the graph are likely the result of debris caught on the sensor.
- Neither *in situ* nor grab sample measurements nor visual observations indicated turbidity issues.

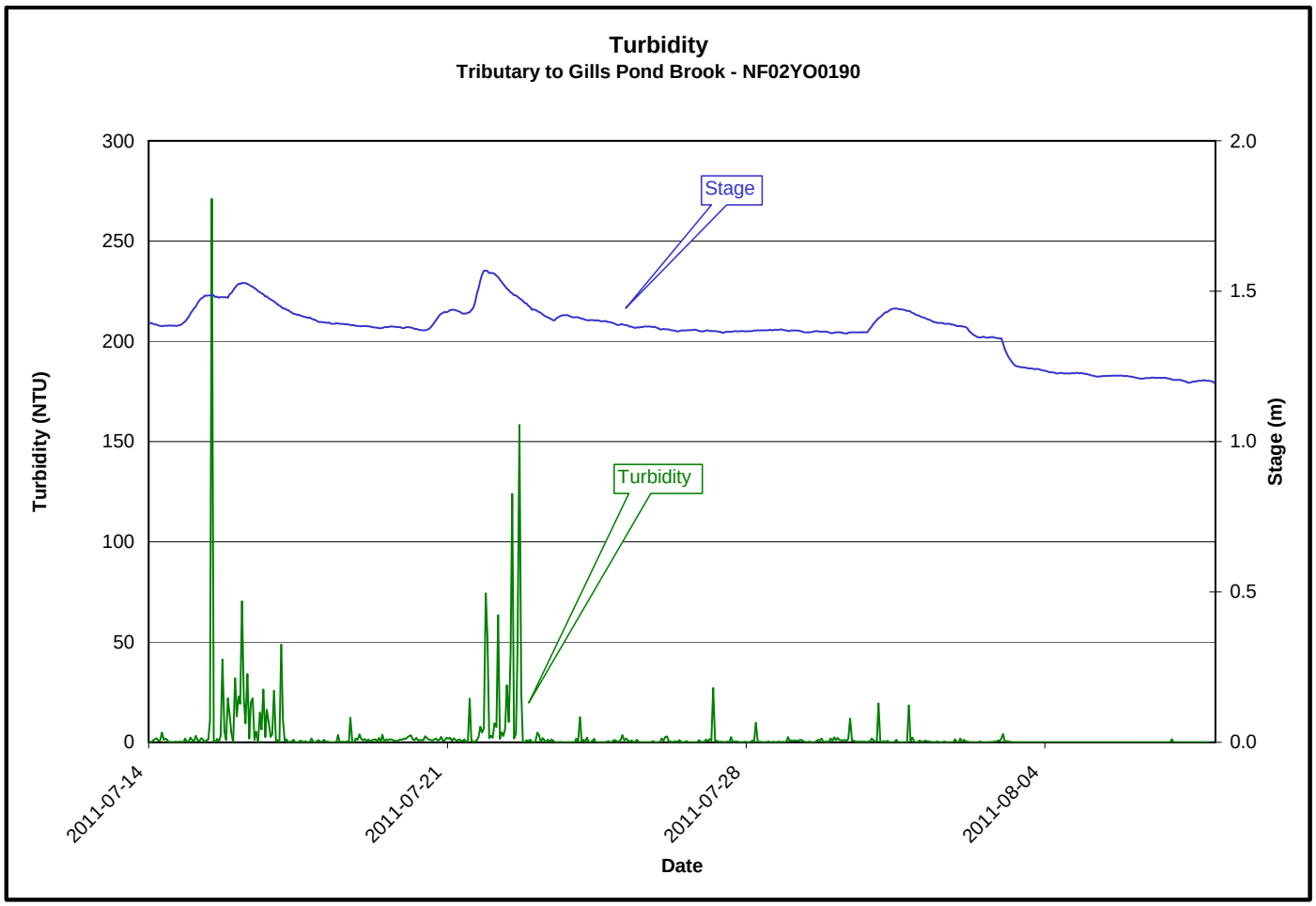


**Figure 5**

- The stage or water level ranged from a minimum of 1.19 m to a maximum of 1.57 m. The flow or discharge ranged from a minimum of 0.01 $m^3/s$ to a maximum of 1.50 $m^3/s$ (**Figure 6)**.
- The higher levels correspond to periods of discharge from Polishing Pond, while the peaks correspond to precipitation events.
- All values are within the normal range.

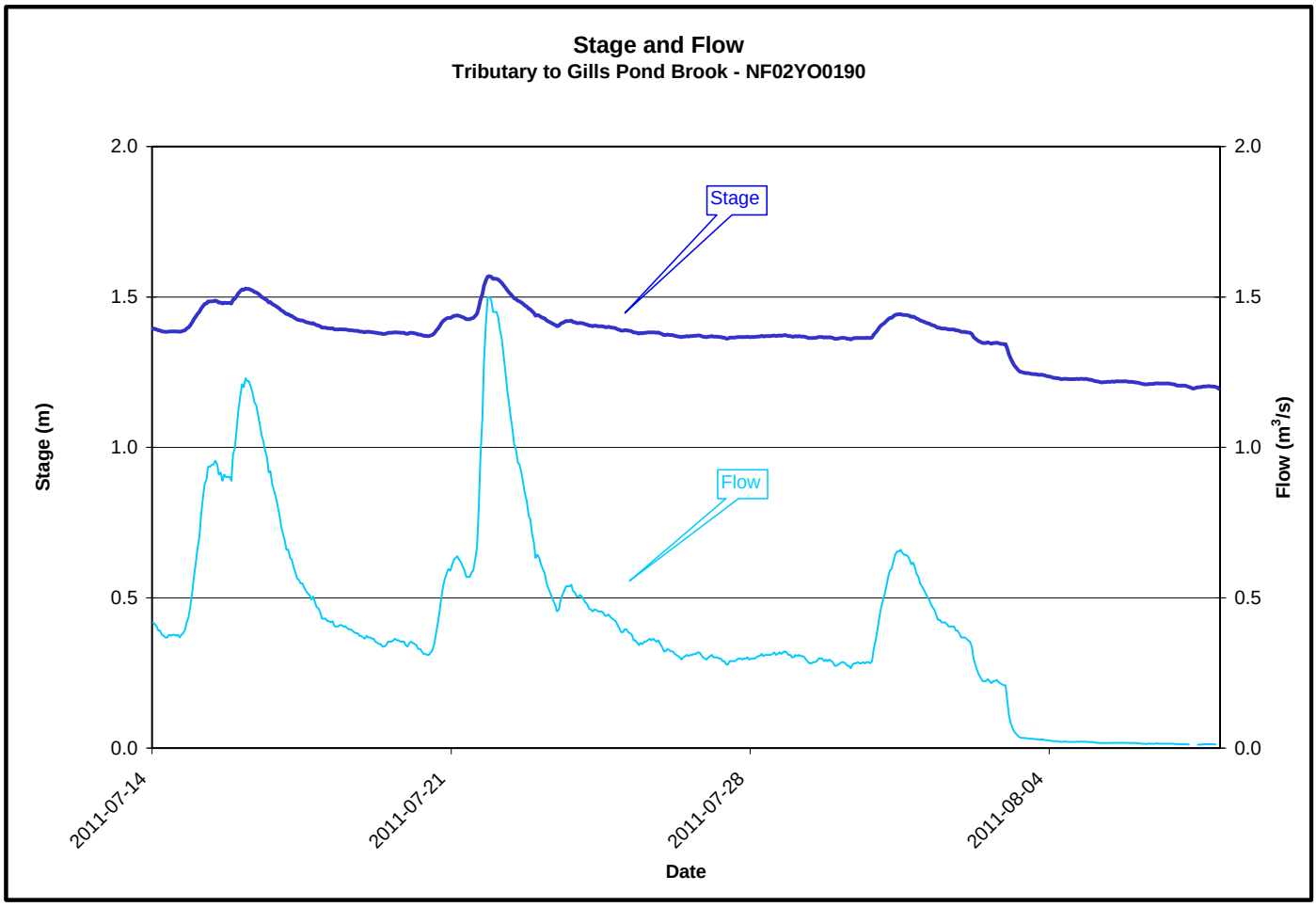


**Figure 6**

## EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 12.20 ˚C to a maximum of 22.98 ˚C.
- There appears to be little correlation with stage.

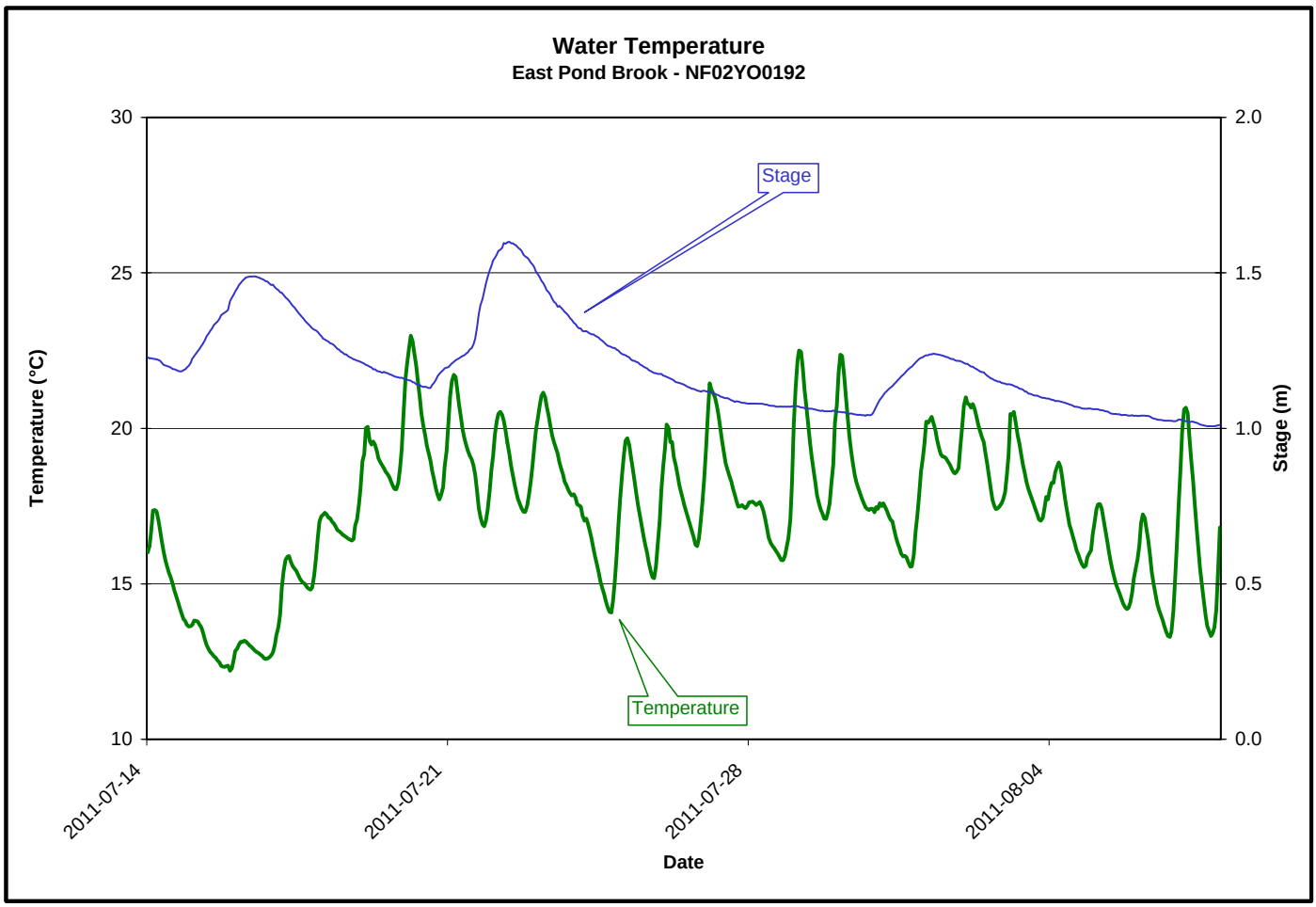


**Figure 7**

- Throughout the deployment period pH values (**Figure 8**) ranged from a minimum of 6.29 to a maximum of 6.97 with some of the values falling below the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- The background pH of this stream is normally quite low, and values near and below the limit are not unusual.
- There is an inverse relationship between pH and Stage

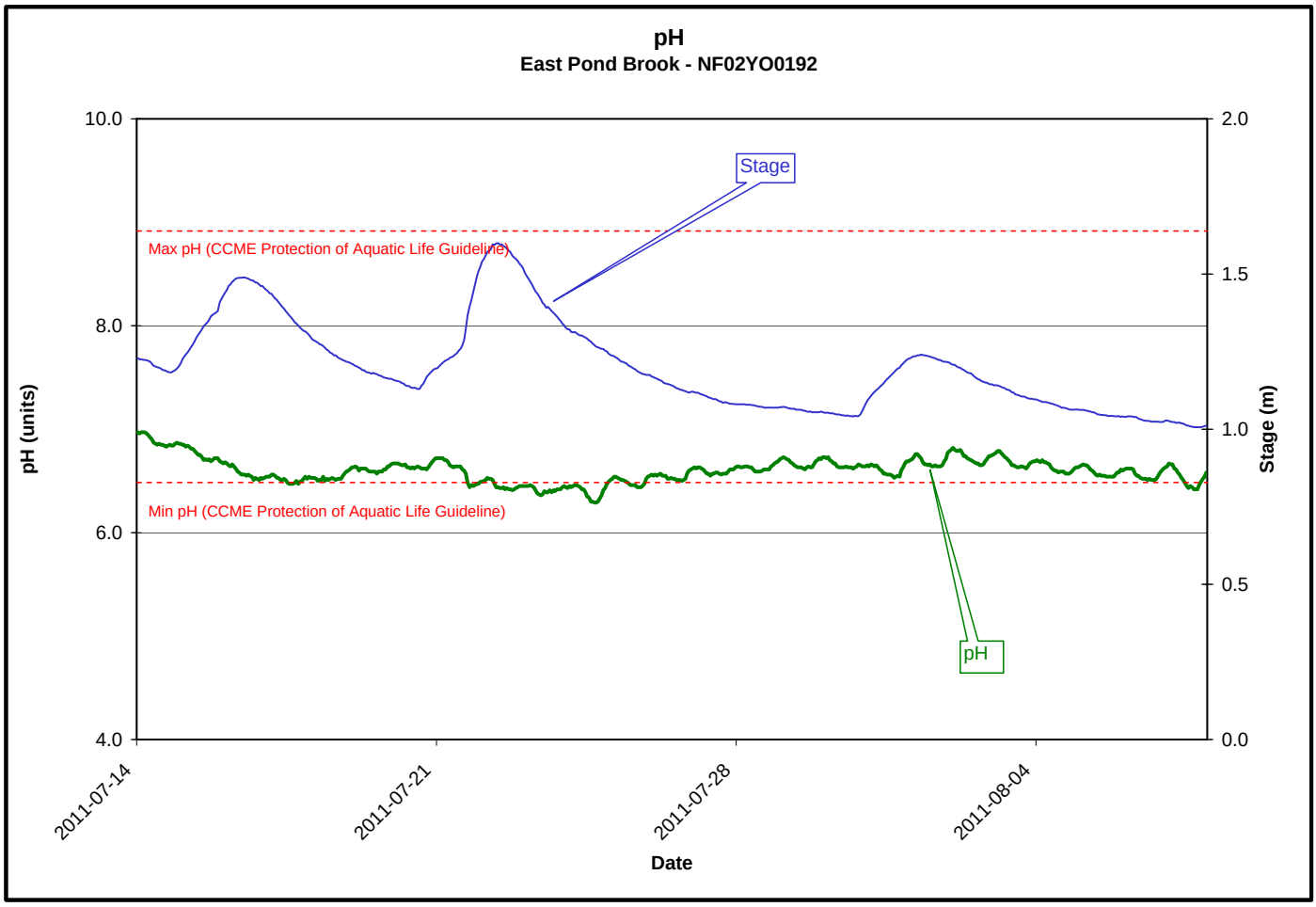


**Figure 8**

- The specific conductivity **(Figure 9)** ranged from a minimum of 18.9 µS/cm to a maximum of 32.0 µS/cm.
- All values are within the normal range.

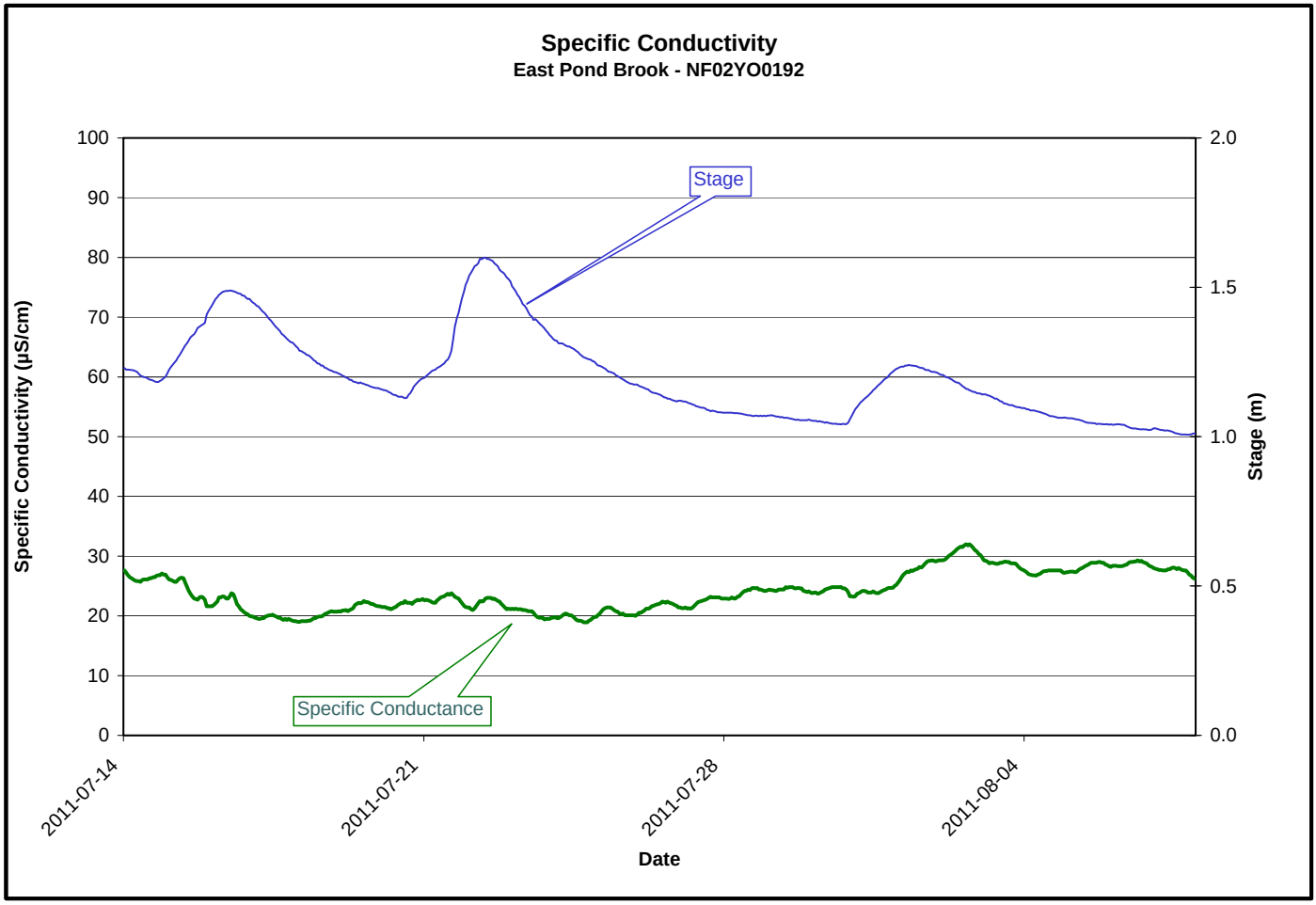


**Figure 9**

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 8.26 mg/L to a maximum of 10.13 mg/L over the deployment period, with the percent saturation ranging between 90.9 and 98.1.
- Dissolved oxygen is inversely proportional to water temperature.
- Throughout all of the deployment period, dissolved oxygen values fell above the lower limit recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (cold water/other life stages – above 6.5 mg/L; cold water/early life stages – above 9.5 mg/L).
- Based upon the fact that Dissolved Oxygen % Saturation had limited drift, we can be confident that the Dissolved Oxygen mg/L values are accurate.

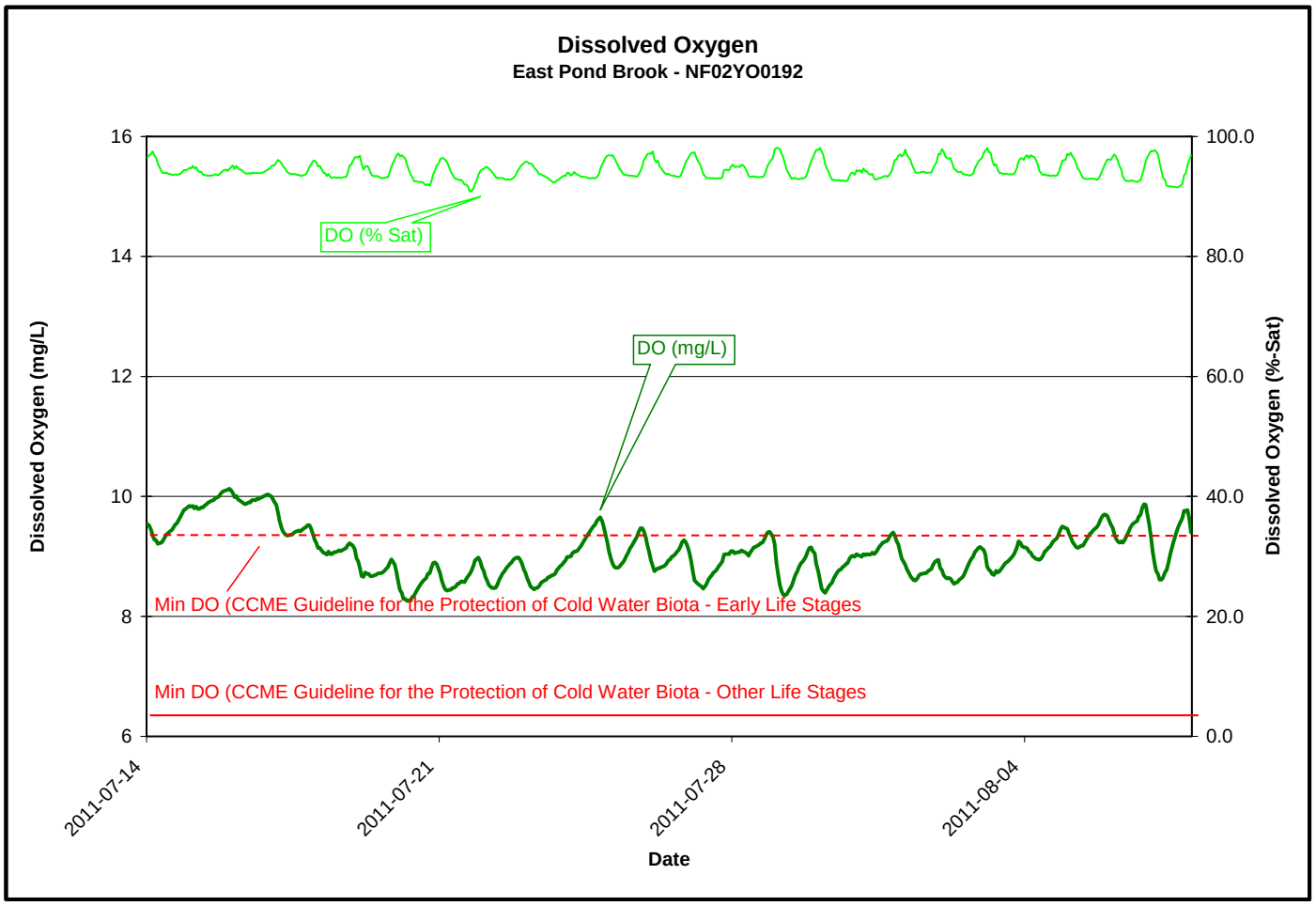


**Figure 10**

- The turbidity values **(Figure 11)** ranged from a minimum of 0.0 NTU to a maximum of 12.1 NTU.
- Typically, turbidity values in this stream are near zero; the peaks being insignificant events when natural in-stream debris and/or air bubbles passed near the sensor.
- Neither *in situ* nor grab sample measurements nor visual observations indicated turbidity issues.

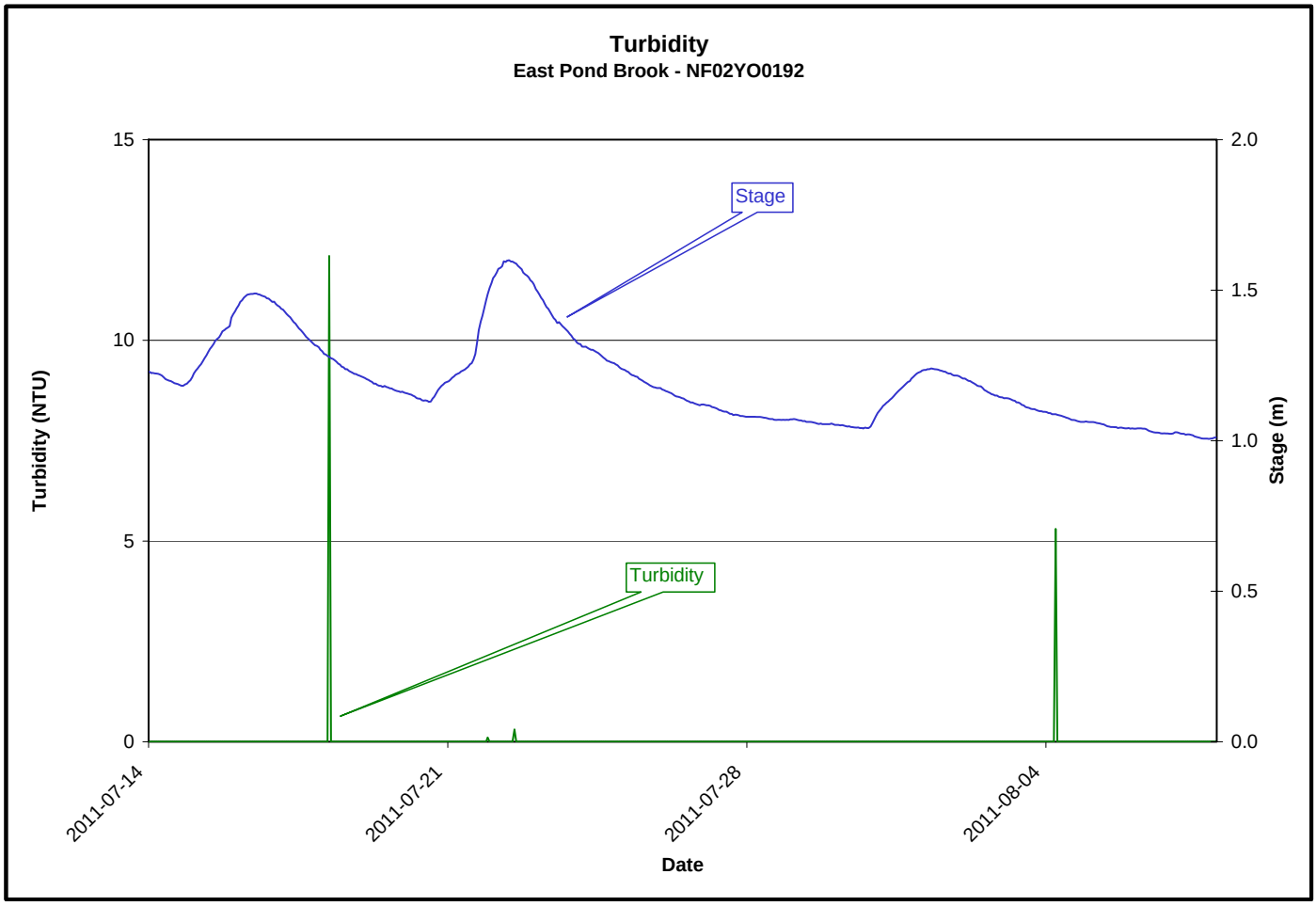


**Figure 11**

- The stage or water level ranged from a minimum of 1.01 m to a maximum of 1.60 m. The flow or discharge ranged from a minimum of 0.44 $m^3/s$ to a maximum of 7.49 $m^3/s$ **(Figure 12)**.
- Peaks are the result of precipitation/runoff events.
- Both stage and flow are within normal ranges.

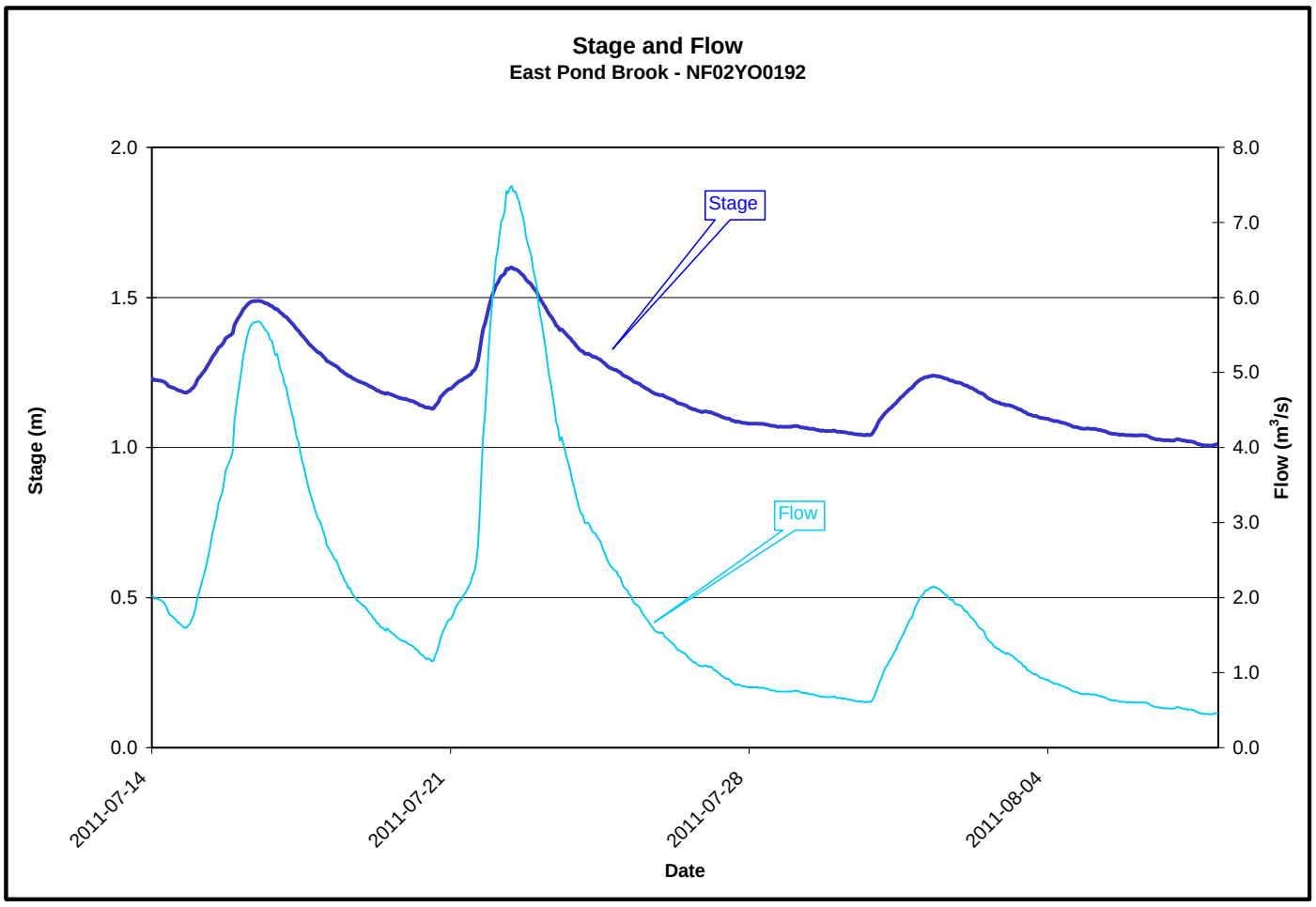


**Figure 12**

## WELL AFTER TAILING DAM (MW1)

- No data is available for this Deployment Period.

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