# Real-Time Water Quality Deployment Report

## Rattling Brook Network

**April 5th, 2013 to May 14th, 2013**

Newfoundland Labrador

**Government of Newfoundland & Labrador**
**Department of Environment and Conservation**
**Water Resources Management Division**
**St. John's, NL, A1B 4J6 Canada**

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## 2013-04-05 to 2013-05-14

## General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Considerable drift was observed in pH at Big Pond station during this deployment period. The drift was considerably more alkaline than expected values and conditions downstream did not reflect unusual pH values. Therefore, discussion of pH at Big Pond station was not undertaken in this report was removed from the dataset.
- A datalogger fault resulted in a transmission gap at Big Pond station in early April. The fault resulted in a loss of some stage level data and a replacement of the datalogger. The water quality gap was filled with internally logged data.

## 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**

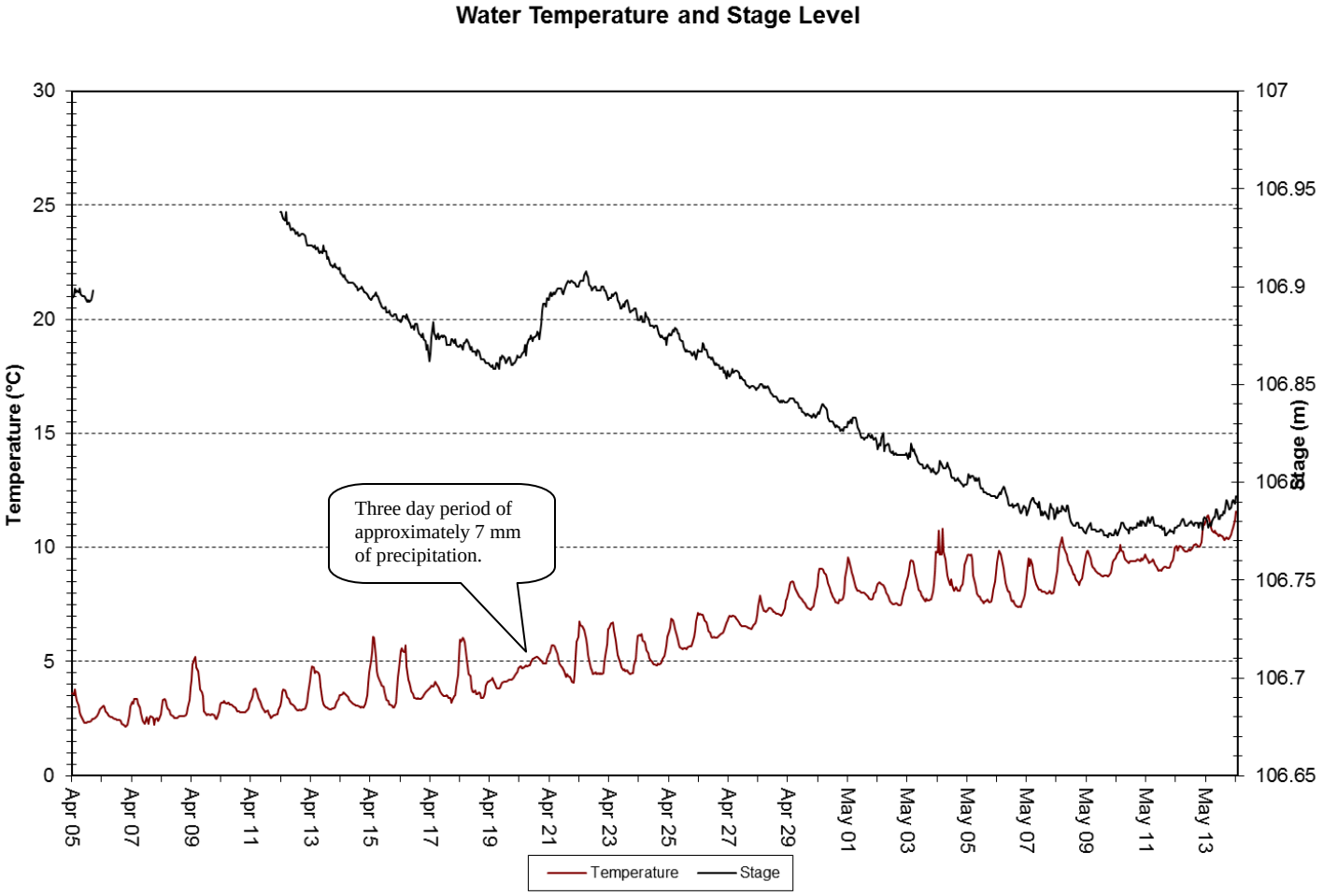
| Station | Date | Action | Comparison Ranking | | | | |
|---|---|---|---|---|---|---|---|
| | | | Temperature | pH | Conductivity | Dissolved Oxygen | Turbidity |
| Rattling Brook Big Pond | April 5, 2013 | Deployment | Marginal | Good | Good | Good | Excellent |
| | May 14, 2013 | Removal | Excellent | Poor | Good | Excellent | Excellent |
| Rattling Brook below Bridge | April 5, 2013 | Deployment | Poor | Fair | Excellent | Good | Excellent |
| | May 14, 2013 | Removal | Excellent | Excellent | Excellent | Good | Good |
| Rattling Brook below Plant Discharge | April 5, 2013 | Deployment | Marginal | Excellent | Excellent | Fair | Marginal |
| | May 14, 2013 | Removal | Excellent | Good | Excellent | Excellent | Excellent |

- The temperature probe on the QAQC Sonde at the time of deployment was approximately 1$^{o}$C below all three Field Sondes during deployment. It can be assumed that the Field Sondes were correct in this instance.
- pH values drifted considerably at Big Pond Station and were marked as “Poor”. The sensor was examined following deployment and recalibrated without issue.

# Data Interpretation

## Temperature

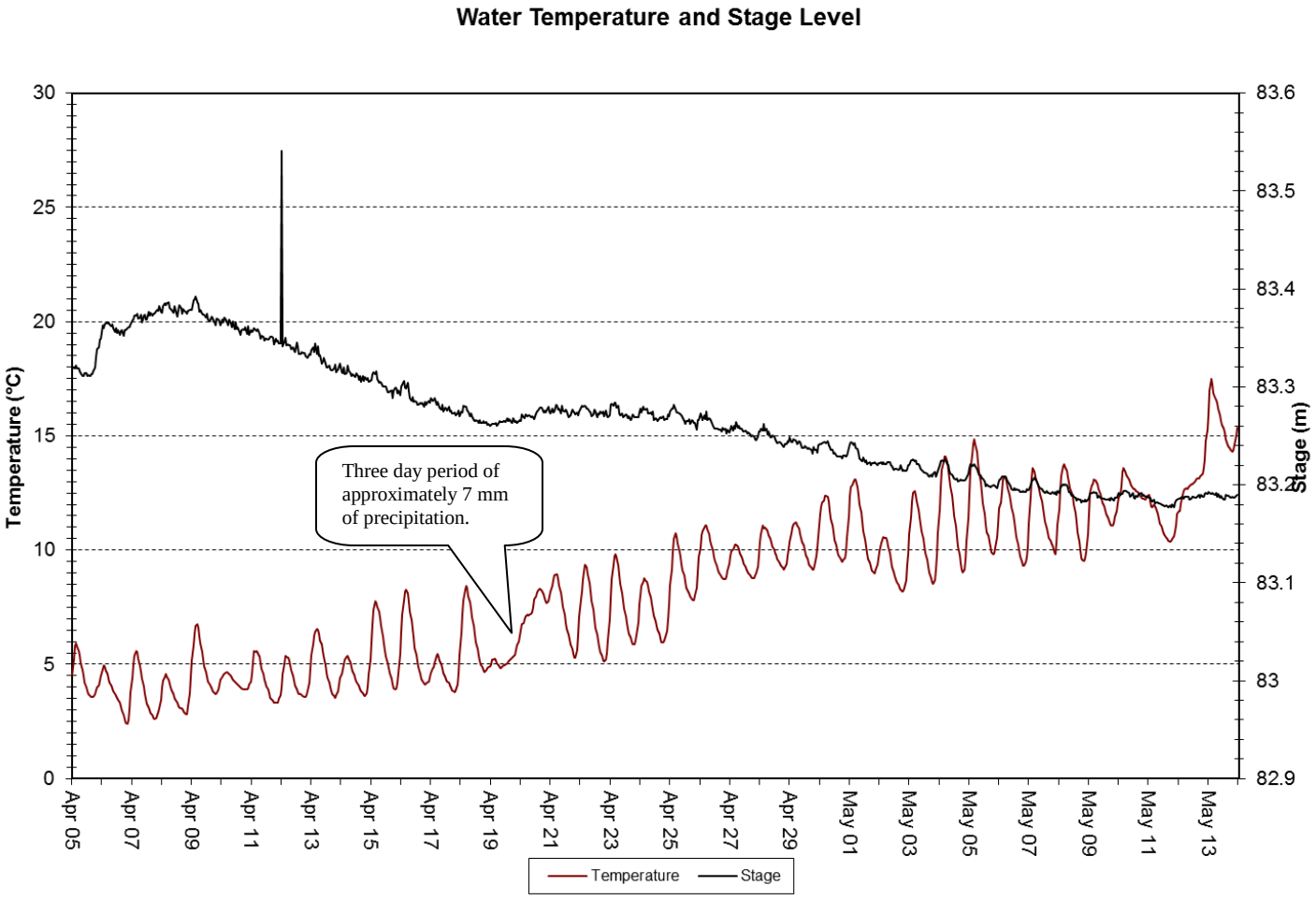
**Figure 1: Water Temperature at Rattling Brook Big Pond from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Temperature('C) | 11.58 | 2.16 | 5.94 |

- Annual spring water temperature rise is clearly under way during this deployment period. Diurnal temperature fluctuations are obvious in the figure above except between April 19th and 22nd during a three day period of precipitation.
- Water temperature was lower at Big Pond station compared to those stations downstream.

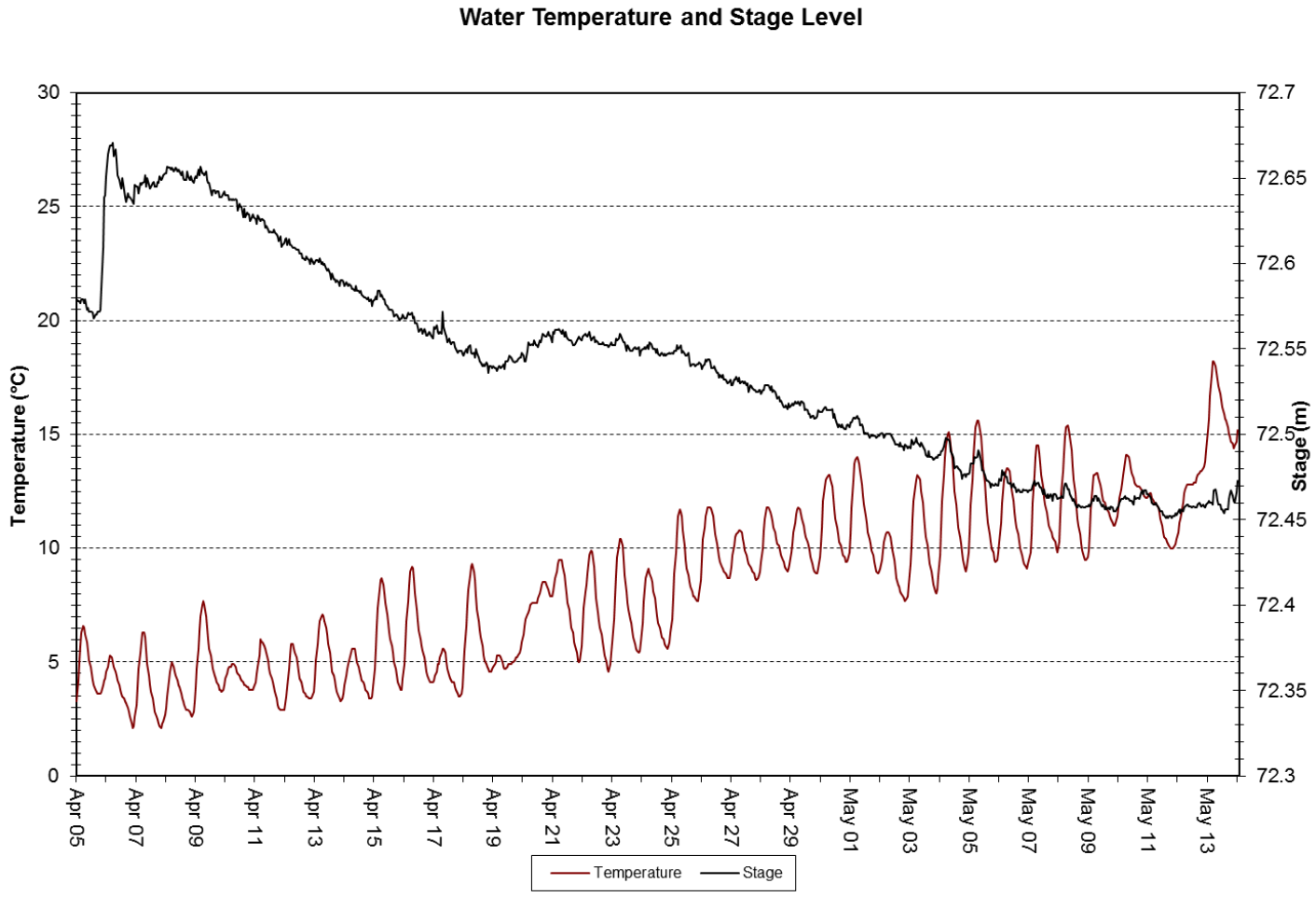
**Figure 2: Water Temperature at Rattling Brook below Bridge from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Temperature('C) | 17.51 | 2.39 | 8.43 |

- Water temperature increased consistently during this deployment period. Temperatures were consistently higher than those upstream at Big Pond station due to greater interaction with atmospheric conditions.

**Figure 3: Water Temperature at Rattling Brook below Plant Discharge from April 5 to May 14**

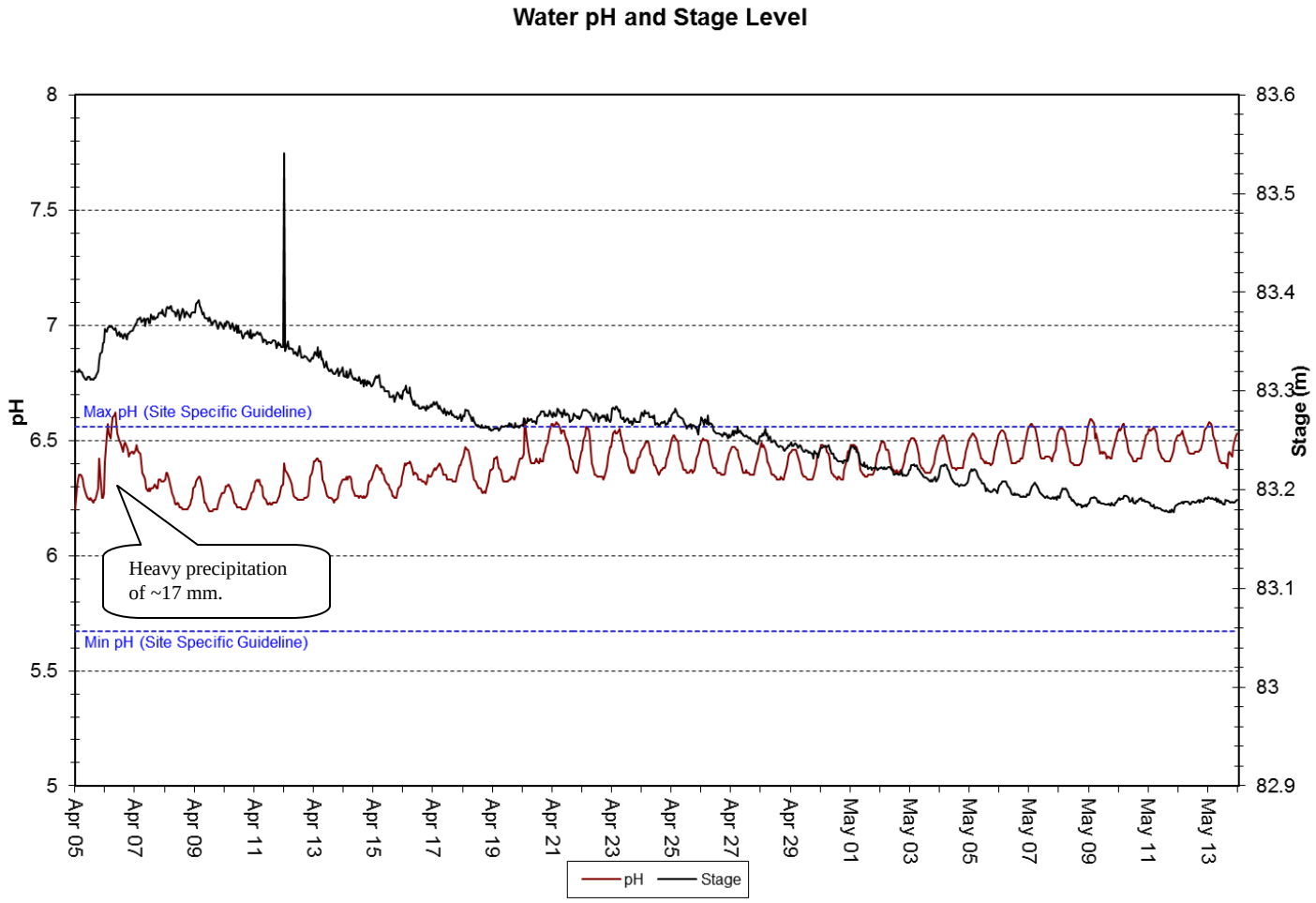



| Parameter | Max | Min | Median |
|---|---|---|---|
| Temperature('C) | 18.20 | 2.10 | 8.60 |

- Median water temperature was found to be approximately 0.2$^{o}$C greater than Bridge station because of a longer period for water to interact with warmer atmospheric conditions. Likewise, daily variation (the difference between daytime highs and nighttime lows) was greater.

pH

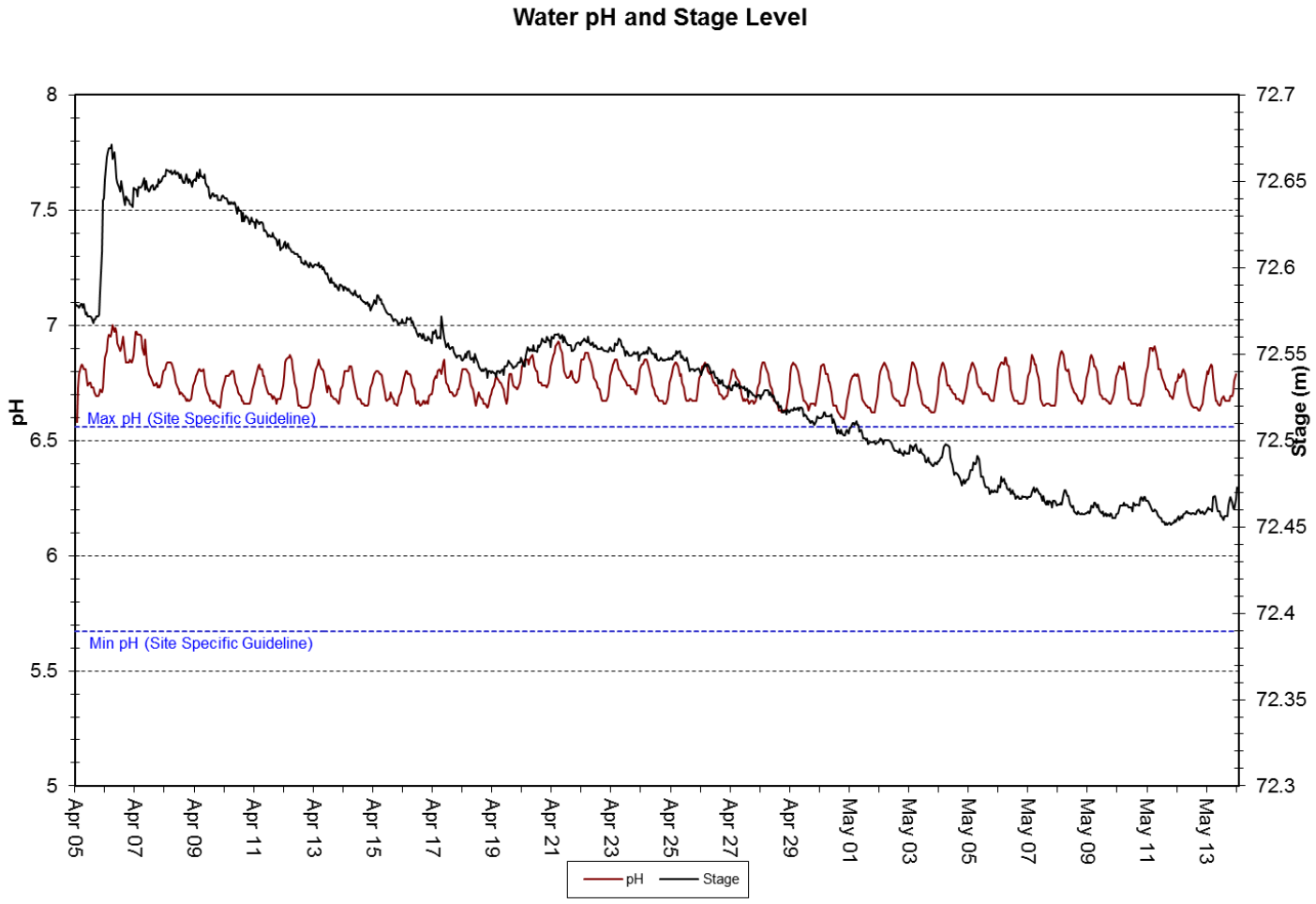
**Figure 4: pH at Rattling Brook below Bridge from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| pH | 6.62 | 6.19 | 6.40 |

- pH levels showed a slight increase over the deployment period but remained mostly within the Site Specific Guidelines. A spike in pH values was observed from April 6th to 7th in conjunction with a heavy precipitation event on April 6th.

**Figure 5: pH at Rattling Brook below Plant Discharge from April 5 to May 14**

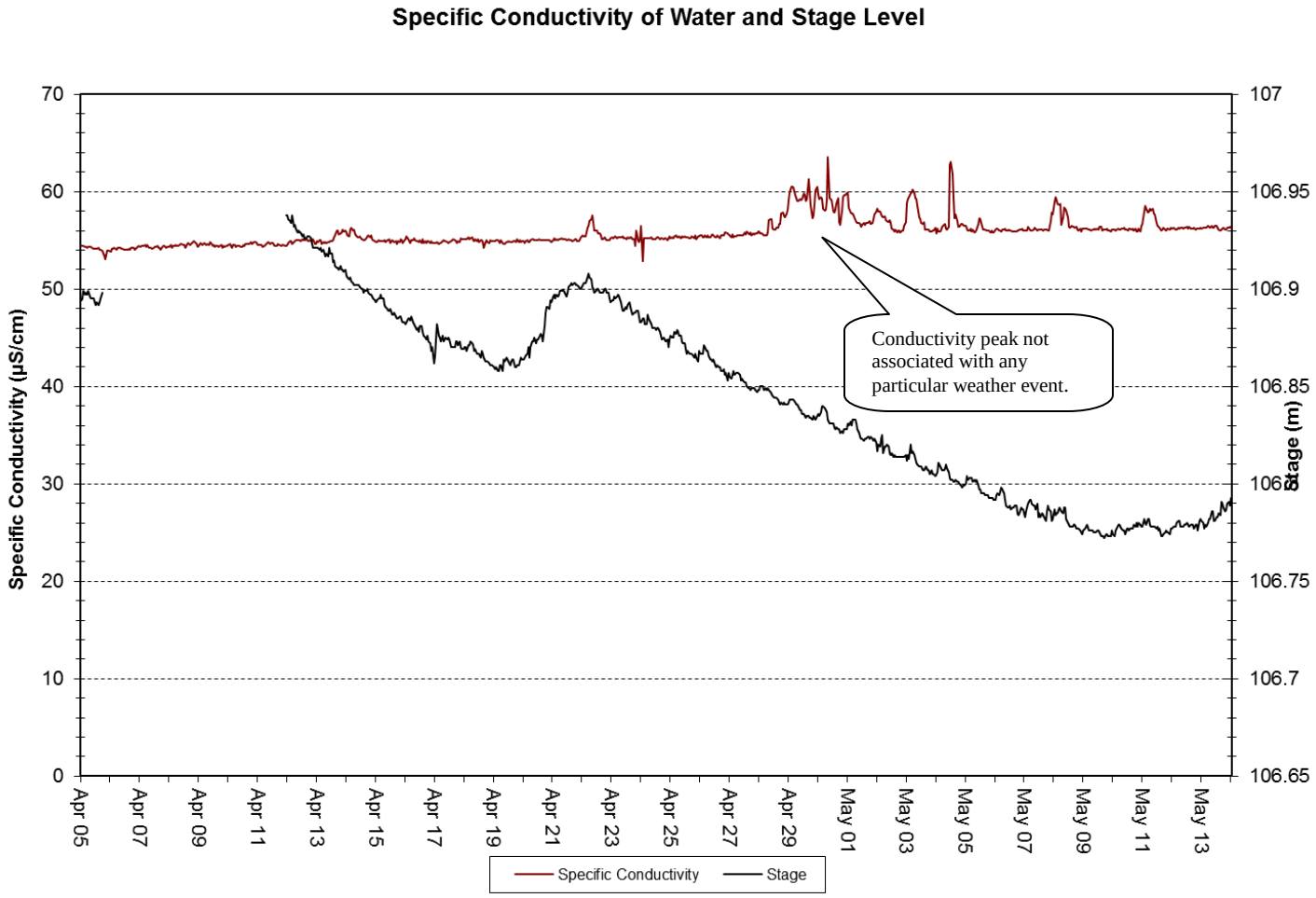



| Parameter | Max | Min | Median |
|---|---|---|---|
| pH | 7.00 | 6.58 | 6.74 |

- pH levels are notably higher than those upstream at Bridge station. Values were consistently above the Site Specific Guideline for the Rattling Brook system. This may be a seasonal effect and will be observed closely.

## Specific Conductivity

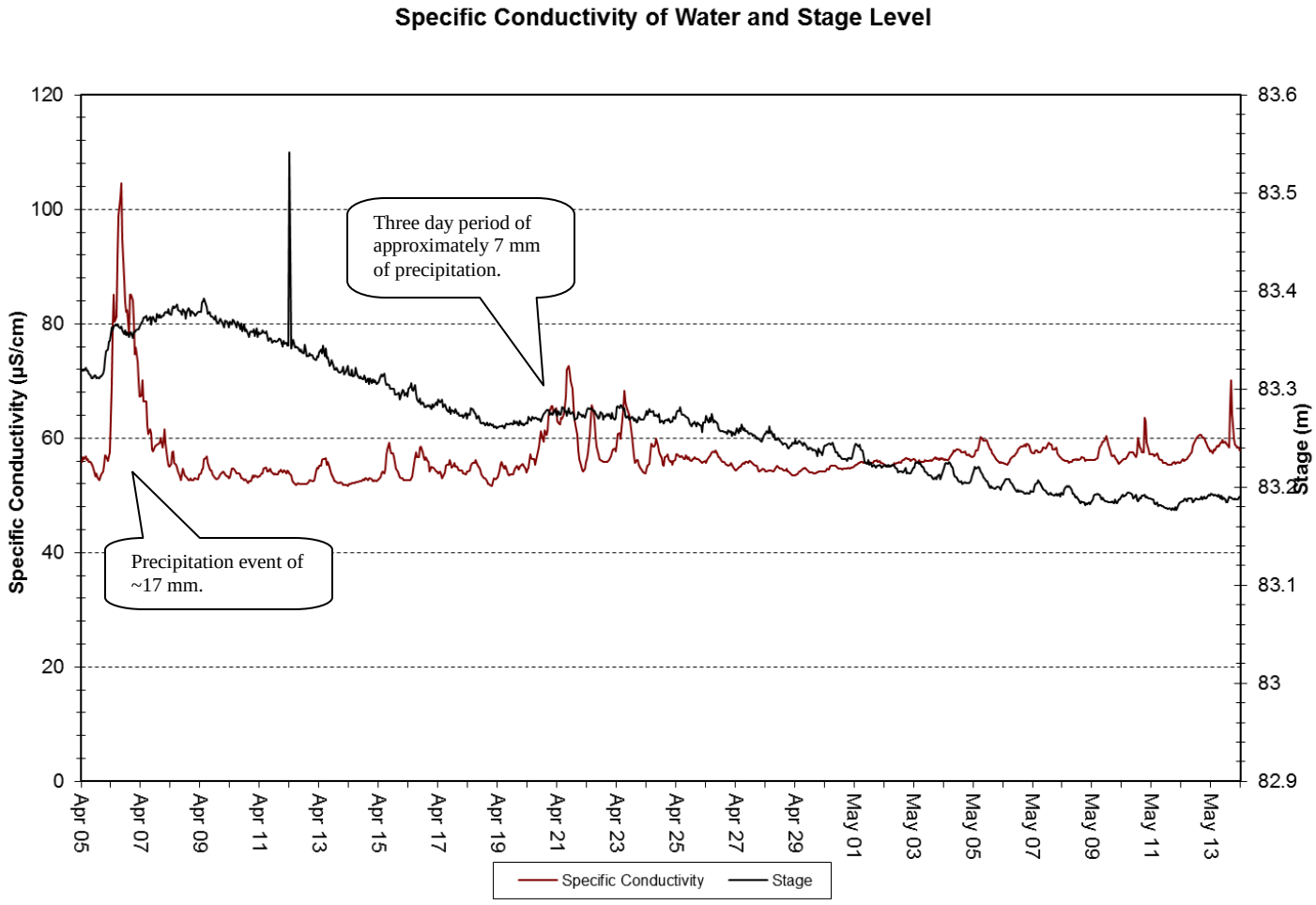
**Figure 6: Specific Conductivity at Rattling Brook Big Pond from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Specific Conductivity (µS/cm) | 63.5 | 52.9 | 55.4 |

- Conductivity increased marginally over the deployment period at Big Pond station. A small number of peaks were noted that did not appear to coincide with recorded precipitation events. Isolated showers and localized weather conditions may have impacted water conditions at these times.
- Beginning around April 28th, a three day period of variable conductivity was observed that did not correspond with any notable weather events. No similar event was observed downstream at Bridge or Plant Discharge station.

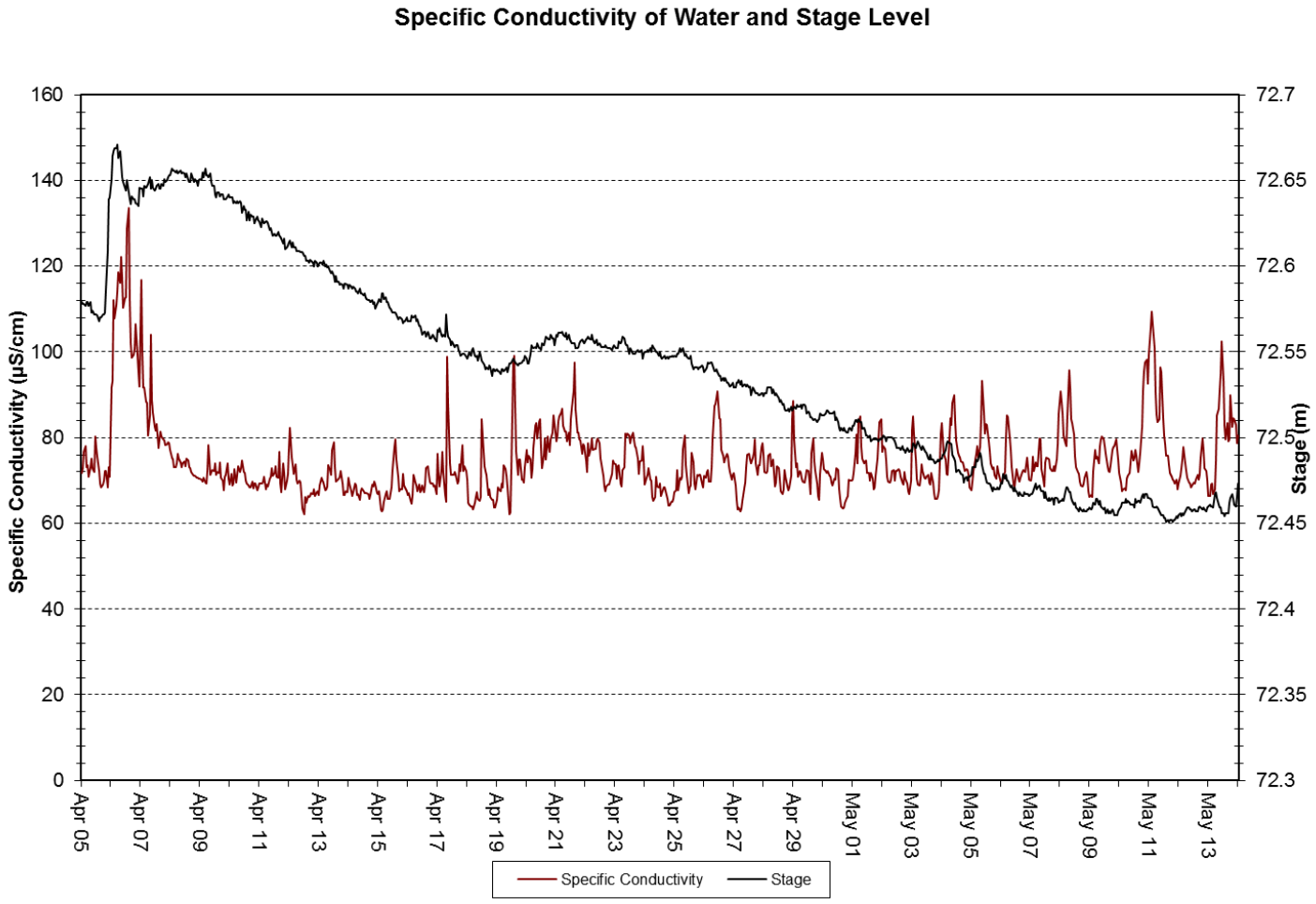
**Figure 7: Specific Conductivity at Rattling Brook below Bridge from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Specific Conductivity (µS/cm) | 104.5 | 51.7 | 55.9 |

- Conductivity values were greater downstream at Bridge station and showed a greater degree of variation.

**Figure 8: Specific Conductivity at Rattling Brook below Plant Discharge from April 5 to May 14**

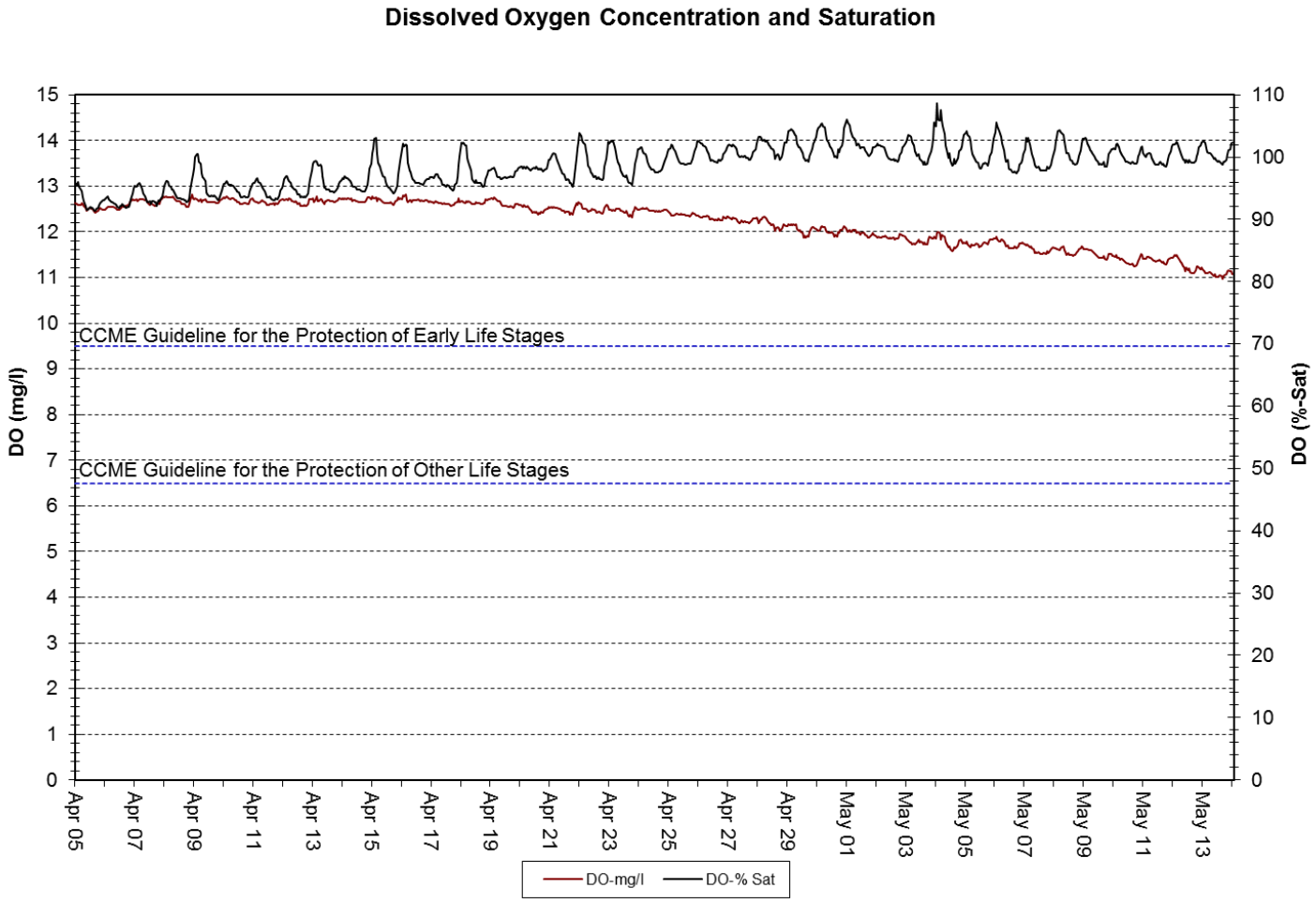



| Parameter | Max | Min | Median |
|---|---|---|---|
| Specific Conductivity (µS/cm) | 133.6 | 62.1 | 72.2 |

- An even greater degree of variability in conductivity was observed at Plant Discharge station compared to Big Pond and Bridge stations. Values also tended to be substantially higher: median conductivity was 16.3 µS/cm higher than Bridge station. Variability was so high that only the April 6$^{th}$ event related to heavy precipitation was obvious.

## Dissolved Oxygen

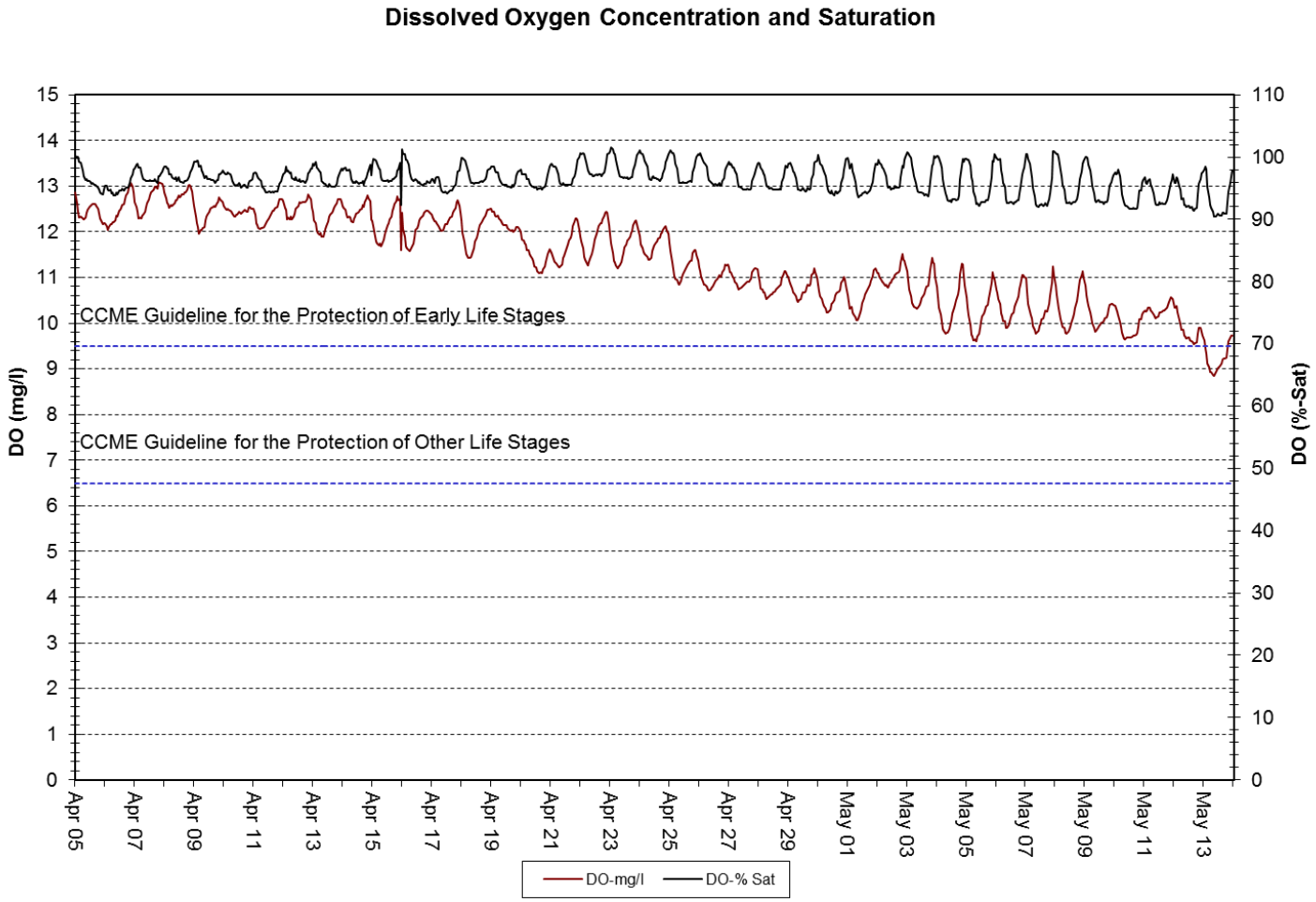
**Figure 9: Dissolved Oxygen at Rattling Brook Big Pond from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Dissolved Oxygen (%-Sat) | 108.6 | 91.4 | 98.9 |
| Dissolved Oxygen (mg/l) | 12.81 | 10.97 | 12.42 |

- Increasing water temperature is expected to drive down the concentration of dissolved oxygen, as is the case in the figure above. Concentrations were consistently above the CCME Guideline for the protection of early life stage cold water biota, but will probably fall below 9.5 mg/l in early to mid-June.

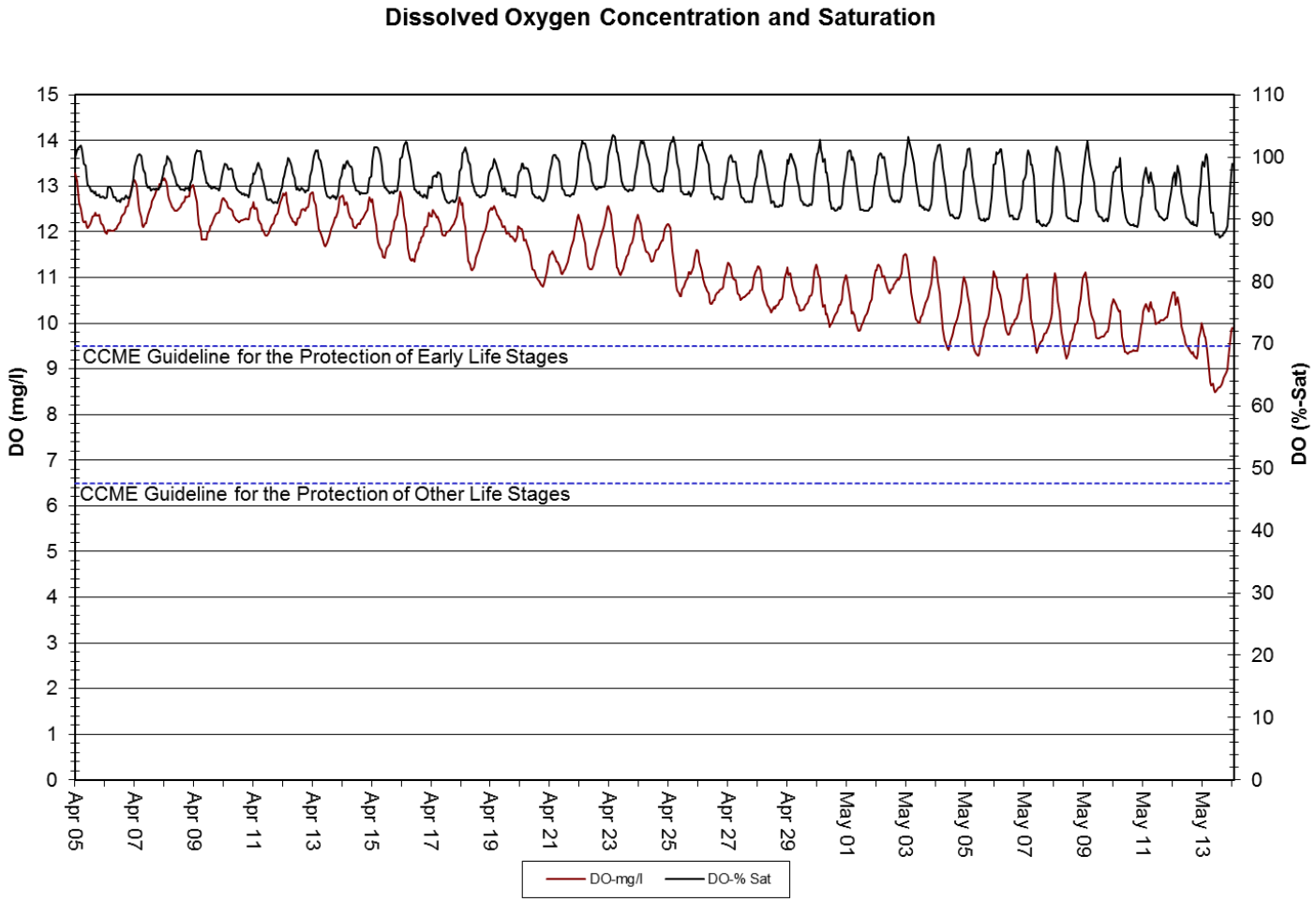
**Figure 10: Dissolved Oxygen at Rattling Brook below Bridge from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Dissolved Oxygen (%-Sat) | 101.6 | 90.4 | 96.2 |
| Dissolved Oxygen (mg/l) | 13.10 | 8.84 | 11.35 |

- Dissolved oxygen concentrations were notably lower at Bridge station compared to those upstream at Big Pond. This is likely the result of warmer water temperatures in the lower reaches of Rattling Brook.

**Figure 11: Dissolved Oxygen at Rattling Brook below Plant Discharge from April 5 to May 14**

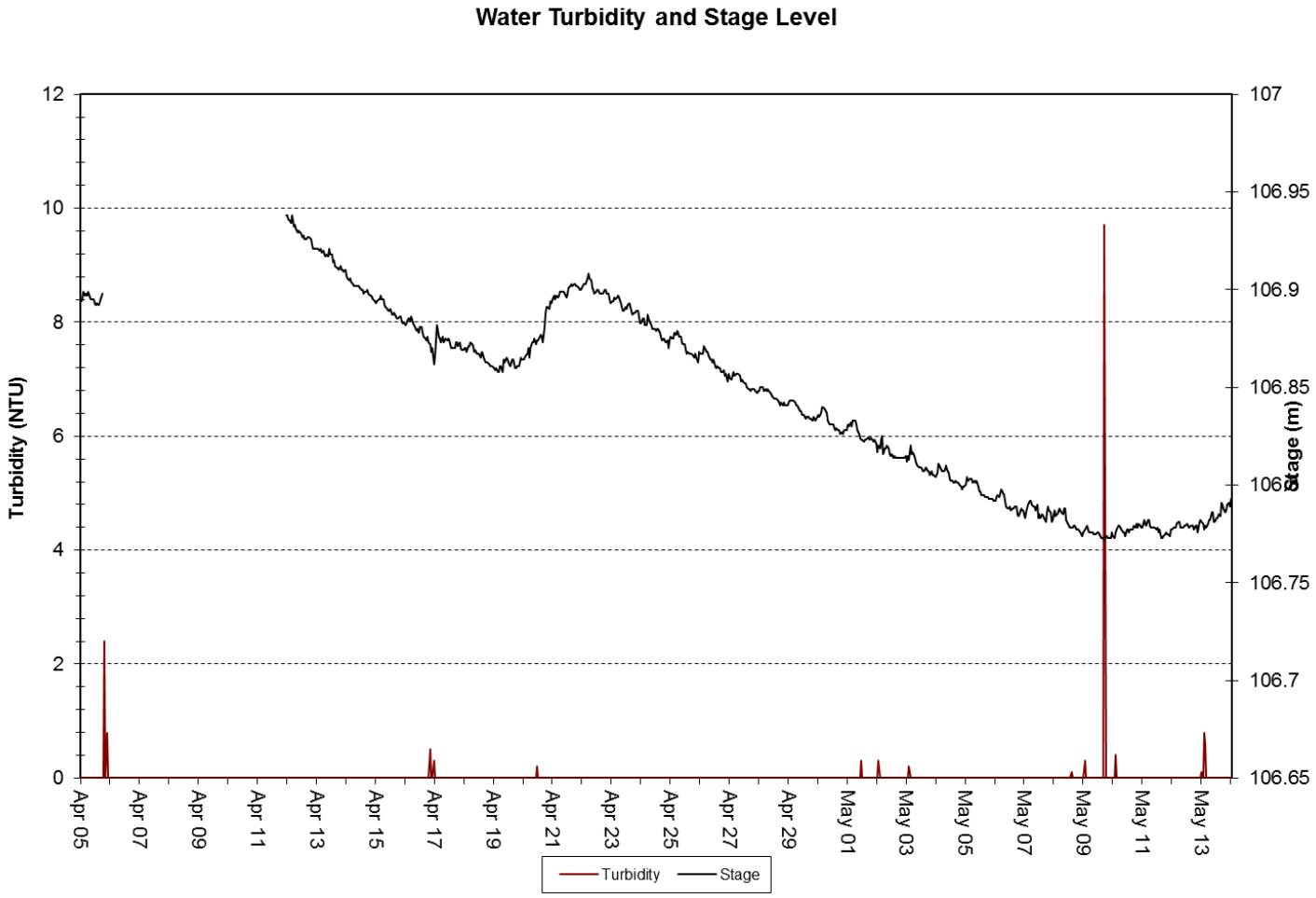



| Parameter | Max | Min | Median |
|---|---|---|---|
| Dissolved Oxygen (%-Sat) | 103.6 | 87.1 | 95.1 |
| Dissolved Oxygen (mg/l) | 13.27 | 8.49 | 11.28 |

- Warmer water temperatures lower in Rattling Brook forced dissolved oxygen concentrations below the CCME Guideline of 9.5 mg/l sooner than the upper portions. May 4th marked the first time in 2013 that DO concentrations fell below the level prescribed for the protection of early life stage cold water biota. This did not occur until a week later at Bridge station.

## Turbidity

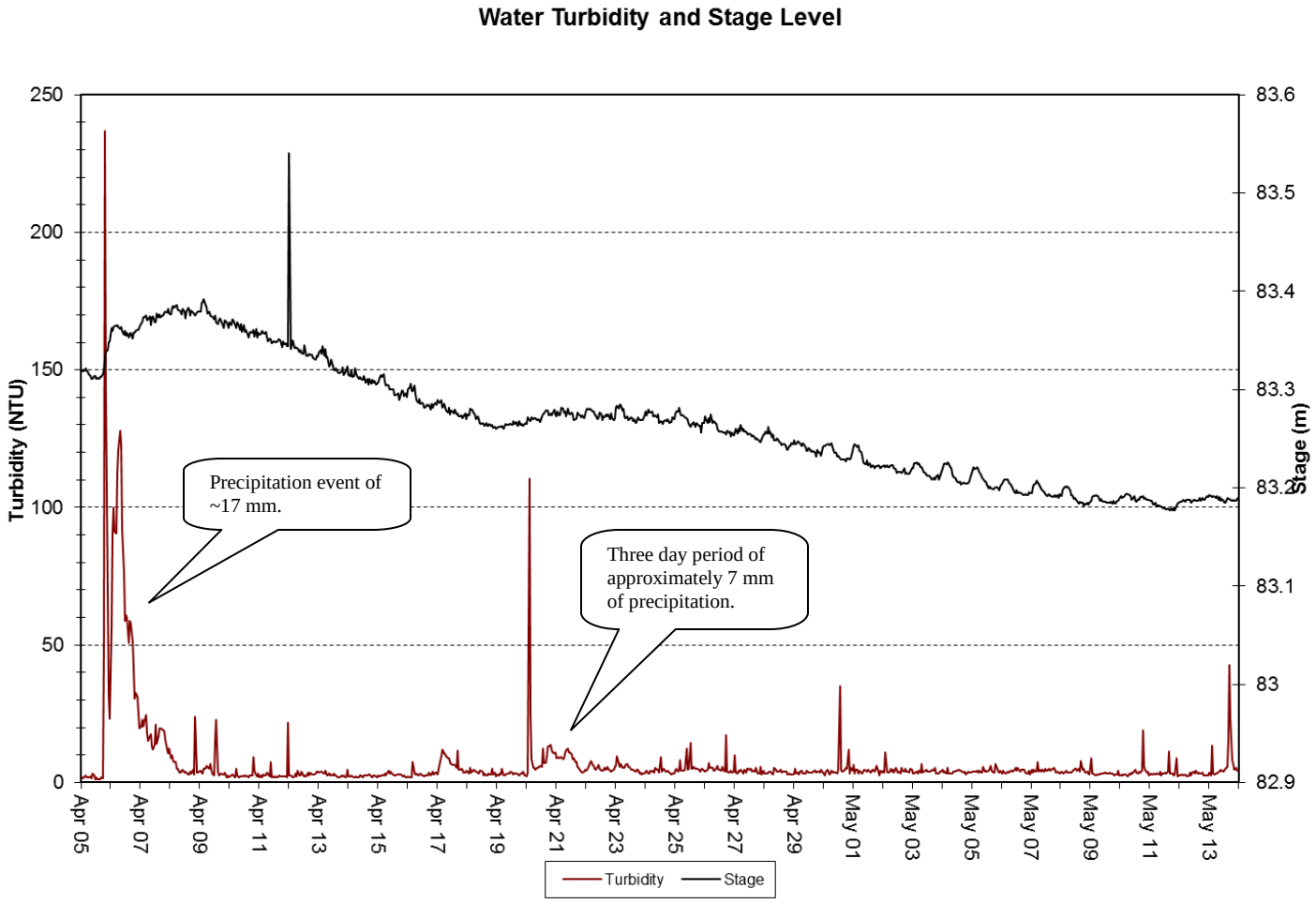
**Figure 12: Turbidity at Rattling Brook Big Pond from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Turbidity (NTU) | 9.7 | 0.0 | 0.0 |

- Turbidity levels were low during this deployment at Big Pond. Turbidity peaks tended to occur as singular, low-magnitude incidences that resolved within an hour – including the deployment maximum of 9.7 NTU, which may have been provoked by relatively foul weather on May 9$^{th}$ (4 mm of precipitation).

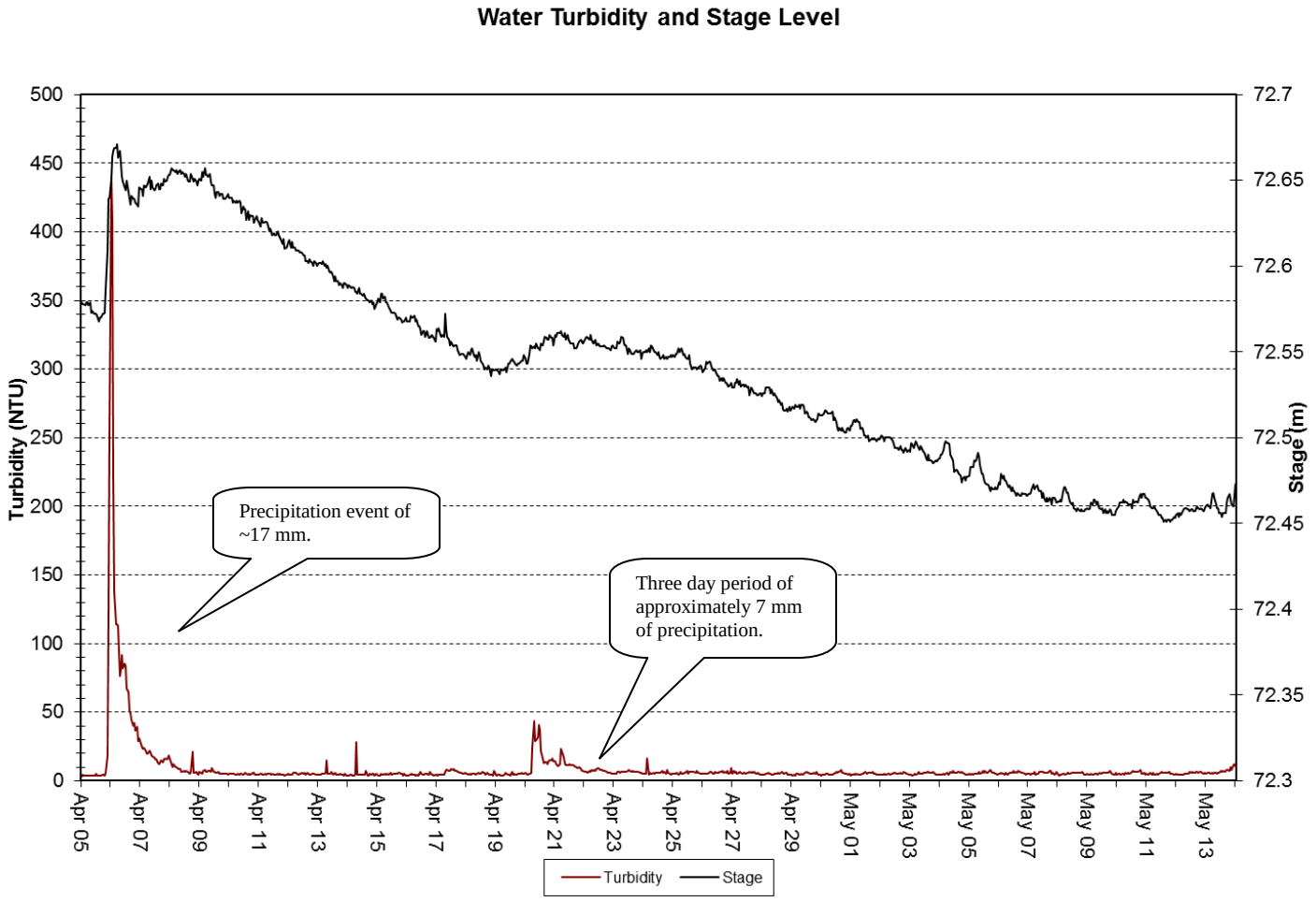
**Figure 13: Turbidity at Rattling Brook below Bridge from April 5 to May 14**




| Parameter | Max | Min | Median |
|---|---|---|---|
| Turbidity (NTU) | 236.8 | 1.0 | 3.8 |

- Water turbidity consistently displayed an observable, but low, level of turbidity. Two turbidity events above this "background" were notable in early and late April – both related to increasing stage level and precipitation.
- During this deployment 20 turbidity records were found to be at, or above, the turbidity alert threshold of 55 NTU.

**Figure 14: Turbidity at Rattling Brook below Plant Discharge from April 5 to May 14**



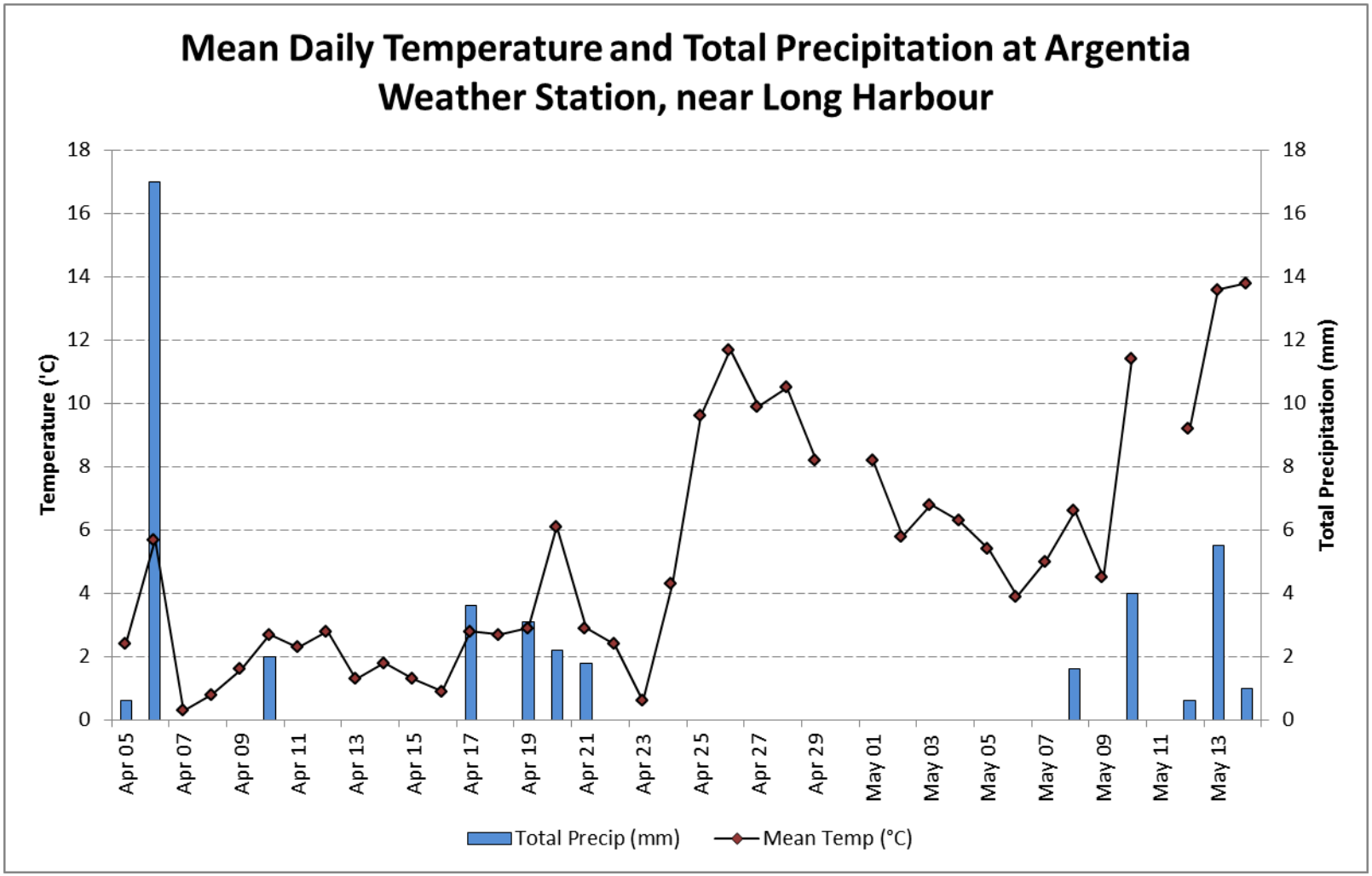

| Parameter | Max | Min | Median |
|---|---|---|---|
| Turbidity (NTU) | 440.0 | 3.2 | 5.4 |

- Much like Bridge station, a consistent level of low-level, but observable, turbidity was present at this station from early April to mid-May, although the level was marginally higher in magnitude. The same two turbidity events were seen here as observed upstream at Bridge station.
- During this deployment period 24 turbidity records were found to be at, or above the turbidity alert threshold of 40 NTU.

## Conclusions

- The LDO sensor on the original Bridge station Hydrolab was fixed in early May and deployed upon removal of the stand-in Hydrolab on May 14th.
- A gap in transmission from Big Pond in early April resulted in a partial loss of stage level data. Water Quality data was backfilled using internally logged data. The transmission loss required replacement of the datalogger.
- No water quality events of major concern were observed from April 5th to May 14th, though the turbidity levels at Bridge and Plant Discharge stations have yet to fall back to background. This is still expected in time as Forgotten Pond stabilizes and new vegetation holds back silt and sediment

# Appendix

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