Real-Time Water Quality Deployment Report

Rattling Brook Network

November 2, 2012 to December 20, 2012

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

Newfoundland Labrador

Real-Time Water Quality Deployment Report
Rattling Brook Network
2012-11-02 to 2012-12-20

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Though complete, habitat rehabilitation work in the Forgotten Pond area continued to produce high turbidity conditions throughout the deployment period. This is expected to trail off overtime as silt settles and washes out of the Rattling Brook system.

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

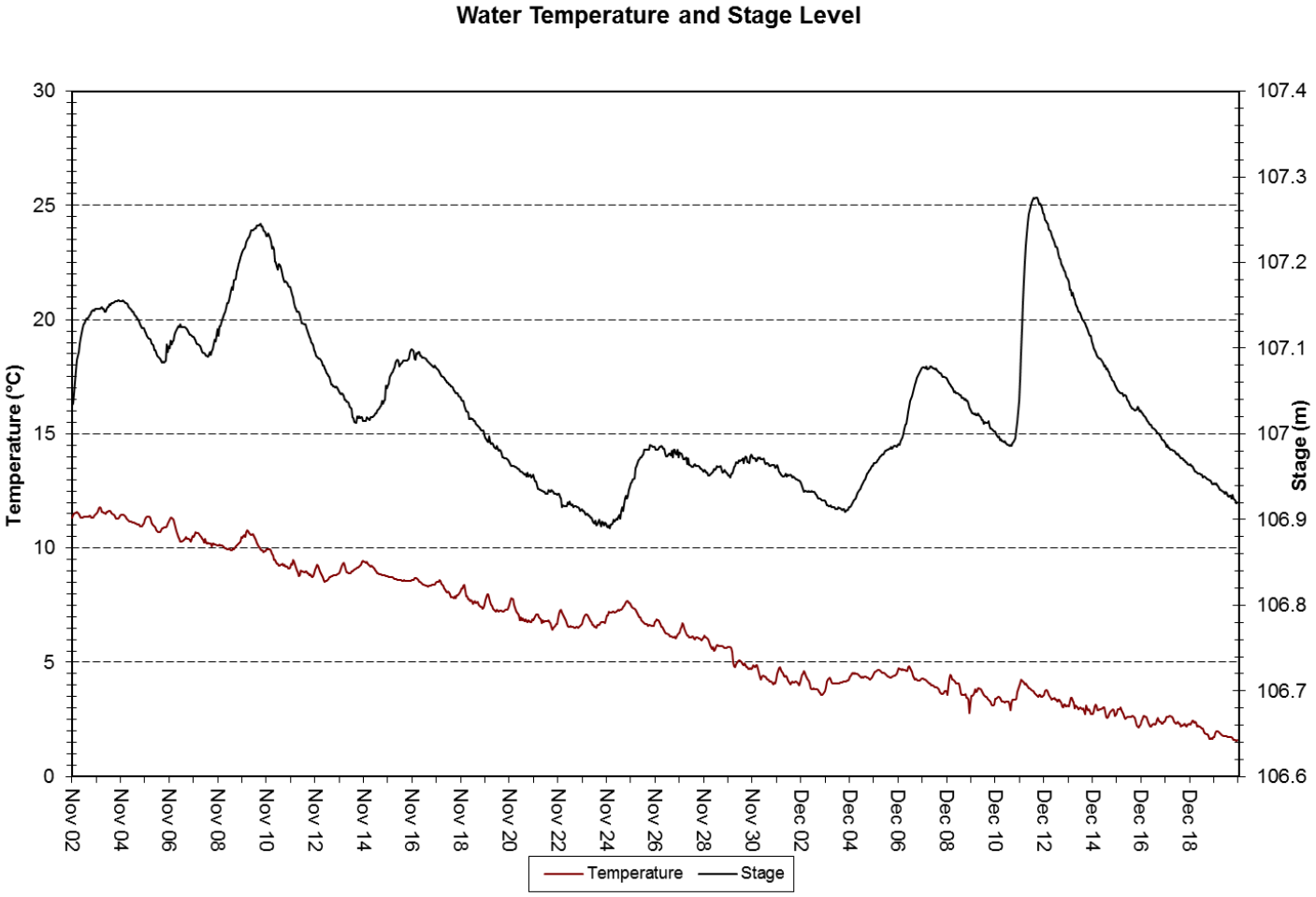
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	2012-11-02	Deployment	Excellent	NA	Good	Good	Excellent
	2012-12-20	Removal	NA	NA	Good	Excellent	Excellent
Rattling Brook below Bridge	2012-11-02	Deployment	Excellent	NA	Marginal	Excellent	NA
	2012-12-20	Removal	NA	NA	Marginal	Excellent	Fair
Rattling Brook below Plant Discharge	2012-11-02	Deployment	Excellent	NA	Excellent	Excellent	NA
	2012-12-20	Removal	NA	NA	Good	Excellent	NA

- Some problems with temperature, pH, and turbidity sensors on the QAQC sonde unfairly influenced the rankings in Table 1 and have been excluded.
- A failure of the lab to report results for turbidity at the time of deployment prevented a reasonable assessment of accuracy at Bridge and Plant Discharge stations where apparent turbidity was present. Both Field and QAQC sondes reported turbidity, but with a difference of ~ 20%. These rankings were not included. A turbidity ranking for Plant Discharge at removal was also not included due to unreasonable data from the QAQC sonde.

Data Interpretation

Temperature

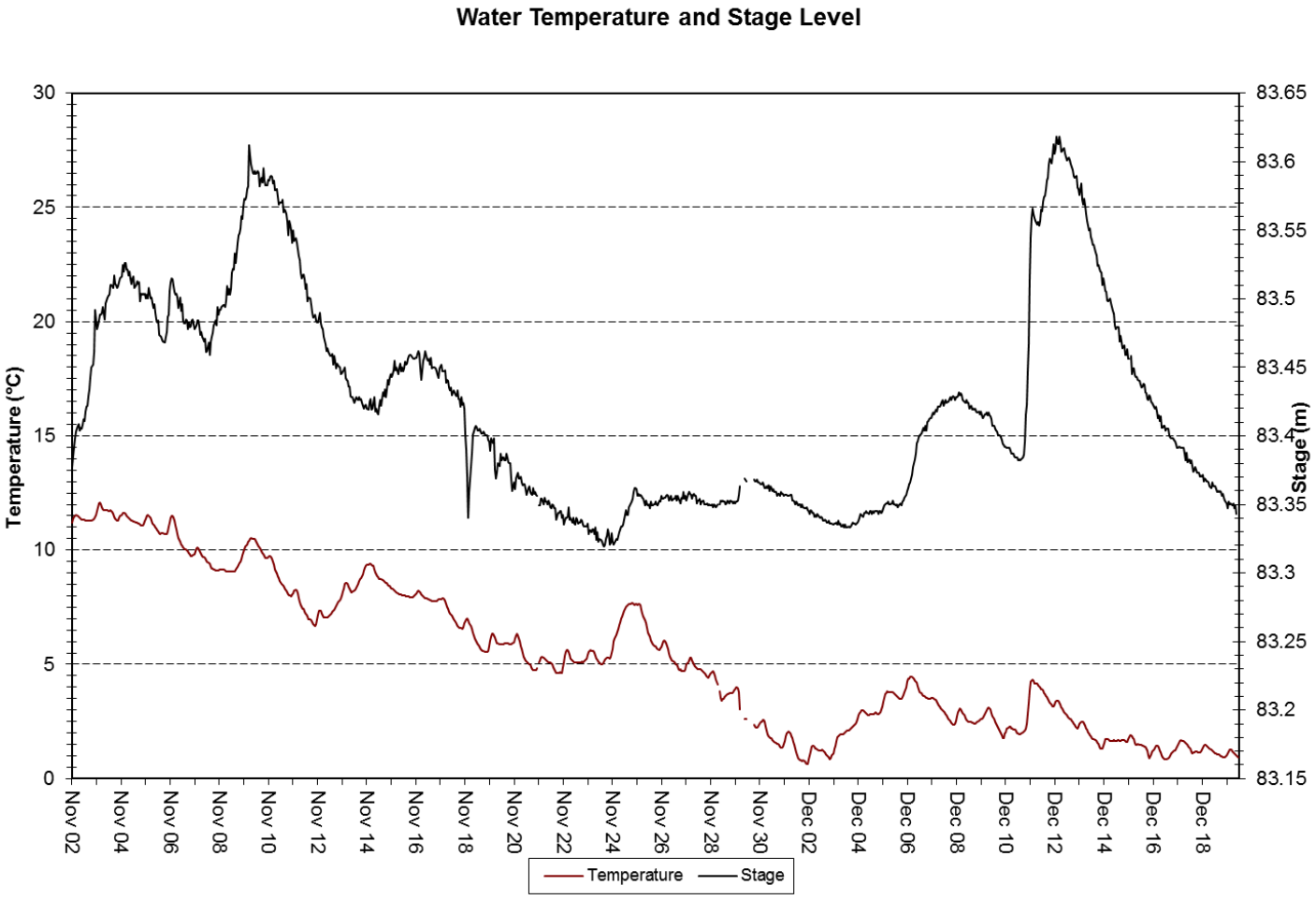
Figure 1: Water Temperature at Rattling Brook Big Pond



Parameter	Max	Min	Median
Temperature('C)	11.77	1.57	6.55

- A steady decline is evident in water temperature into late December. Given the declining trend, ice conditions can be expected in early to mid-January.

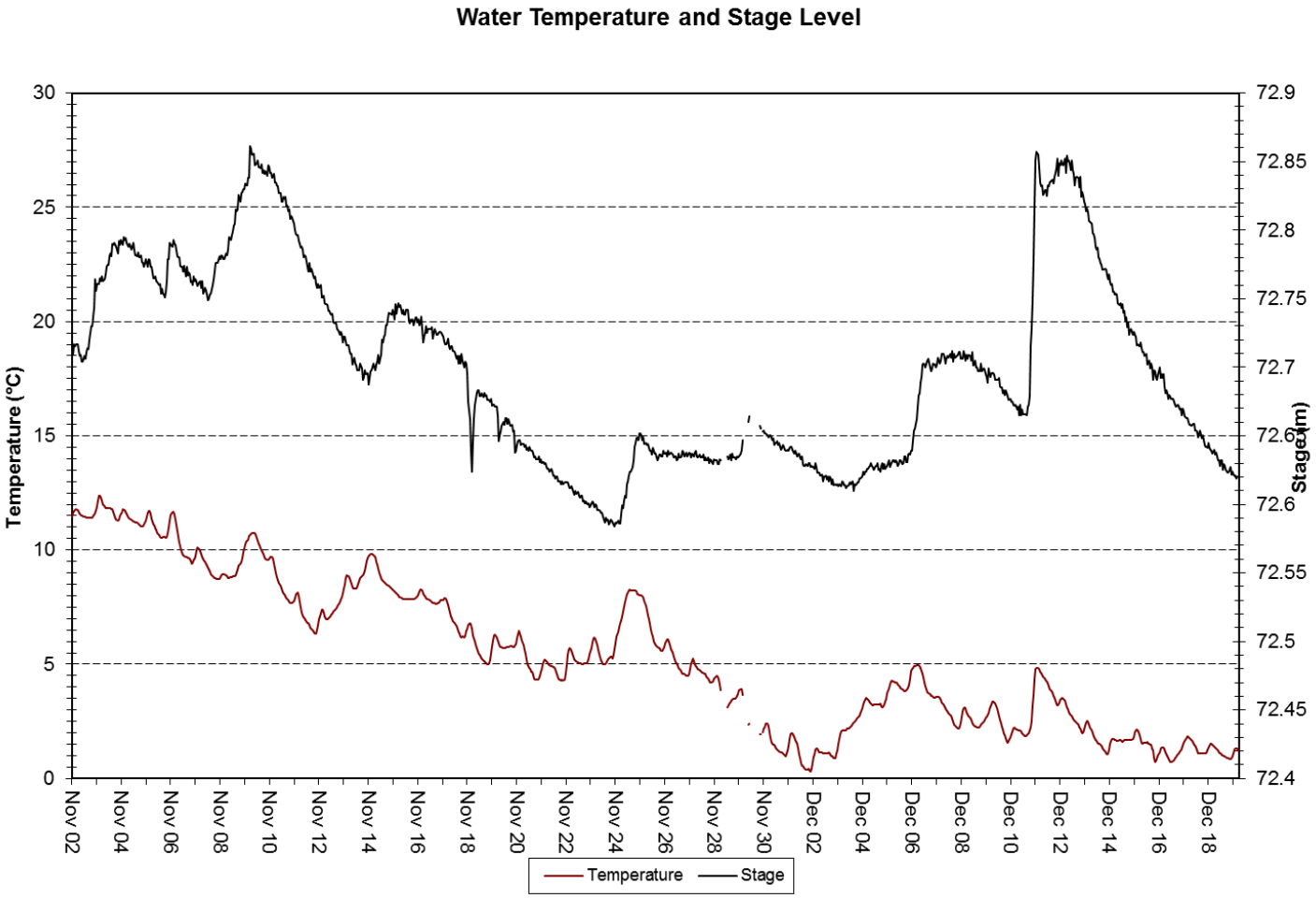
Figure 2: Water Temperature at Rattling Brook below Bridge



Parameter	Max	Min	Median
Temperature('C)	12.08	0.64	5.07

- Bridge station recorded a larger range of temperatures compared to Big Pond station during this deployment; however, temperatures at Bridge station were found to be cooler than those found upstream. As of the end of December, water temperatures were approaching the freezing point.

Figure 3: Water Temperature at Rattling Brook below Plant Discharge

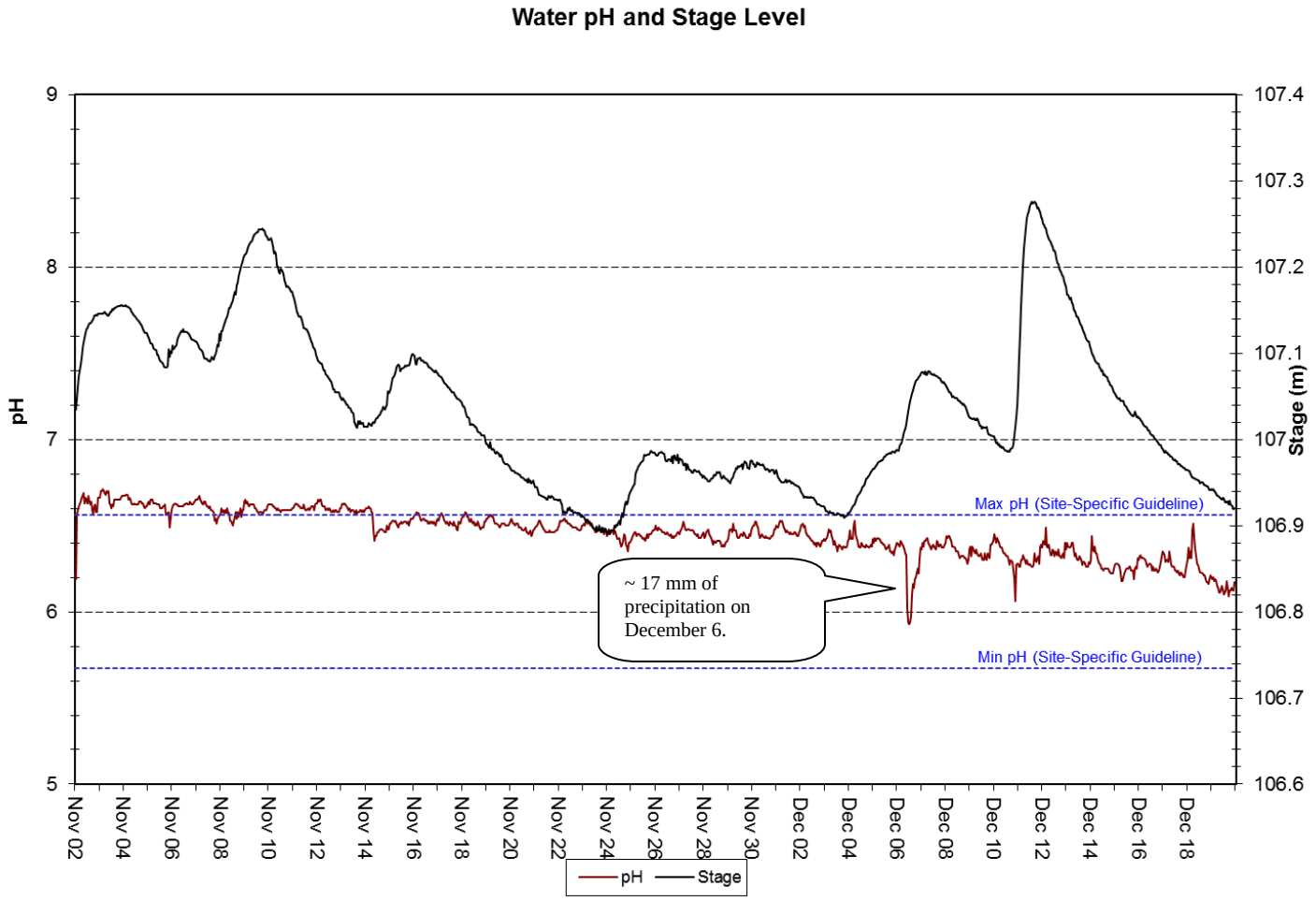


Parameter	Max	Min	Median
Temperature('C)	12.38	0.32	4.99

- Warmer water temperatures were more prevalent at Plant Discharge station compared to those above at Bridge and Big Pond stations. The same perturbations were present here, however, high and low extremes were more emphasized.

pH

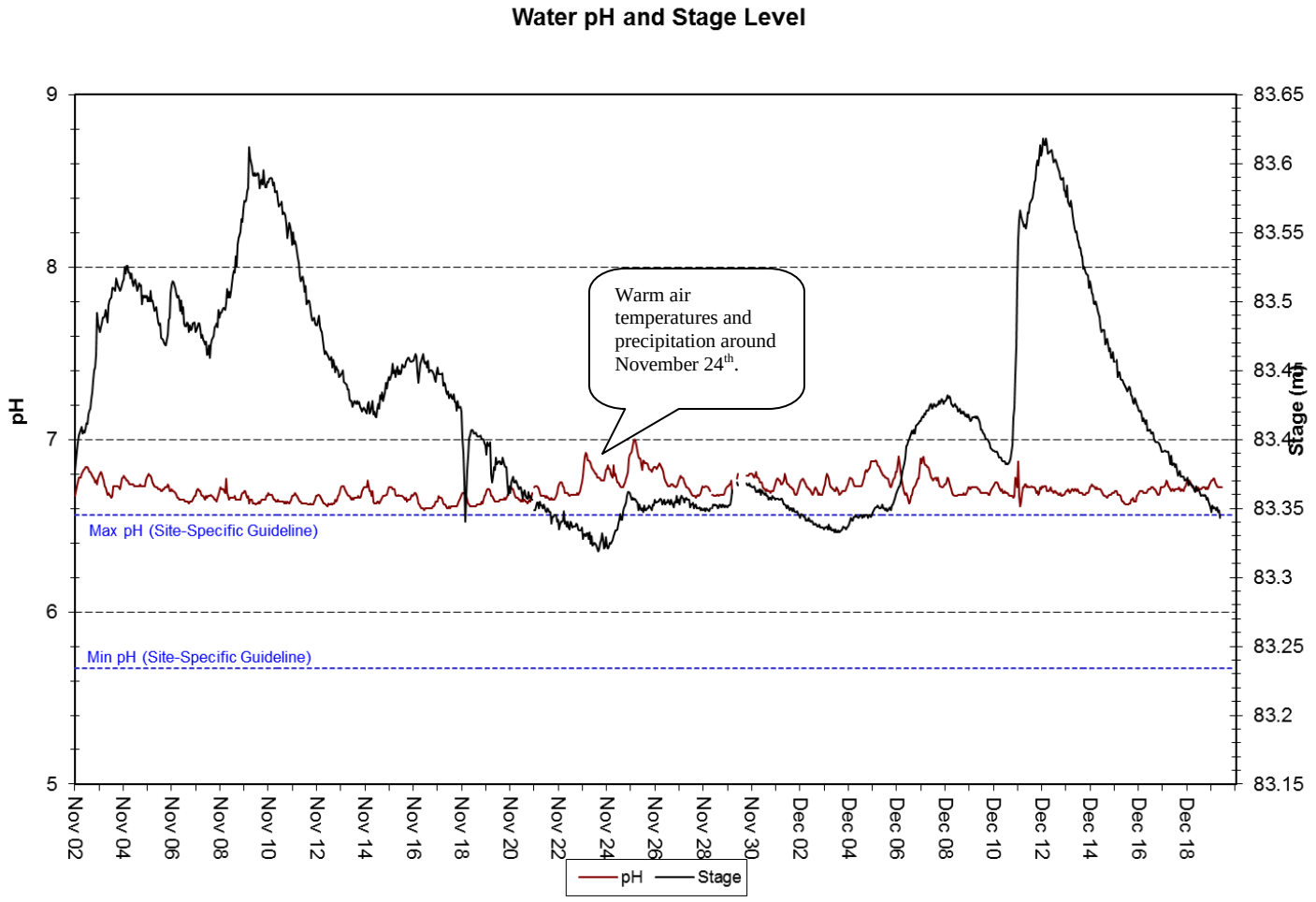
Figure 4: pH at Rattling Brook Big Pond



Parameter	Max	Min	Median
pH	6.71	5.93	6.46

- A slow drop in pH was observed at Big Pond station during this deployment period. Early pH values were found to be above the Site Specific Guideline for pH but fell to expected levels by the end of the deployment.
- A sharp decline and subsequent recovery in pH was observed on December 6 during a period of approximately 17 mm of precipitation.

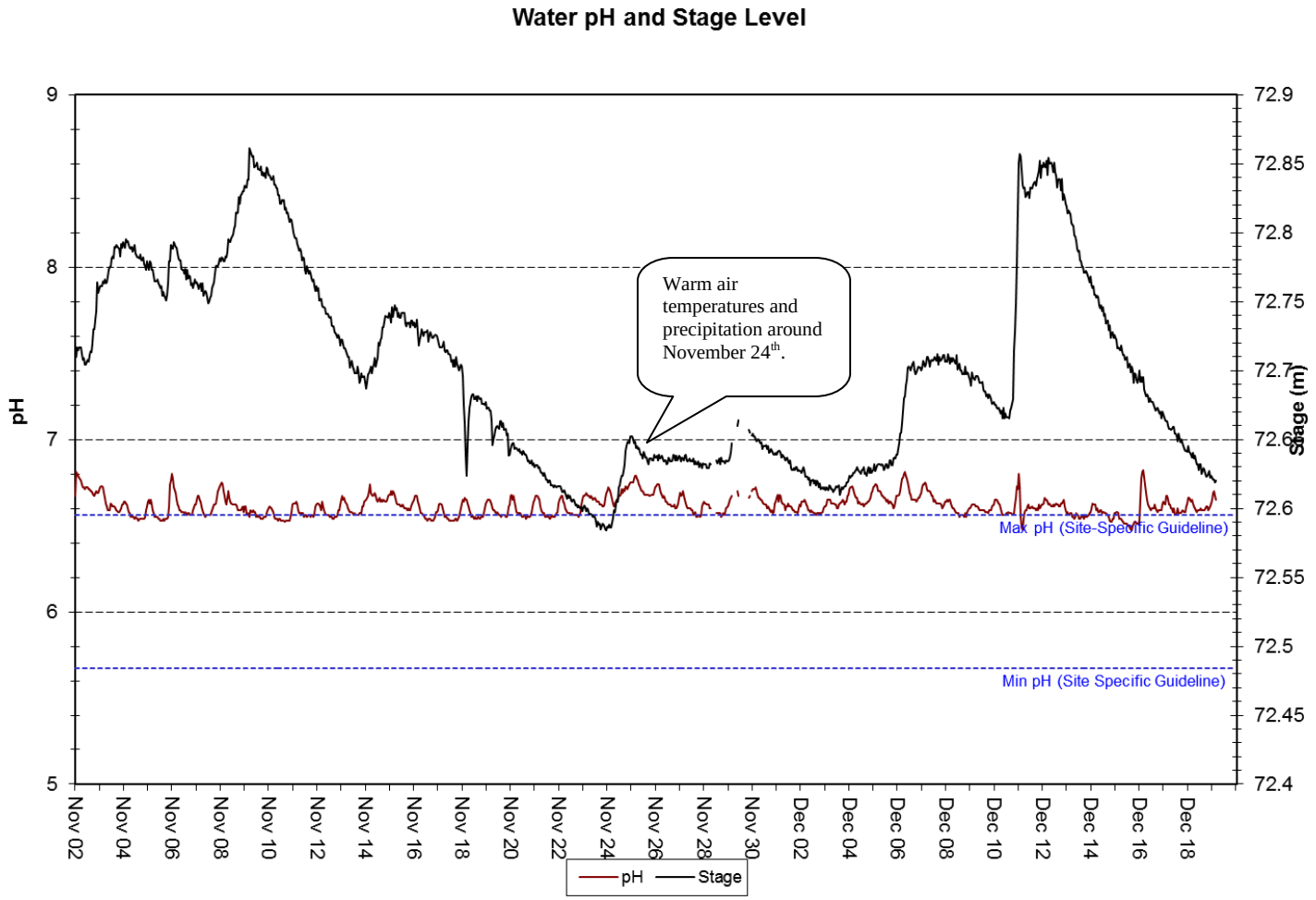
Figure 5: pH at Rattling Brook below Bridge



Parameter	Max	Min	Median
pH	7.00	6.59	6.70

- pH levels at Bridge station are more alkaline than those found upstream. All values were found to be above the Site Specific Guideline of 6.56. This may be a sensor calibration issue, since Bridge station is generally expected to be more acidic.
- Regardless of the apparent miscalibration of the pH sensor, no major shifts in pH were observed during the deployment period.

Figure 6: pH at Rattling Brook below Plant Discharge

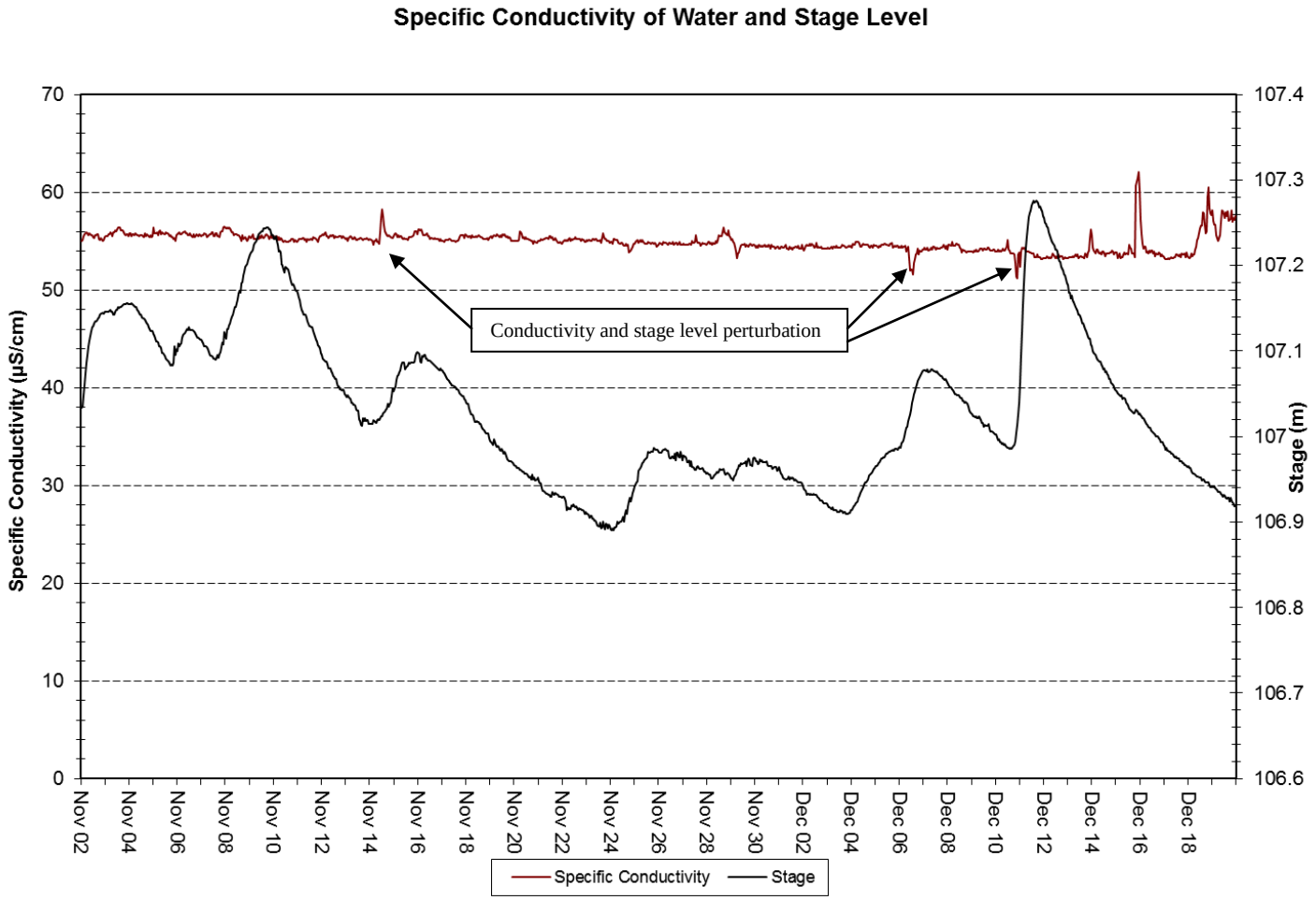


Parameter	Max	Min	Median
pH	6.82	6.47	6.61

- pH values straddled the upper Site Specific Guideline for much of the deployment period and were generally less than pH values seen upstream at Bridge station.

Conductivity

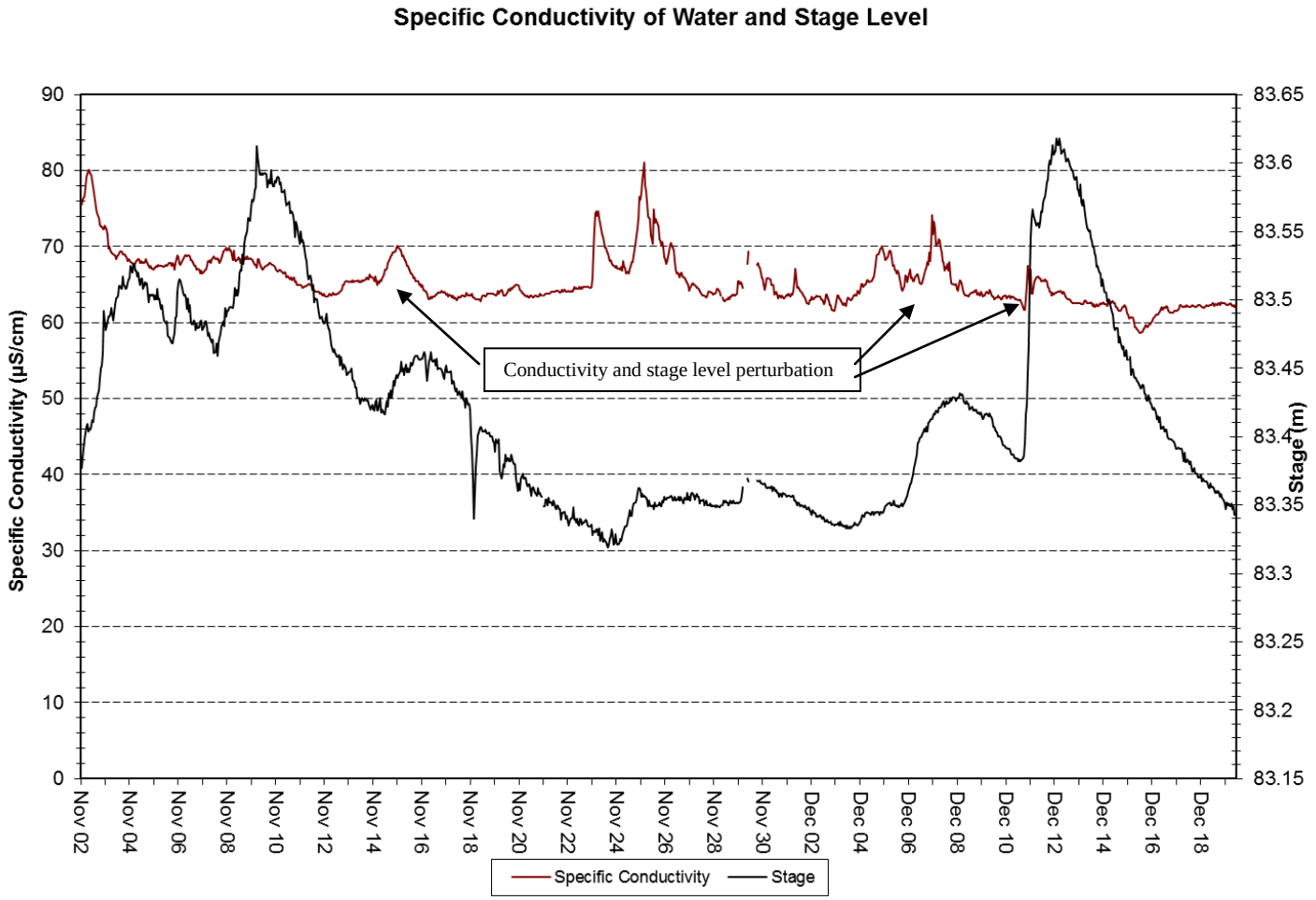
Figure 7: Conductivity at Rattling Brook Big Pond



Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	62.1	51.2	55.0

- Specific conductivity fell slightly during this time frame and showed a few minor perturbations that can be associated with precipitation events.

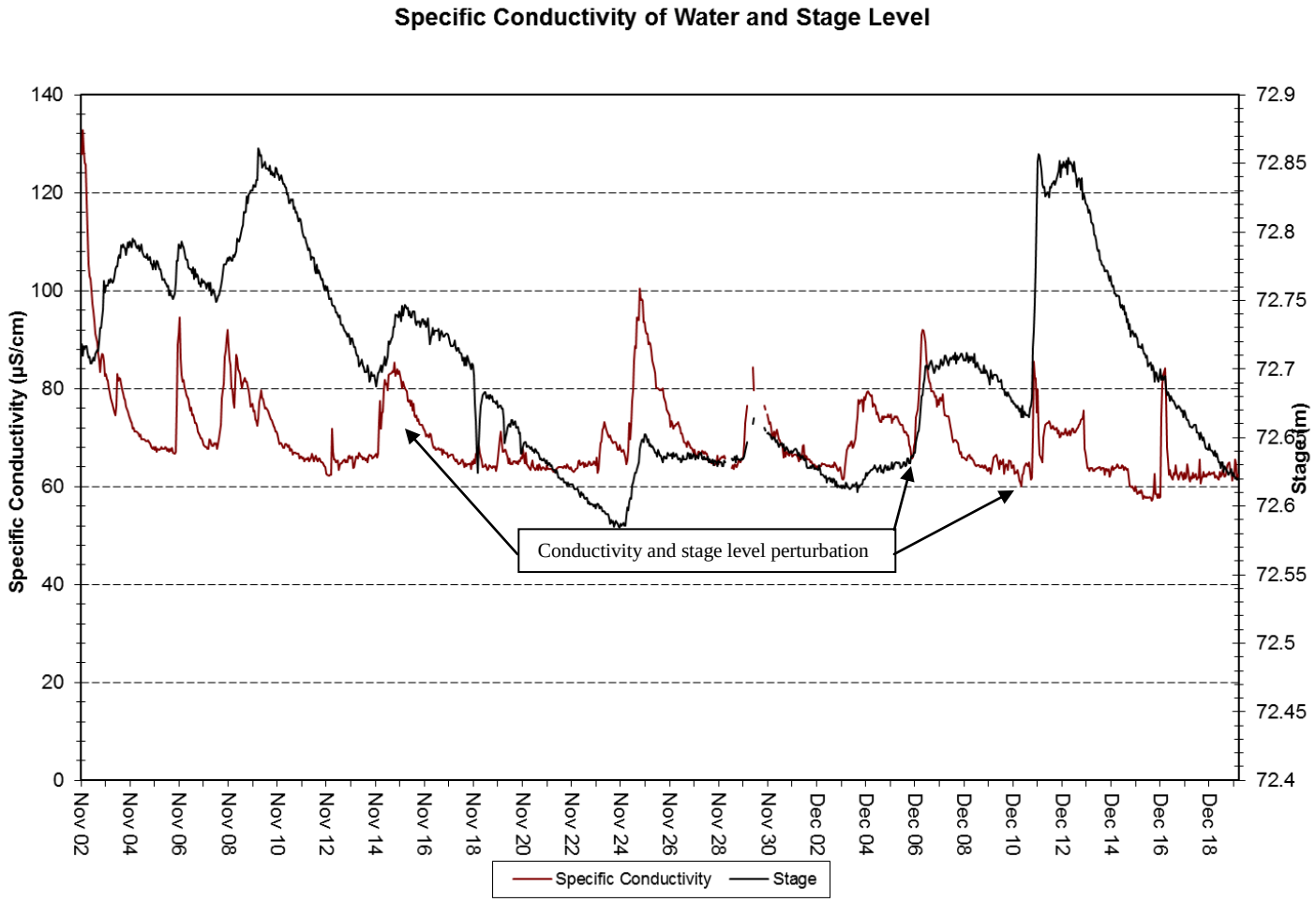
Figure 8: Conductivity at Rattling Brook below Bridge



Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	81.1	58.6	64.7

- Specific conductivity was more variable at Bridge station compared to Big Pond, however, the same perturbations in conductivity are present.

Figure 9: Conductivity at Rattling Brook below Plant Discharge

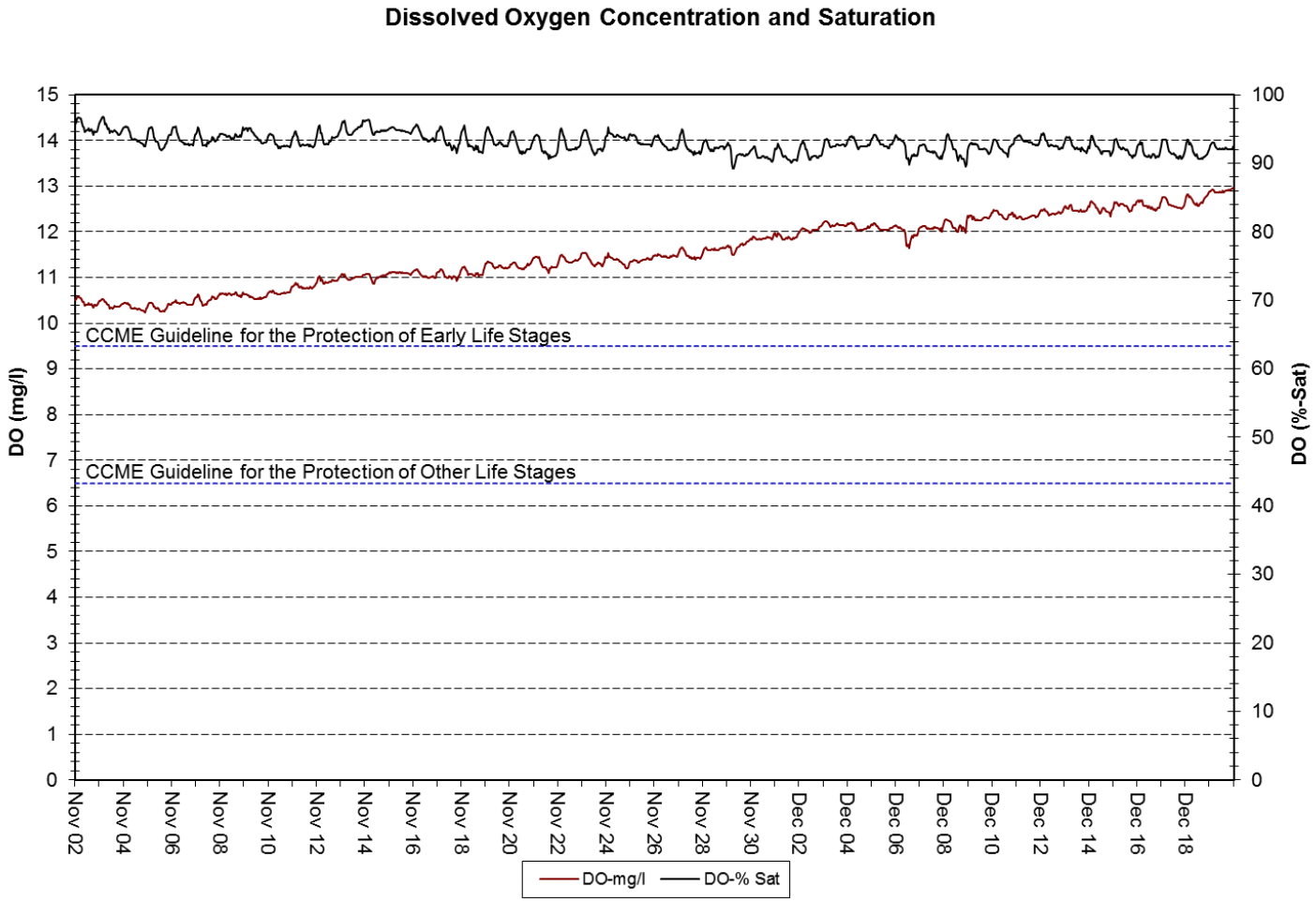


Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	132.8	57.2	67.2

- As expected, Plant Discharge station presented relatively high conductivity values compared to the upstream stations. Additional inputs from road surfaces and settling ponds are expected to contribute to the increasing dissolved solid load downstream.

Dissolved Oxygen

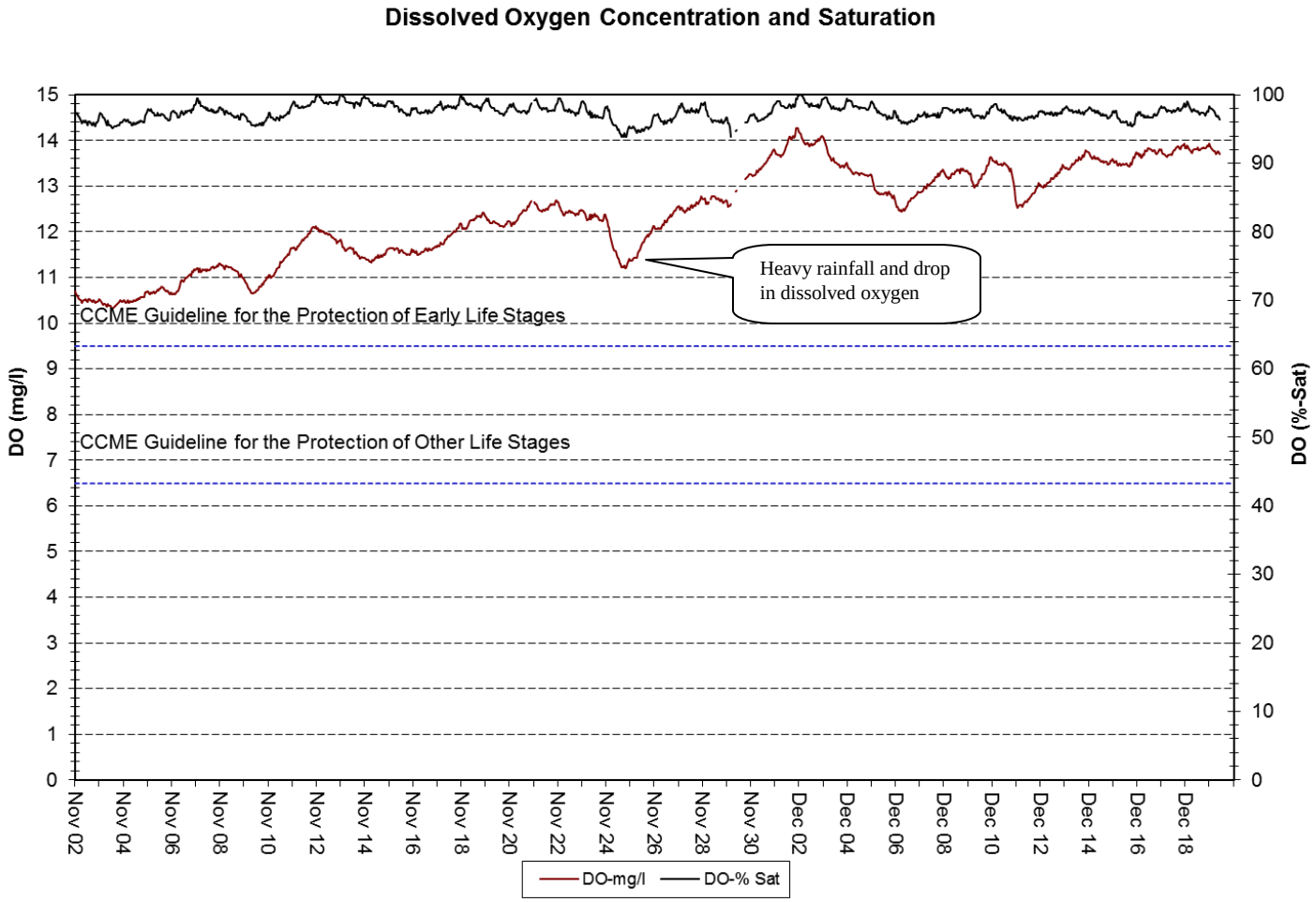
Figure 10: Dissolved Oxygen at Rattling Brook Big Pond



Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	96.8	89.3	92.8
Dissolved Oxygen (mg/l)	12.97	10.24	11.45

- The seasonal rise in dissolved oxygen concentration is readily apparent given the decline in water temperature. All values are above the CCME Guidelines for the Protection of Aquatic Life.

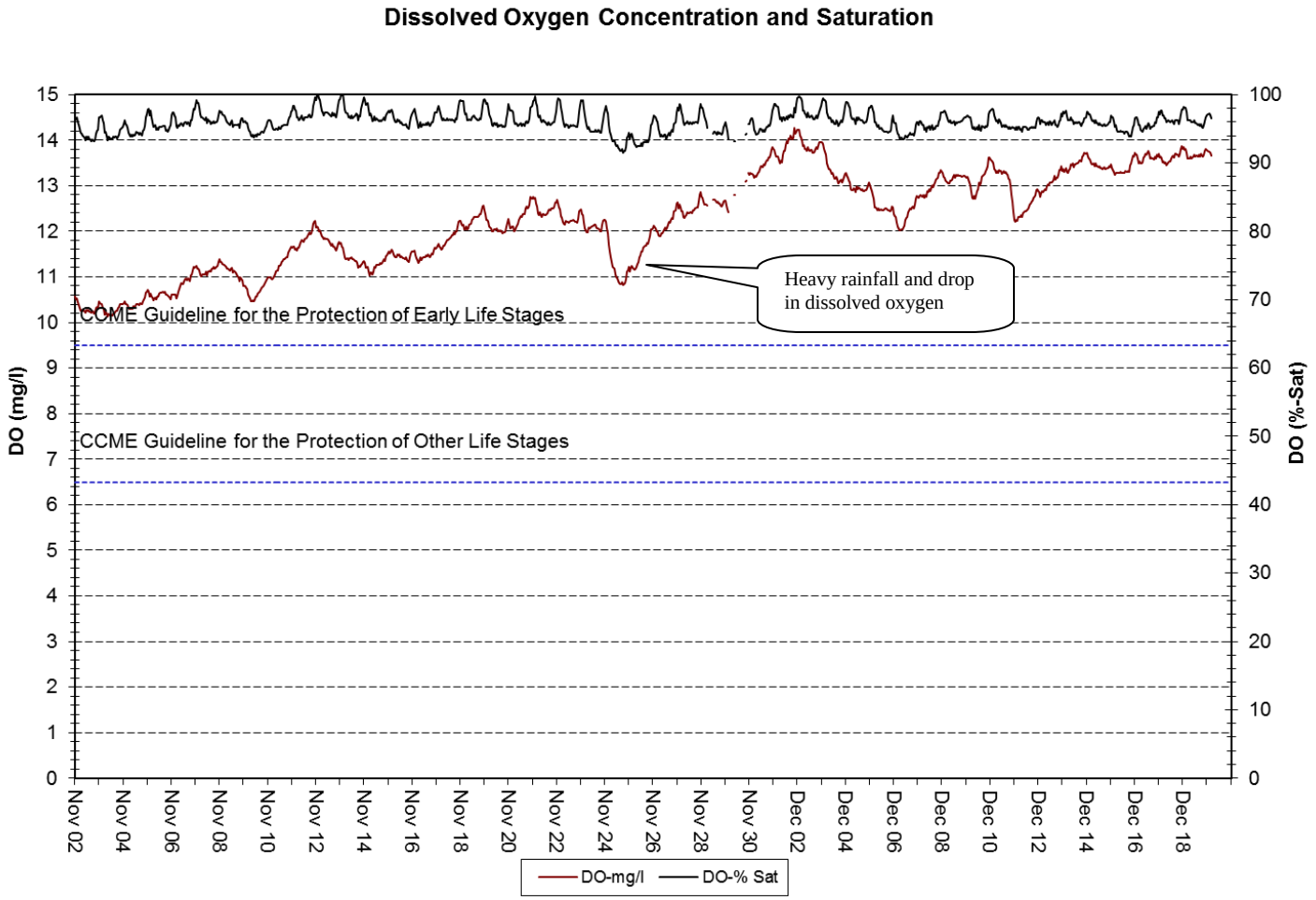
Figure 11: Dissolved Oxygen at Rattling Brook below Bridge



Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	100.4	93.8	97.5
Dissolved Oxygen (mg/l)	14.27	10.31	12.46

- From the start of this deployment period, all dissolved oxygen values were found to be above the CCME Guidelines for the Protection of Aquatic Life. The seasonal upward trend is obvious at Bridge station, like Big Pond – however there are more perturbations in the trend. Whereas Big Pond's DO levels will not fluctuate greatly with foul weather because there is no increase in flow, rising water levels downstream at Bridge station will cause vigorous flow conditions. A vigorous and churning stream will dissolve a great deal more oxygen in the water.

Figure 12: Dissolved Oxygen at Rattling Brook below Plant Discharge

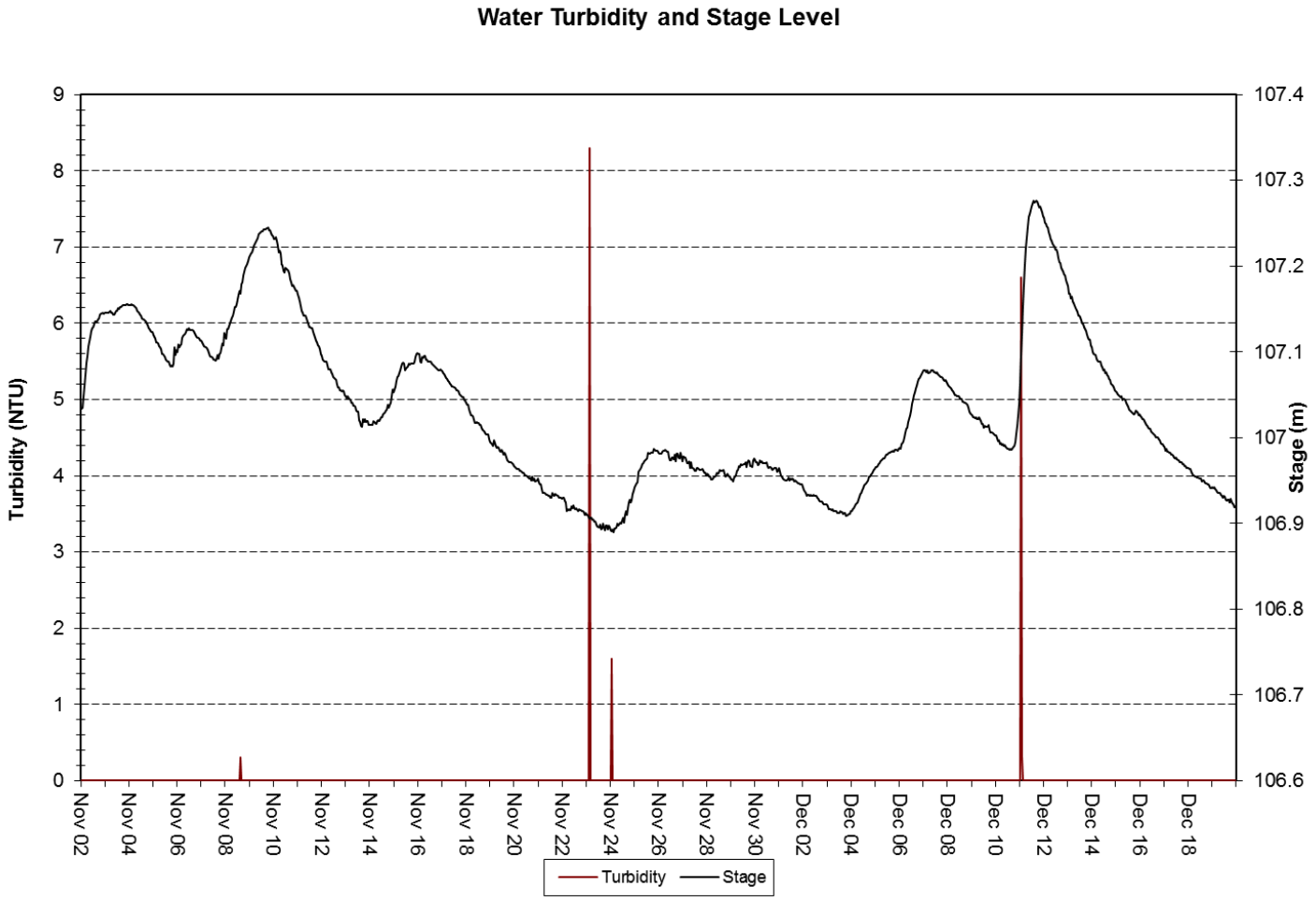


Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	100.1	91.5	95.9
Dissolved Oxygen (mg/l)	14.27	10.13	12.32

- All dissolved oxygen levels were above the CCME Guideline for the Protection of Aquatic Life but were slightly lower than those upstream at Bridge station. A pond, twinning, and widening of the river above between Bridge and Plant Discharge station allows for oxygen levels to equilibrate to atmospheric levels after the vigorous flow seen above Bridge station.

Turbidity

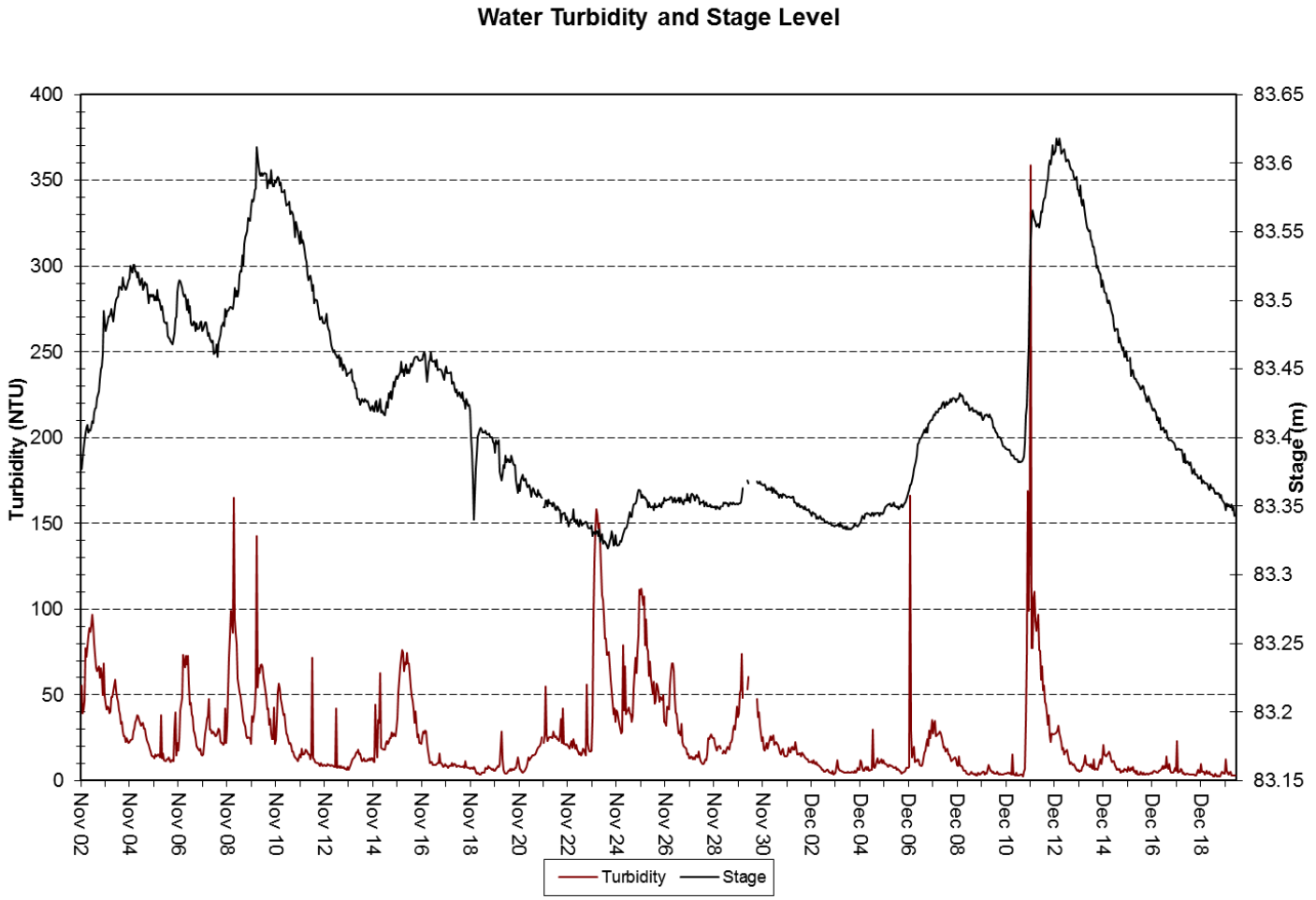
Figure 13: Turbidity at Rattling Brook Big Pond



Parameter	Max	Min	Median
Turbidity (NTU)	8.3	0.0	0.0

- Only five instances of turbidity > 0.0 NTU were encountered during this deployment period (99.6% turbidity-free).

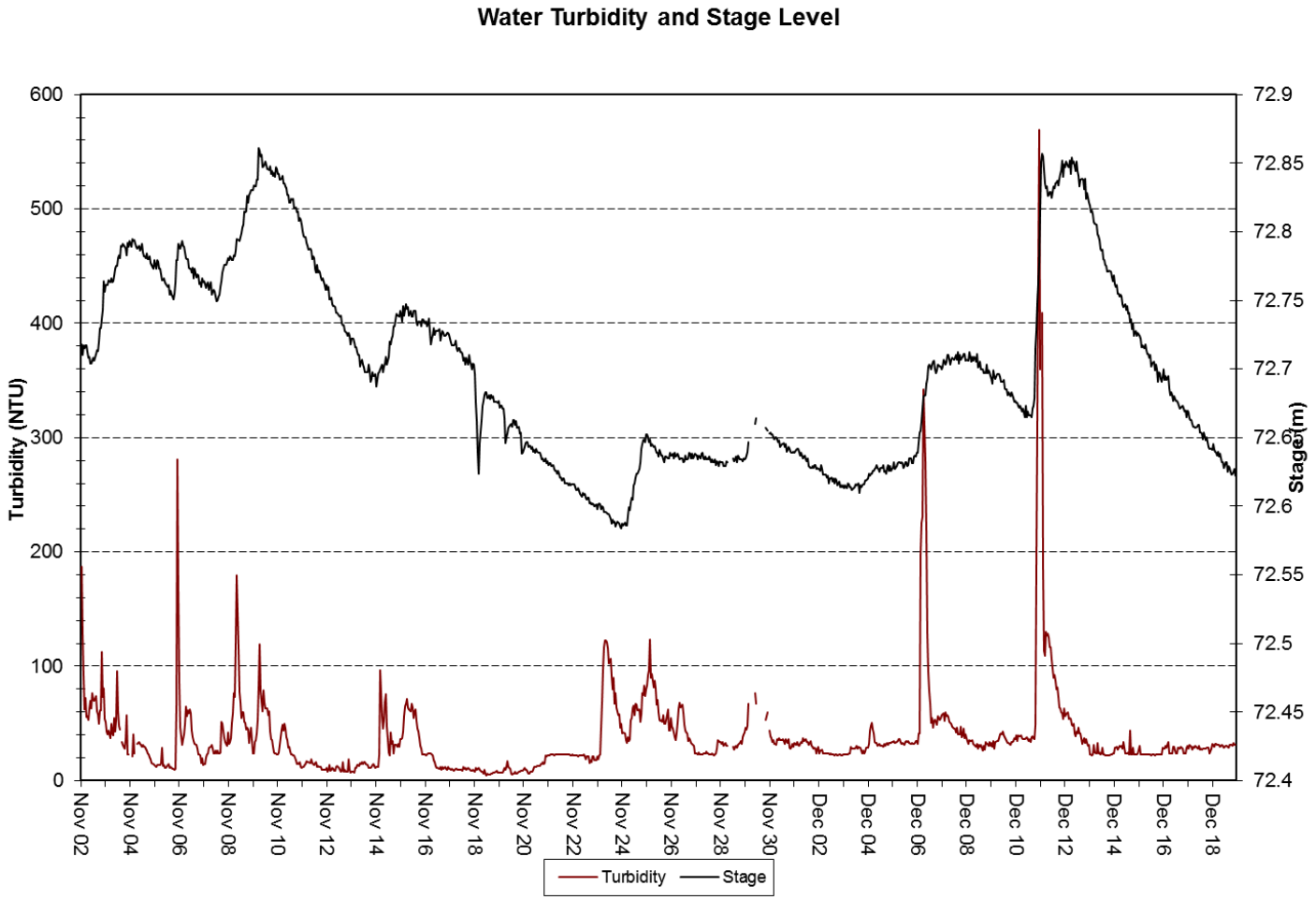
Figure 14: Turbidity at Rattling Brook below Bridge



Parameter	Max	Min	Median
Turbidity (NTU)	359.0	2.4	15.1

- Turbidity levels at Bridge station were highly variable during this deployment period. While some events coincide with those seen at Big Pond stations, they are of much higher magnitude and last far longer.
- The turbidity recorded is likely remnants of the habitat rehabilitation work at Forgotten Pond that was undertaken earlier in the year. Precipitation and the resultant high flow is expected to dislodge loosely bound sediments and transport them through the Rattling Brook system for some time to come.

Figure 15: Turbidity at Rattling Brook below Plant Discharge



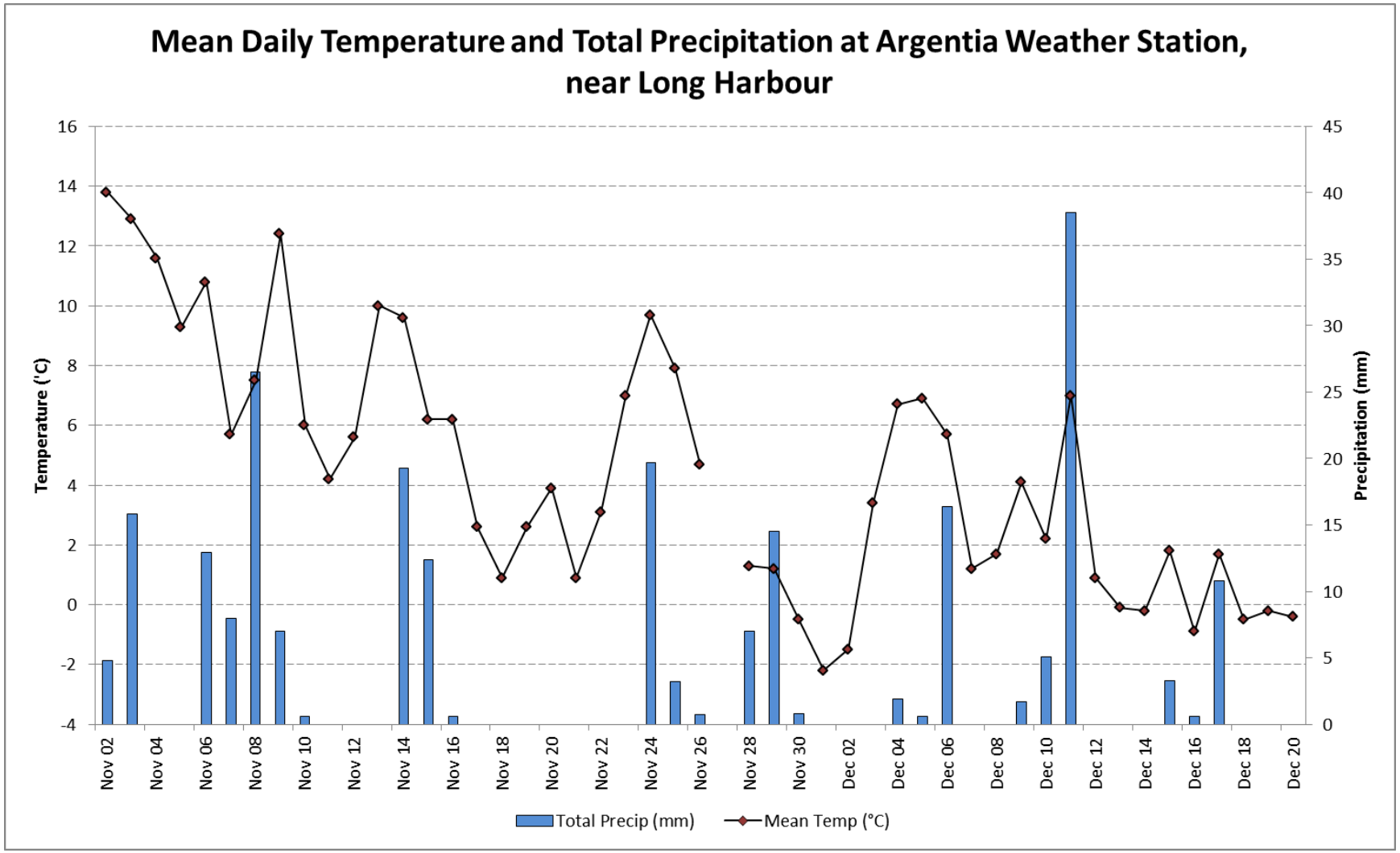
Parameter	Max	Min	Median
Turbidity (NTU)	569.0	4.4	30.2

- Turbidity events at Plant Discharge station mirror those upstream at Bridge station, but were of higher magnitude. It is difficult to determine why turbidity values would be higher at Plant Discharge station since the presence of a pond below Bridge should give time for some of the silt to settle out. It is possible, however, that work performed on that pond in 2011 is contributing to the total load itself.

Conclusions

- Some issues with QAQC Rankings imply unreliable data for this deployment report, however, it is felt that the problem is with the QAQC sonde itself, rather than the Field sondes in use.
- No major unexpected water quality events were observed during this deployment period. Turbidity was found to be high at Bridge and Plant Discharge stations, but was an expected result of habitat compensation work on Forgotten Pond. Over time, the silt load is expected to dwindle as it is washed out of the Rattling brook system or settles to the bottom.

Appendix



Prepared by:
Ryan Pugh
Department of Environment and Conservation
Water Resources Management Division
Phone: 709.729.1681
Fax: 709.729.3020