Real-Time Water Quality Deployment Report

Rattling Brook Network

December 21, 2012 to February 27, 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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General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Following a difficult removal of the Big Pond Hydrolab on February 27th from thick ice it was decided that the station would be suspended until ice conditions improved and no longer posed a threat of damage. Ice conditions were insignificant at Bridge and Plant Discharge stations during removal with coverage estimated at 15% and 10%, respectively.
- A failure in hydrometric equipment at Bridge station resulted in some erratic data and periodic loss. Due to unreliability during this deployment period, stage and flow has not been considered for Bridge station in this report.

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

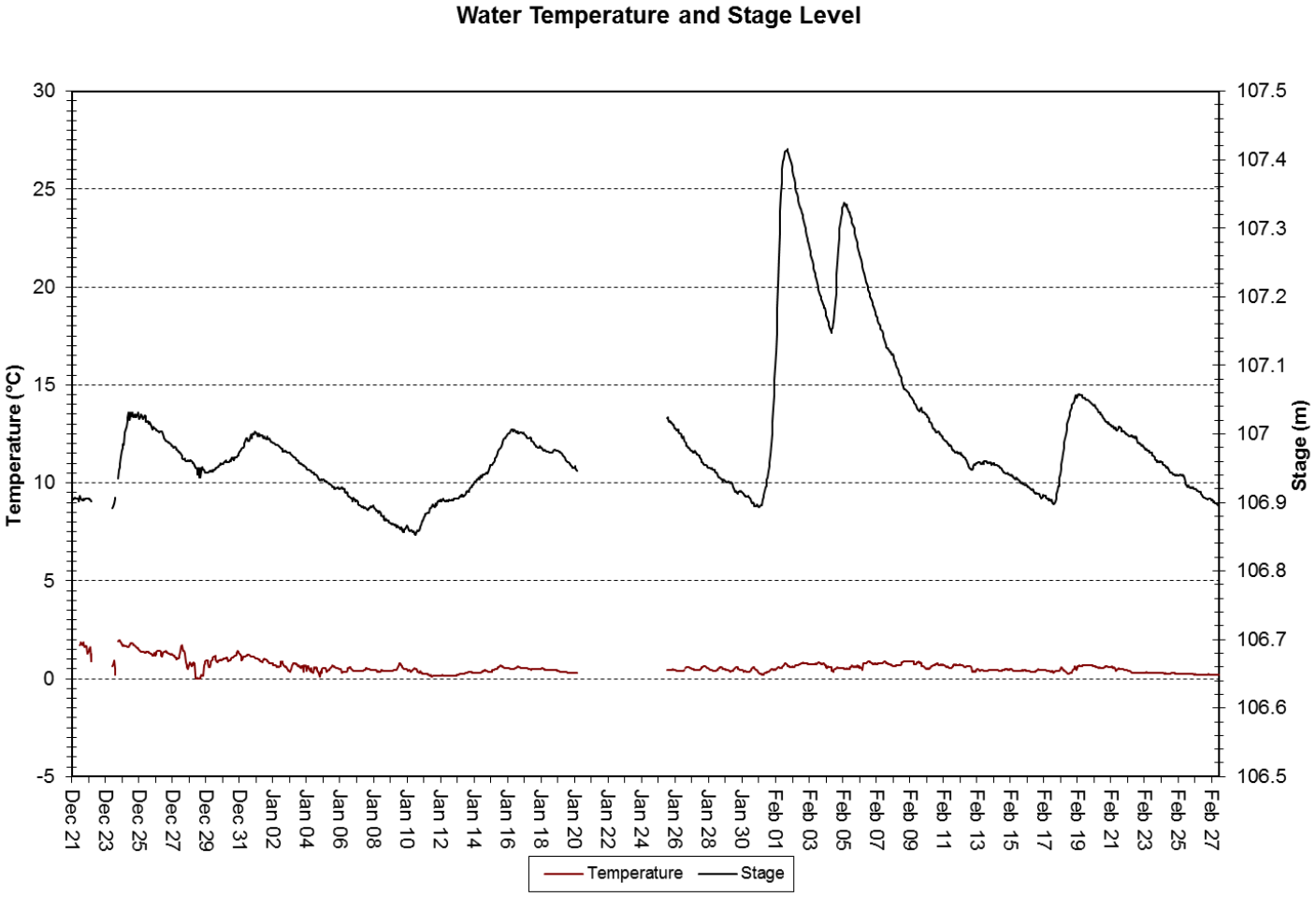
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	2012-12-21	Deployment	NA	Fair	Poor	Good	Excellent
	2013-02-27	Removal	Excellent	Good	Poor	NA	Excellent
Rattling Brook below Bridge	2012-12-21	Deployment	NA	Good	Good	Good	Good
	2013-02-27	Removal	Excellent	Excellent	Excellent	NA	Good
Rattling Brook below Plant Discharge	2012-12-21	Deployment	NA	Excellent	Good	Excellent	Fair
	2013-02-27	Removal	Excellent	Good	Excellent	NA	Good

- Conductivity Rankings at Pond station were “Poor” likely owing to an underreporting by the Field sonde. There was good agreement between the grab sample and QAQC Sonde (59.0 µS/cm and 56.4 µS/cm, respectively).
- During deployment in December, the QAQC Sonde appeared to produce faulty temperature readings and were not included in the Comparison Rankings. At removal in February, the QAQC Sonde was equipped with a Clarke cell type DO sensor which tends to be difficult to compare to LDO sensors in a spot check situation (Clark Cell sensors tend to react negatively momentary deployments such as QAQC situations). These readings were also not included in the Comparison Rankings.

Data Interpretation

Temperature

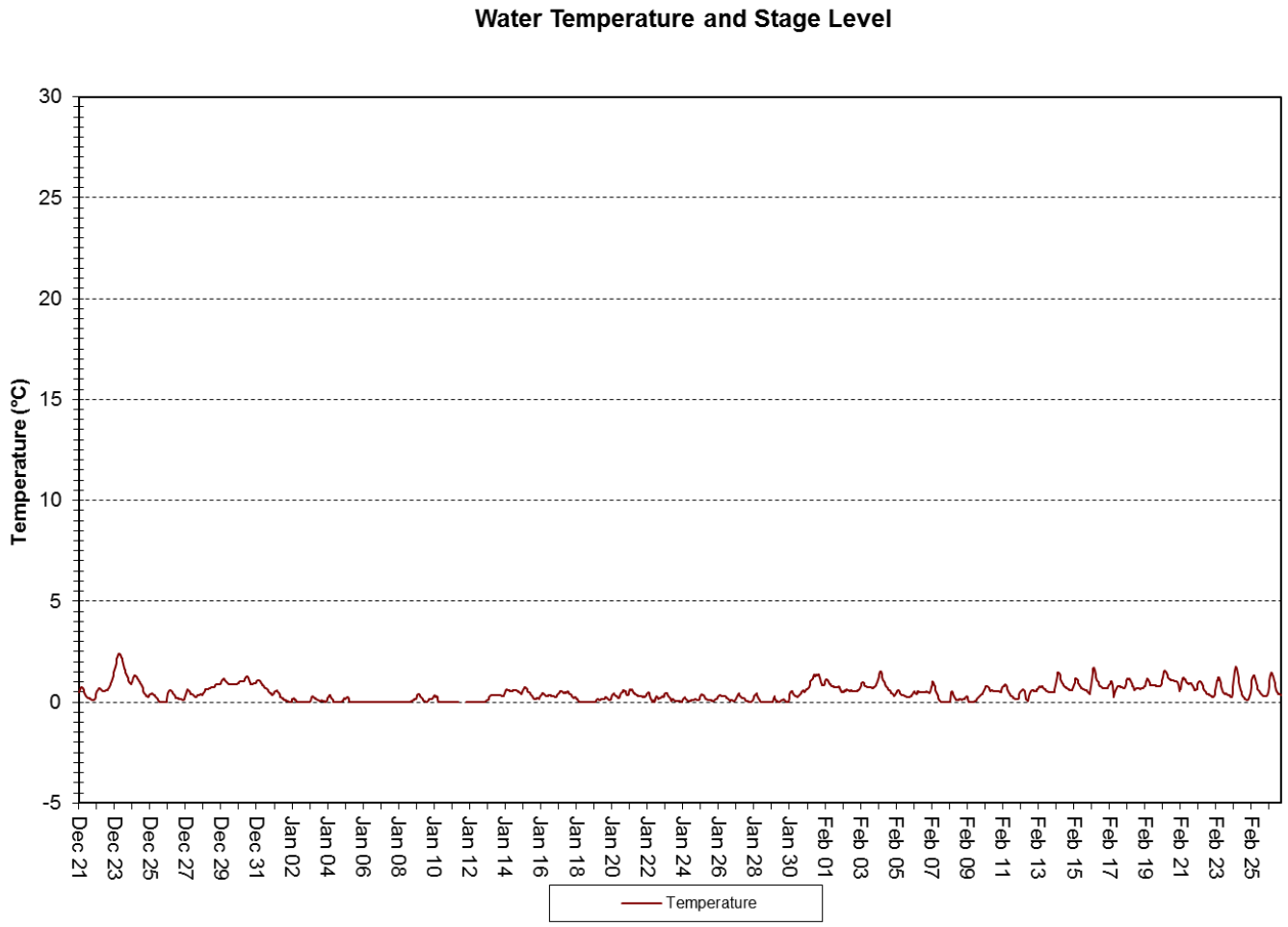
Figure 1: Water Temperature at Rattling Brook Big Pond from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Temperature('C)	1.97	0.00	0.50

- Big Pond water temperatures reached their annual low during this deployment period and showed no major diurnal variation. On February 27th, during the removal of the Hydrolab for regular maintenance and calibration, a hole had to be chopped in ice approximately 30 cm in some places.

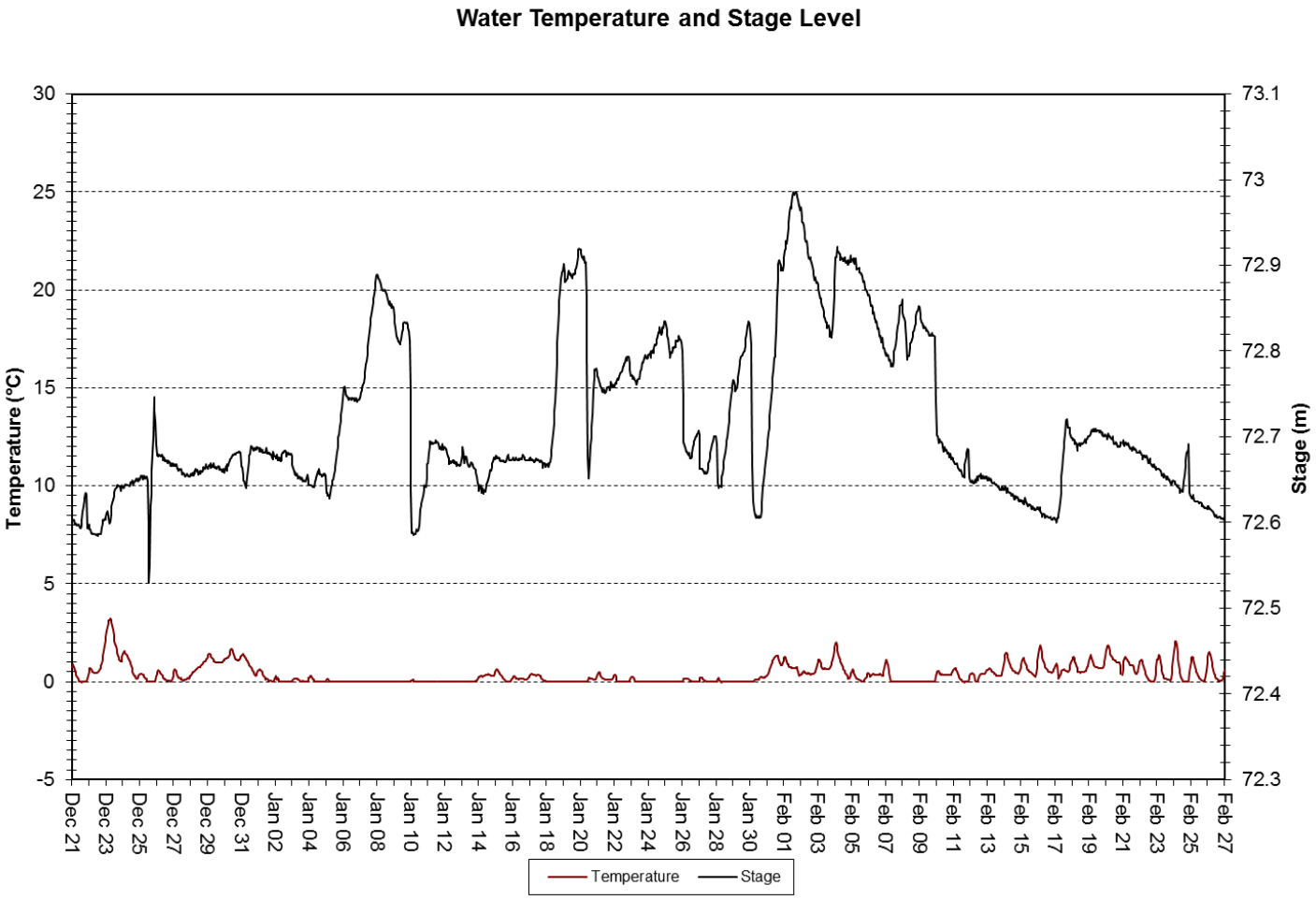
Figure 2: Water Temperature at Rattling Brook below Bridge from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Temperature('C)	2.40	-0.02	0.39

- Water at Bridge station showed a larger range in temperatures compared to those upstream at Big Pond station; however the median temperature was recorded lower. Approximately 15% of the river surface was covered in ice during removal.

Figure 3: Water Temperature at Rattling Brook below Plant Discharge from December 21, 2012 to February 27, 2013

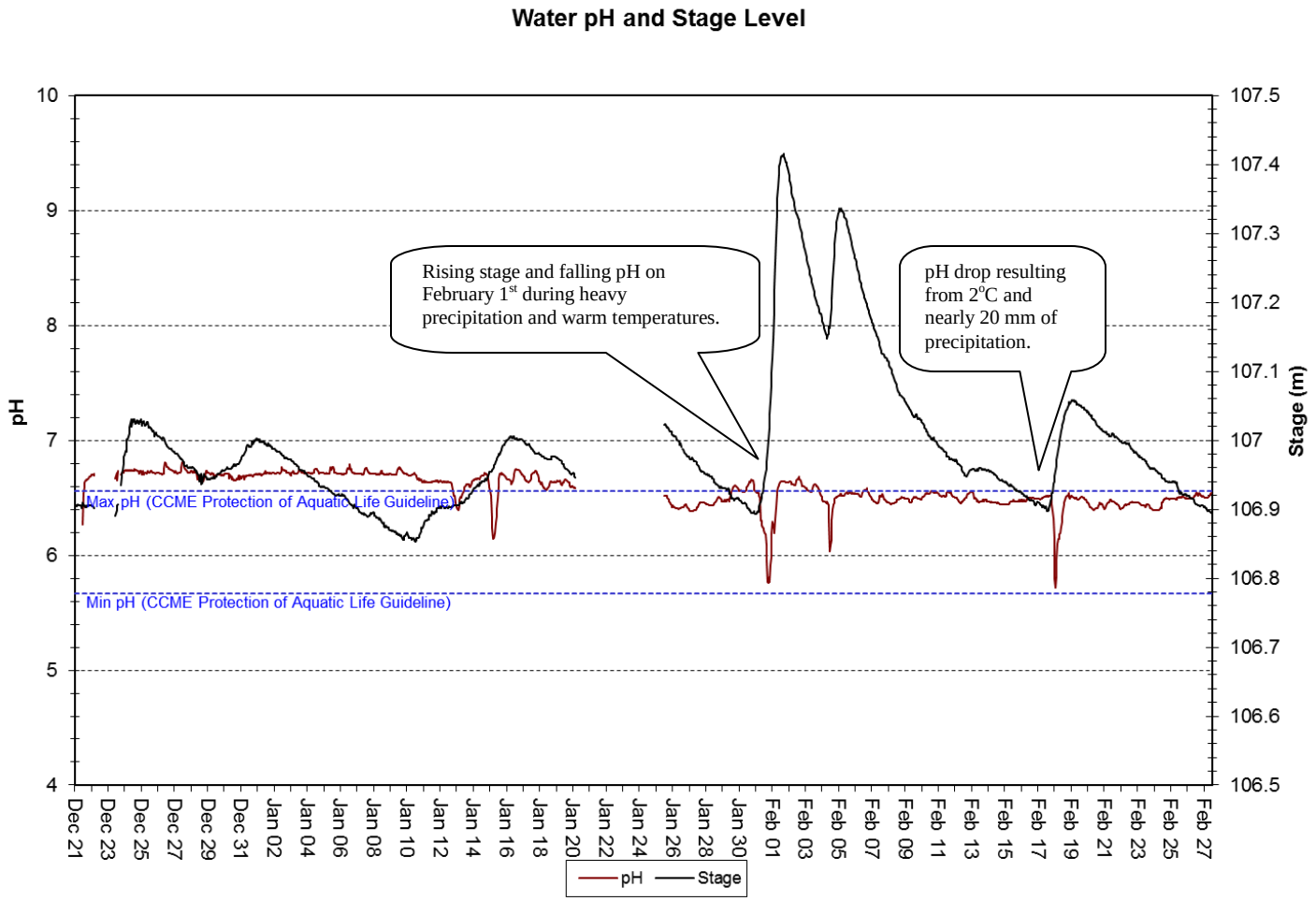


Parameter	Max	Min	Median
Temperature('C)	3.21	-0.03	0.18

- Plant Discharge station has the highest range in water temperatures over the deployment period, but also the lowest median temperature of the three stations. At removal time, approximately 10% of the river contained ice.

pH

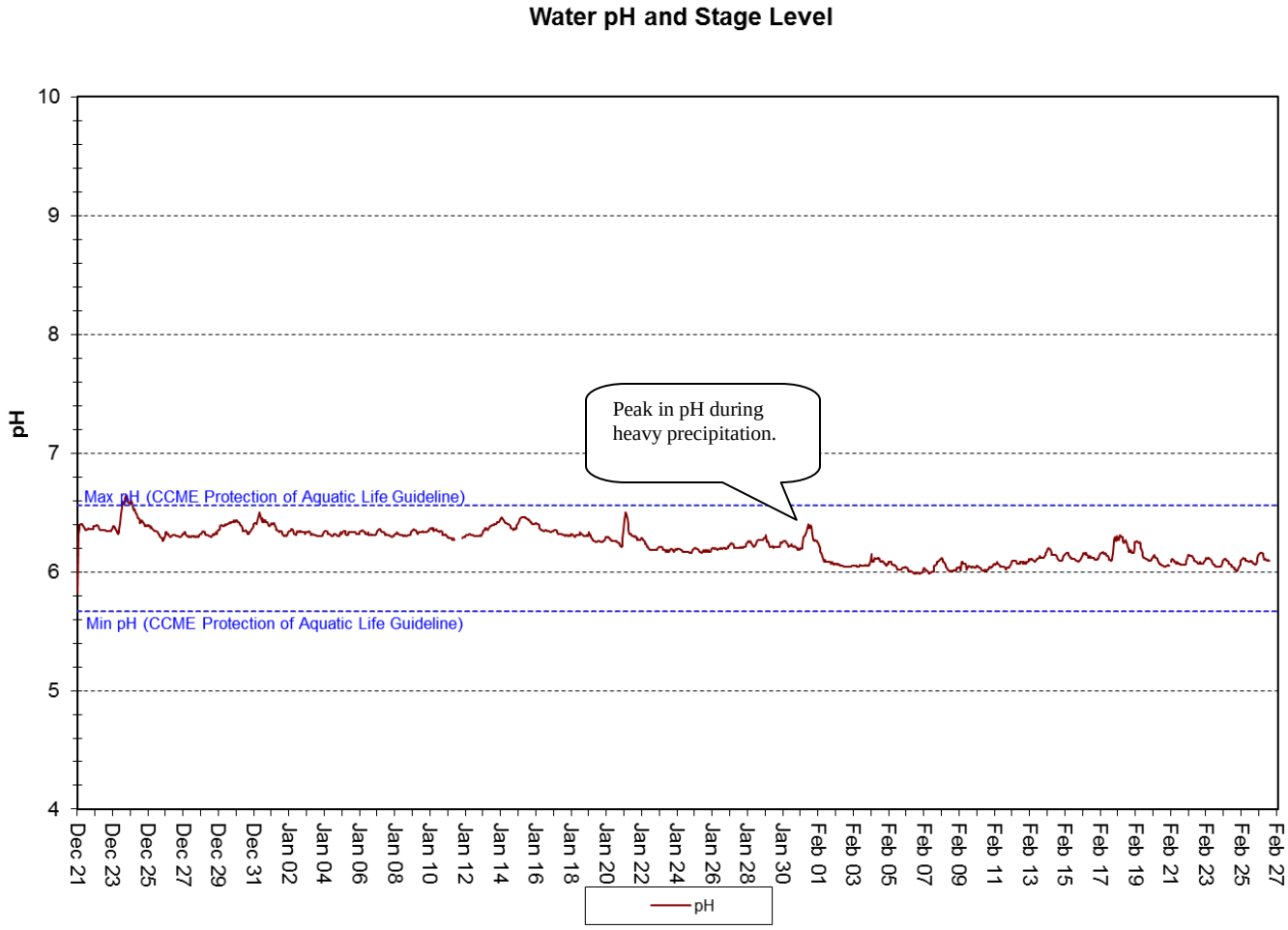
Figure 4: pH at Rattling Brook Big Pond from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
pH	6.81	5.72	6.56

- A slightly declining trend was observed in pH during the deployment period from above the upper Site Specific Guideline to just below. A drop in pH was observed with a simultaneous rise in stage level related to approximately 20 mm of precipitation and a daily mean temperature of 8°C.

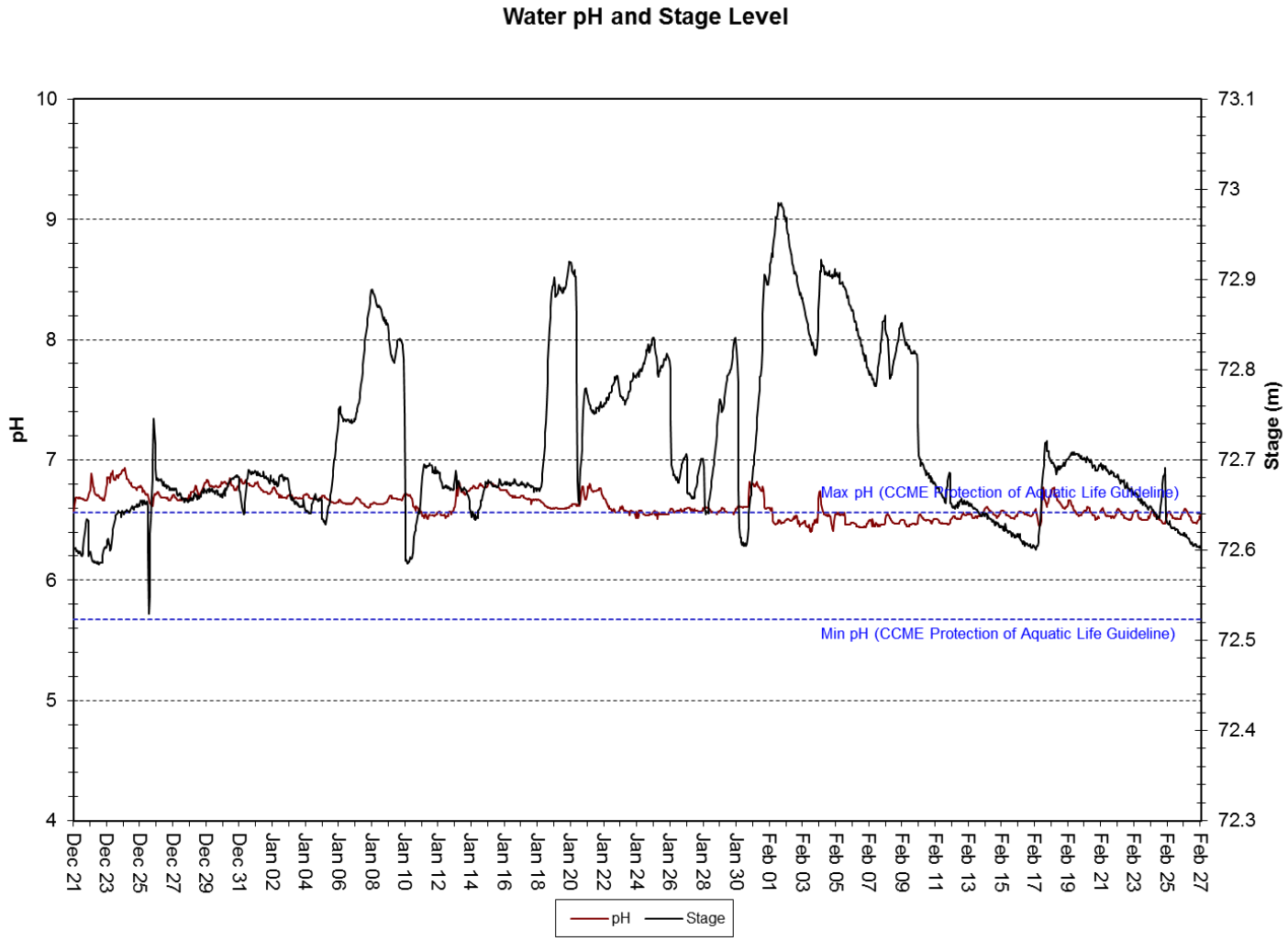
Figure 5: pH at Rattling Brook below Bridge from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
pH	6.64	5.82	6.25

- Another declining trend in pH was observed during the deployment at Bridge station. Although stage data is not presented for Bridge station during this deployment period, a small peak in pH values was noted on February 1st during heavy precipitation, instead of the decline seen upstream at Big Pond station.

Figure 6: pH at Rattling Brook below Plant Discharge from December 21, 2012 to February 27, 2013

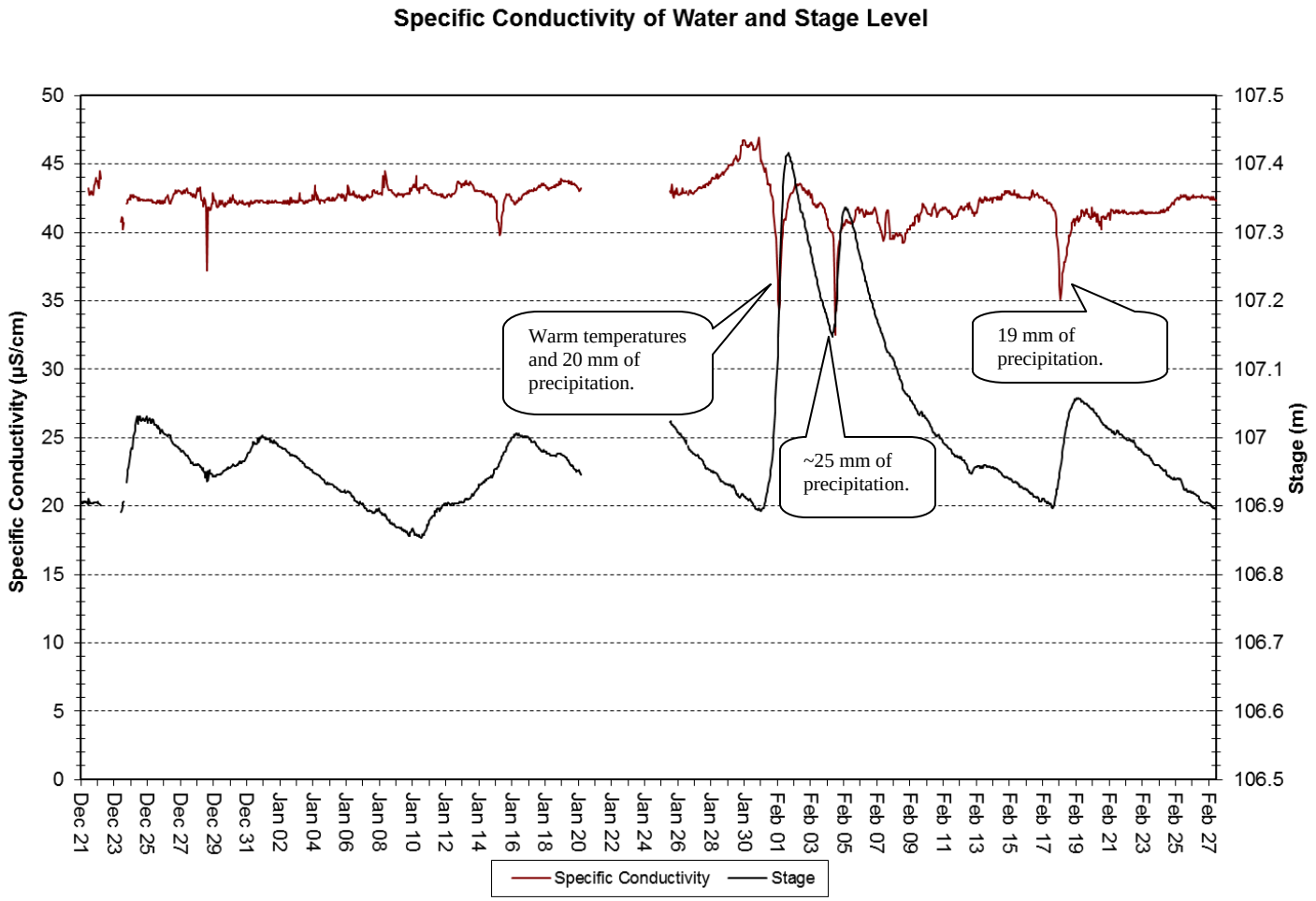


Parameter	Max	Min	Median
pH	6.93	6.40	6.60

- pH levels were mostly level, or with a very slight downward trend, at Plant Discharge station during this deployment period. Most pH values recorded were just at the upper Site Specific Guideline for the second half of the deployment. Unlike the two stations upstream, there was no pH event observed on February 1st at Plant Discharge station.

Specific Conductivity

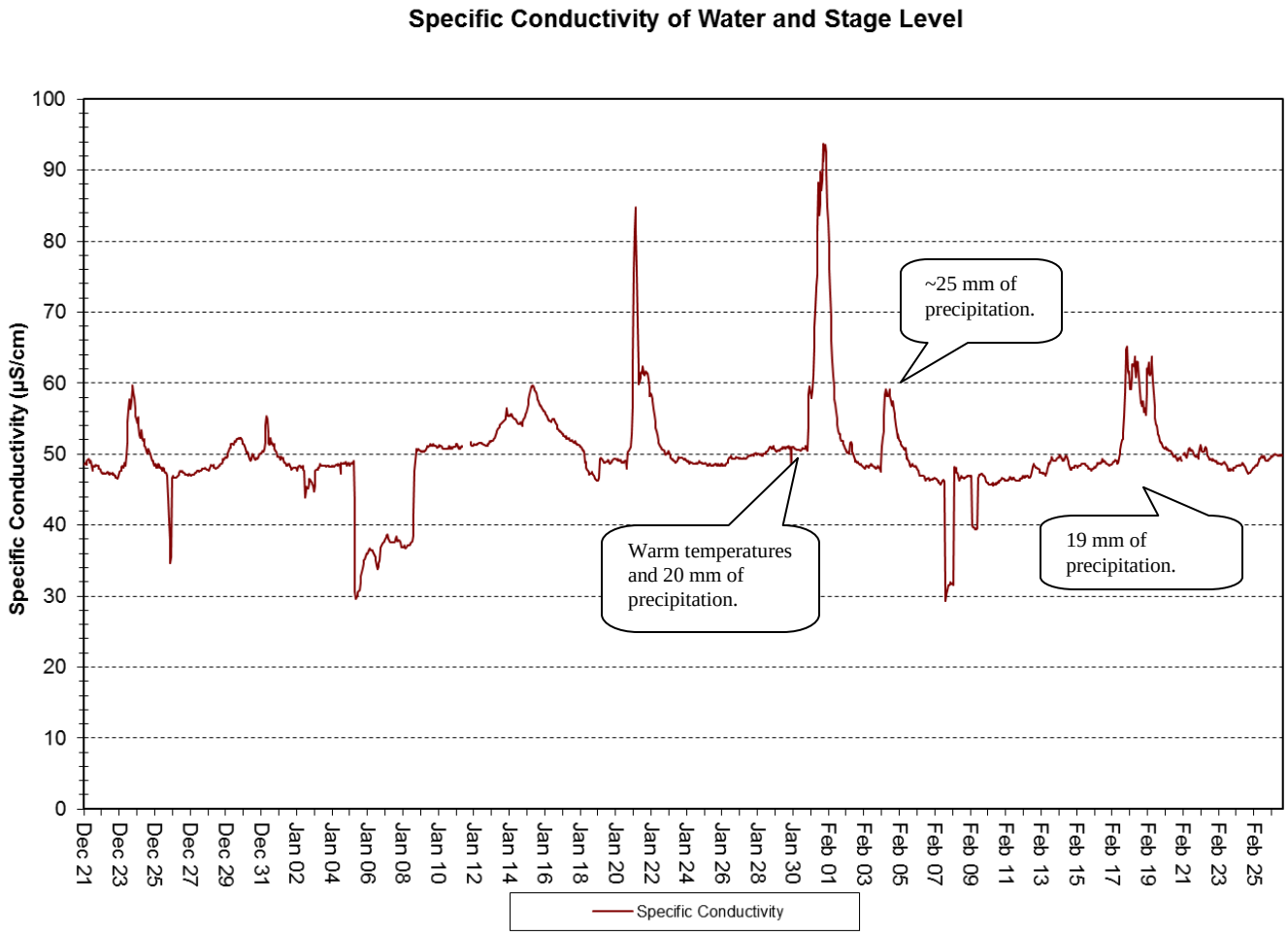
Figure 7: Specific Conductivity at Rattling Brook Big Pond from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	46.9	32.5	42.4

- Specific Conductivity showed several notable drops during stage level increases during this deployment period, relating to dilution of Big Pond by rainwater and/or snowmelt.

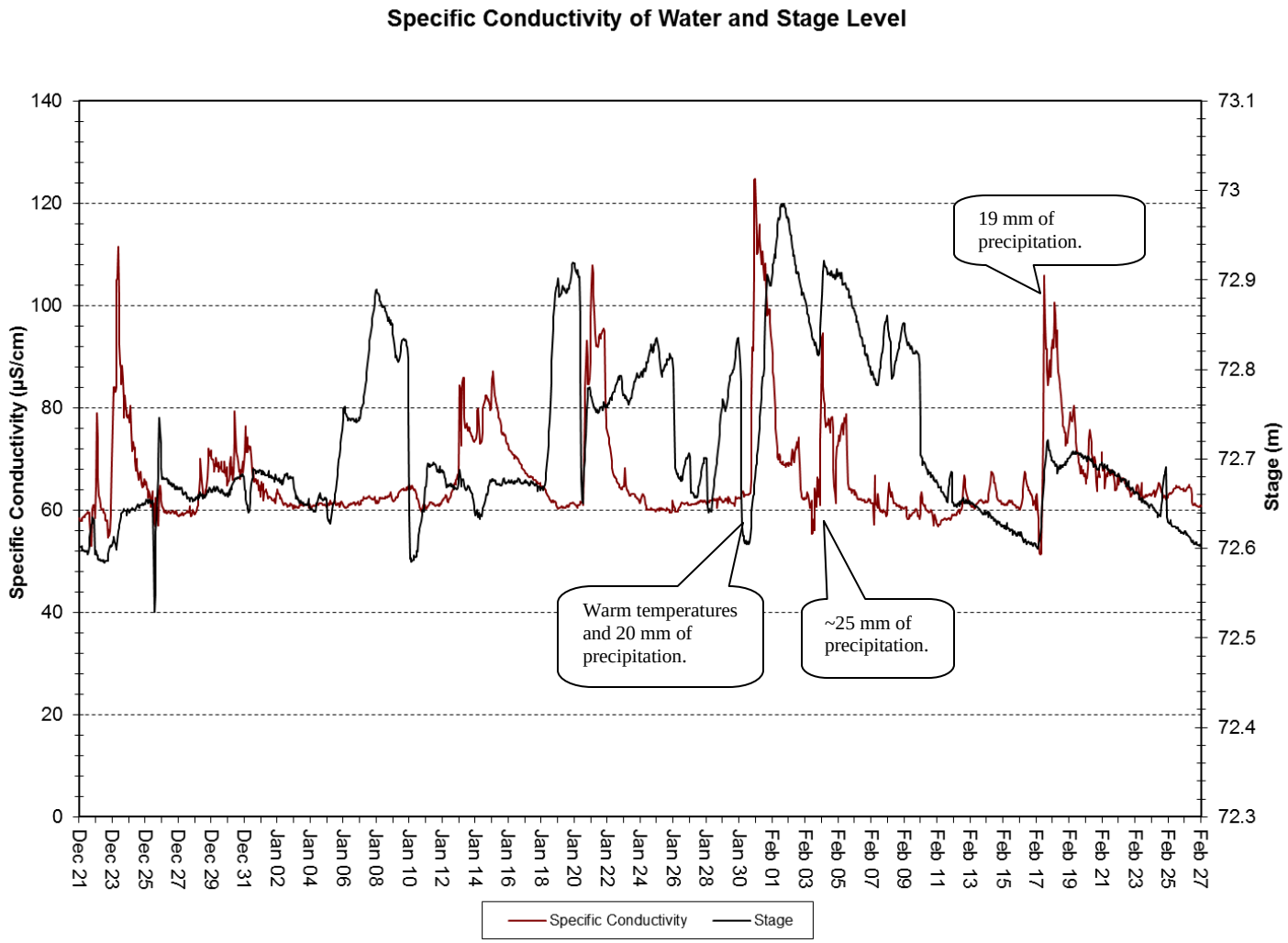
Figure 8: Specific Conductivity at Rattling Brook below Bridge from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	93.7	29.3	49.1

- Conductivity was higher than values seen upstream at Big Pond station. Interestingly, the drops in conductivity values at Big Pond are often registered as peaks in conductivity values downstream. This may be related to dissolved solids being washed downstream in a plume-like fashion.
- During this deployment period, a slightly upward trend is observed.

Figure 9: Specific Conductivity at Rattling Brook below Plant Discharge from December 21, 2012 to February 27, 2013

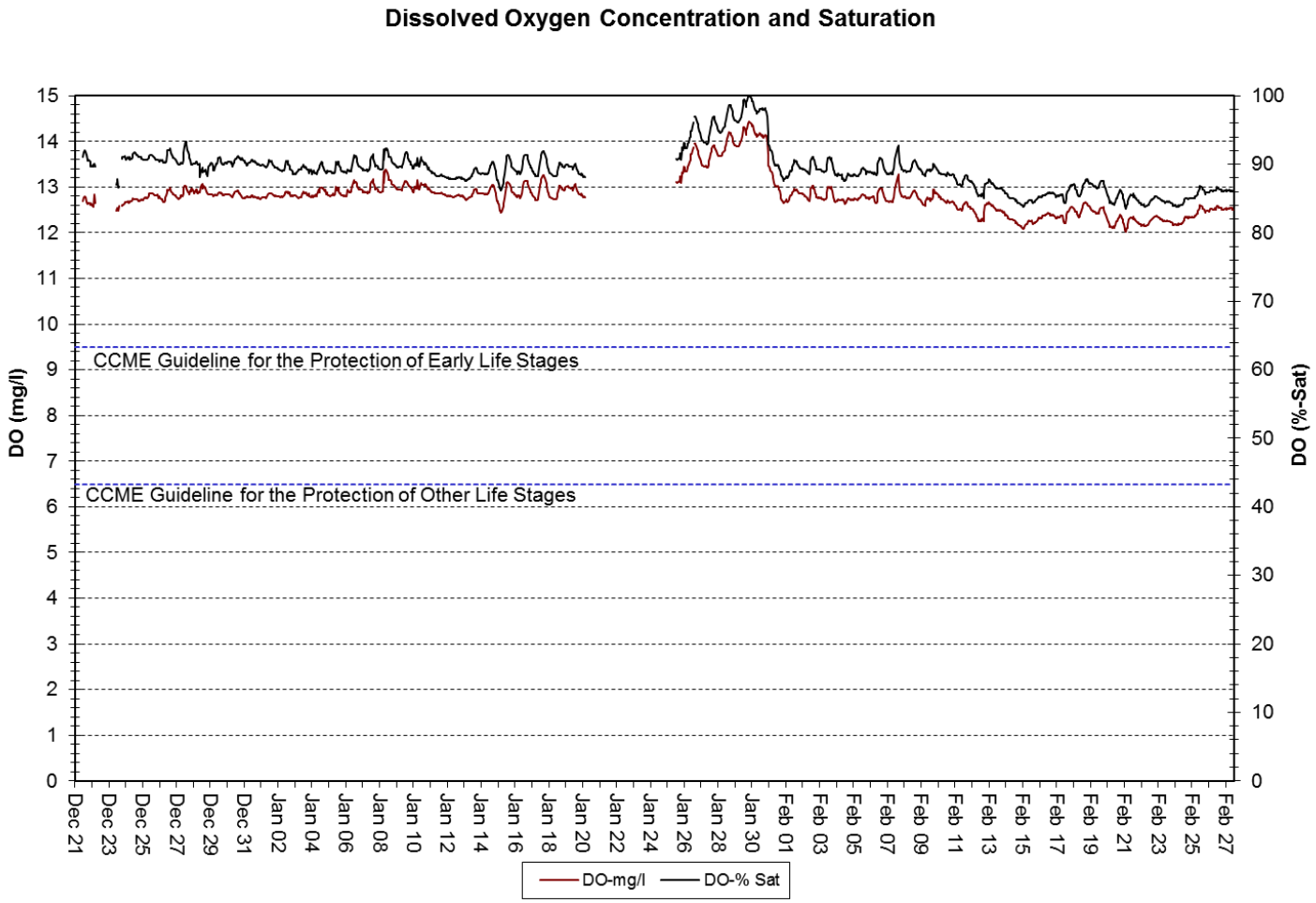


Parameter	Max	Min	Median
Specific Conductivity (µS/cm)	124.8	51.4	62.7

- Specific conductivity is highly variable at Plant Discharge station compared to values seen upstream at Big Pond and Bridge stations. The same conductivity events are observed at Bridge and Plant Discharge stations, although those events downstream tend to be of higher magnitude.
- A slight upward trend in conductivity is apparent during this deployment period.

Dissolved Oxygen

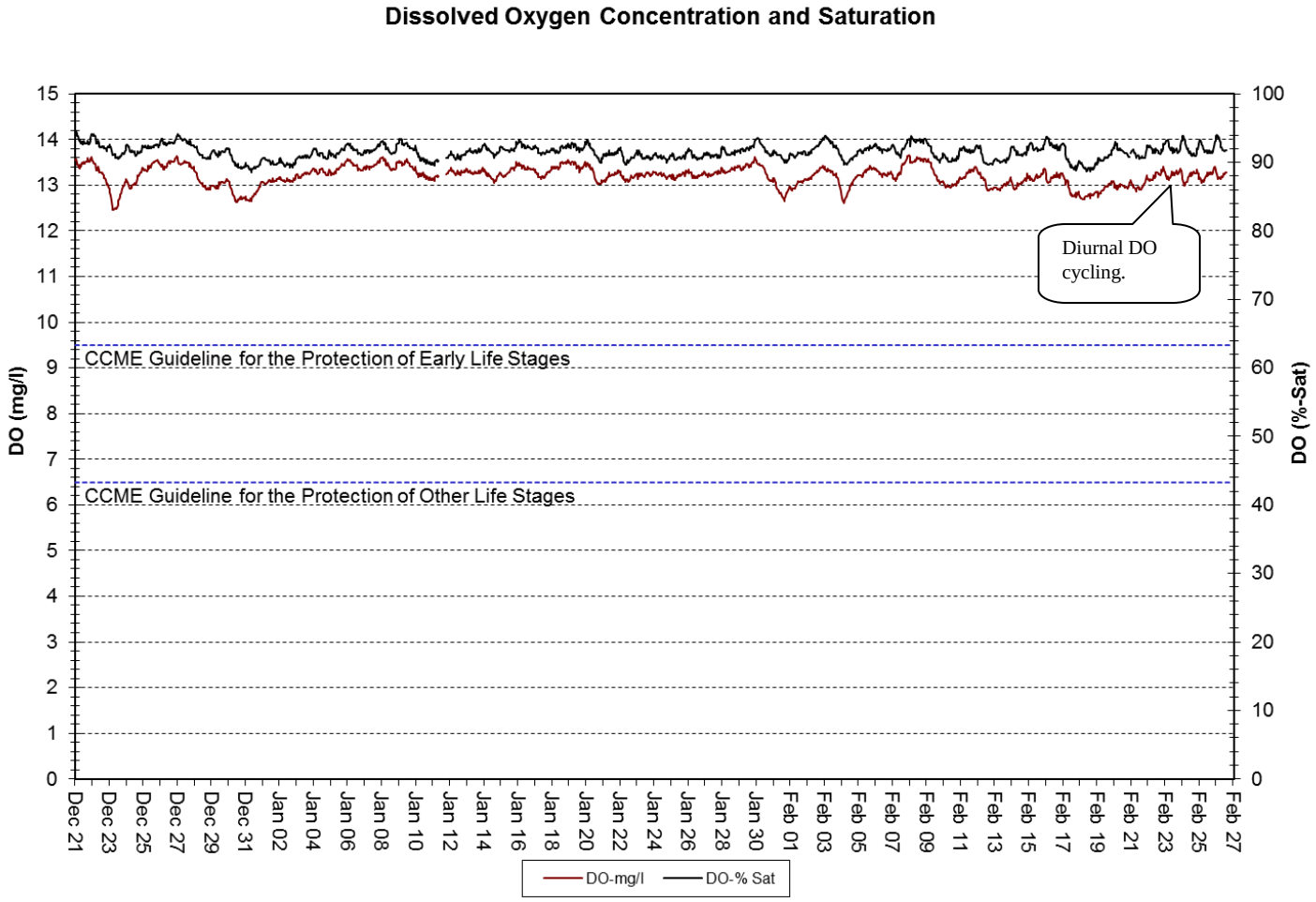
Figure 10: Dissolved Oxygen at Rattling Brook Big Pond from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	100.0	83.5	89.1
Dissolved Oxygen (mg/l)	14.43	12.02	12.79

- Dissolved oxygen showed a dropping trend from December 21st to February 27th as freezing conditions resulted in complete ice cover across Big Pond. Ice cover reduces the impact of wave action, preventing oxygenation of the water. Decreased respiration by aquatic life, however, prevents DO levels from falling below CCME Guidelines.

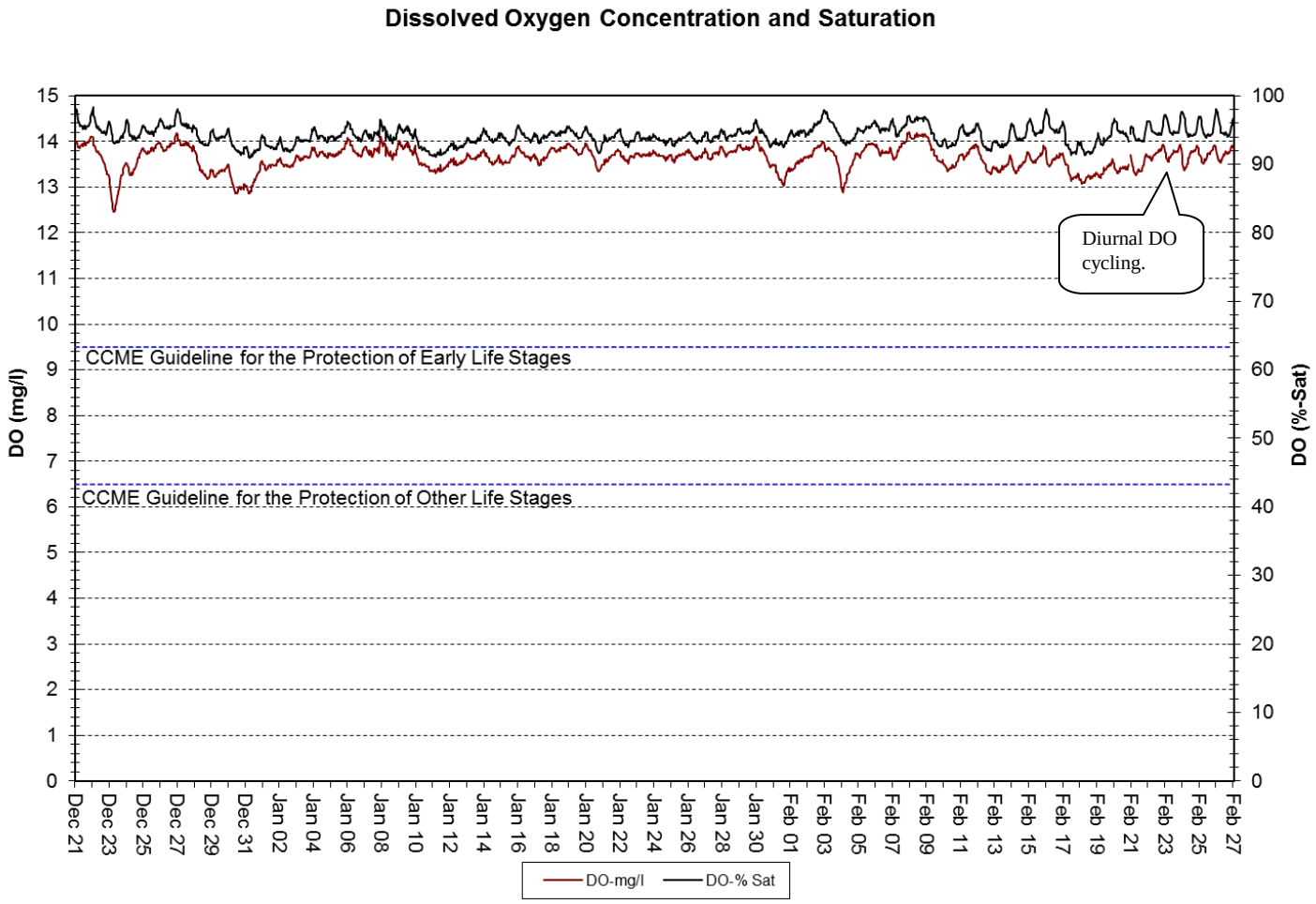
Figure 11: Dissolved Oxygen at Rattling Brook below Bridge from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	94.5	88.6	91.5
Dissolved Oxygen (mg/l)	13.66	12.45	13.23

- Dissolved oxygen levels at Bridge station were largely consistent during the deployment period, owing to open water conditions allowing oxygen admission through vigorous flow over rapids. All values were above CCME Guidelines.
- As of the end of February, diurnal DO cycles began to reappear after being largely absent since the beginning of December. These cycles are the result of increased solar insolation and air temperatures influencing DO concentrations in the water. During routine maintenance at removal on February 27th, a large number of larval insects were found attached to the protective casing in the river.

Figure 12: Dissolved Oxygen at Rattling Brook below Plant Discharge from December 21, 2012 to February 27, 2013

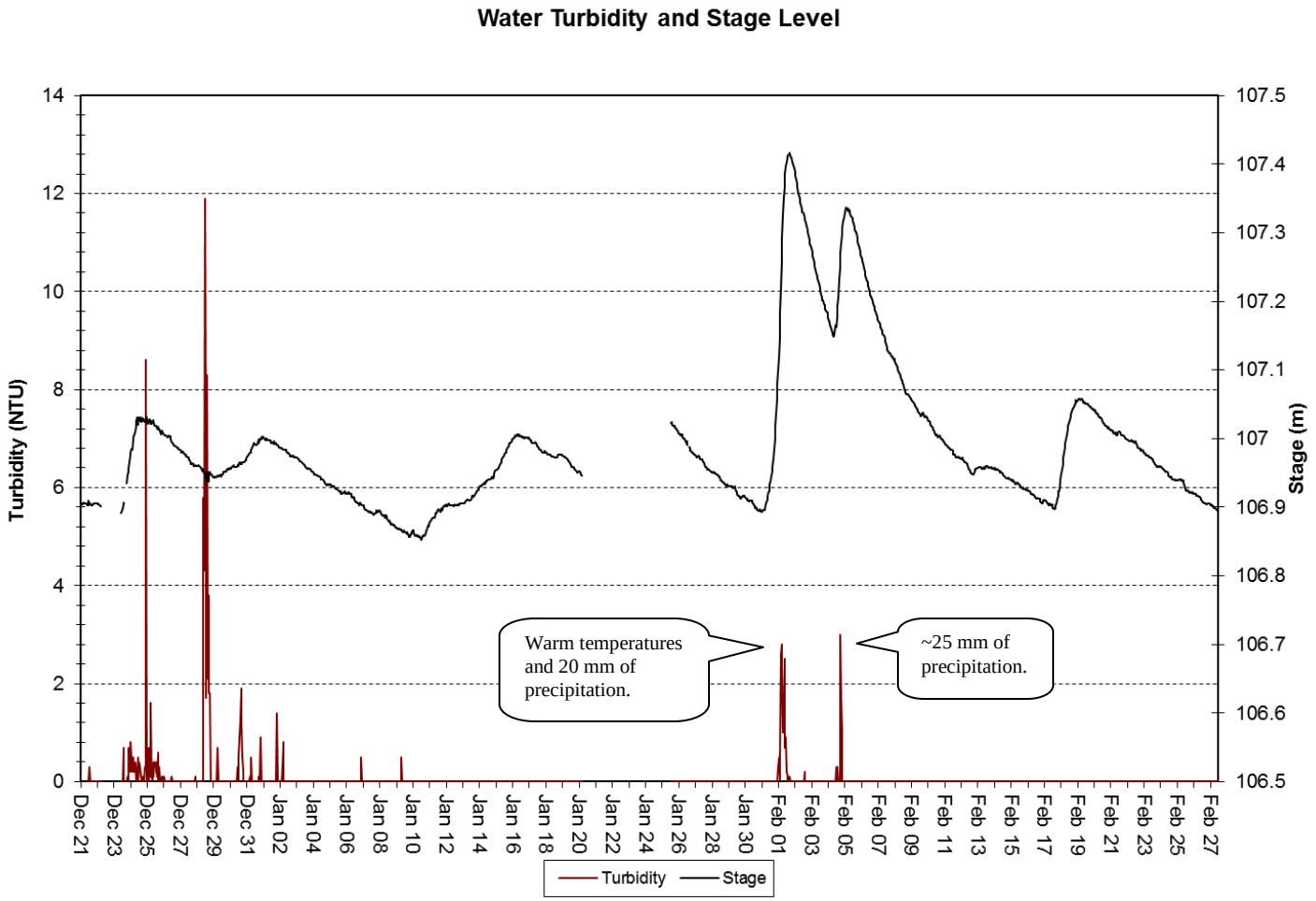


Parameter	Max	Min	Median
Dissolved Oxygen (%-Sat)	98.3	90.9	94.2
Dissolved Oxygen (mg/l)	14.20	12.47	13.67

- Dissolved oxygen levels were higher here than those found upstream at Bridge station. All values were above CCME Guidelines.
- Similar to Bridge station, diurnal DO cycles have returned to Plant Discharge station.

Turbidity

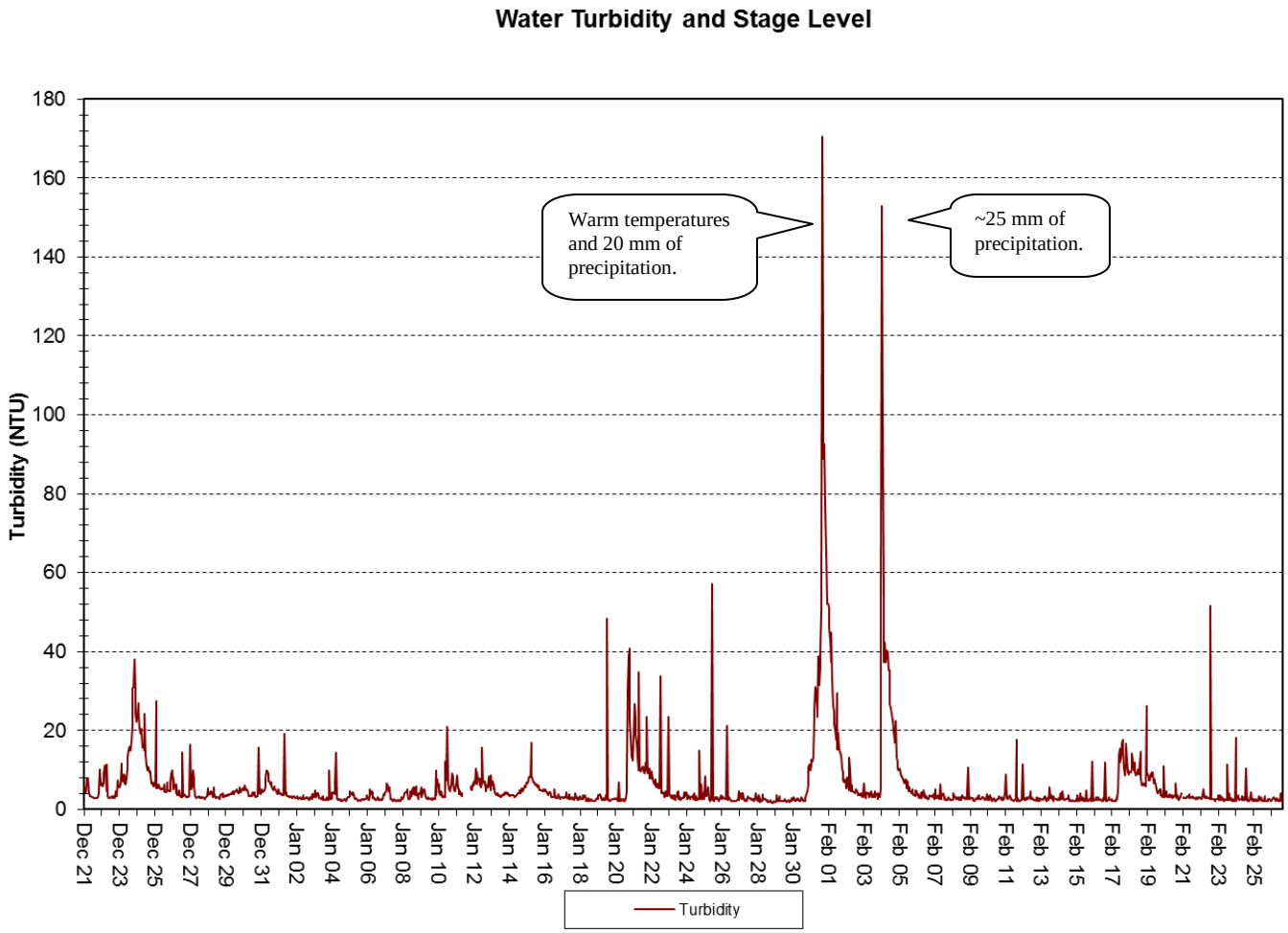
Figure 13: Turbidity at Rattling Brook Big Pond from December 21, 2012 to February 27, 2013



Parameter	Max	Min	Median
Turbidity (NTU)	11.9	0.0	0.0

- Some disturbance in turbidity levels were seen in late December during a period of precipitation and before freeze-up. At this time, turbidity levels peaked at 11.9 NTU. During the remainder of the deployment – and especially after ice had begun to form across the Pond – turbidity levels were low, and mostly zero.

Figure 14: Turbidity at Rattling Brook below Bridge from December 21, 2012 to February 27, 2013

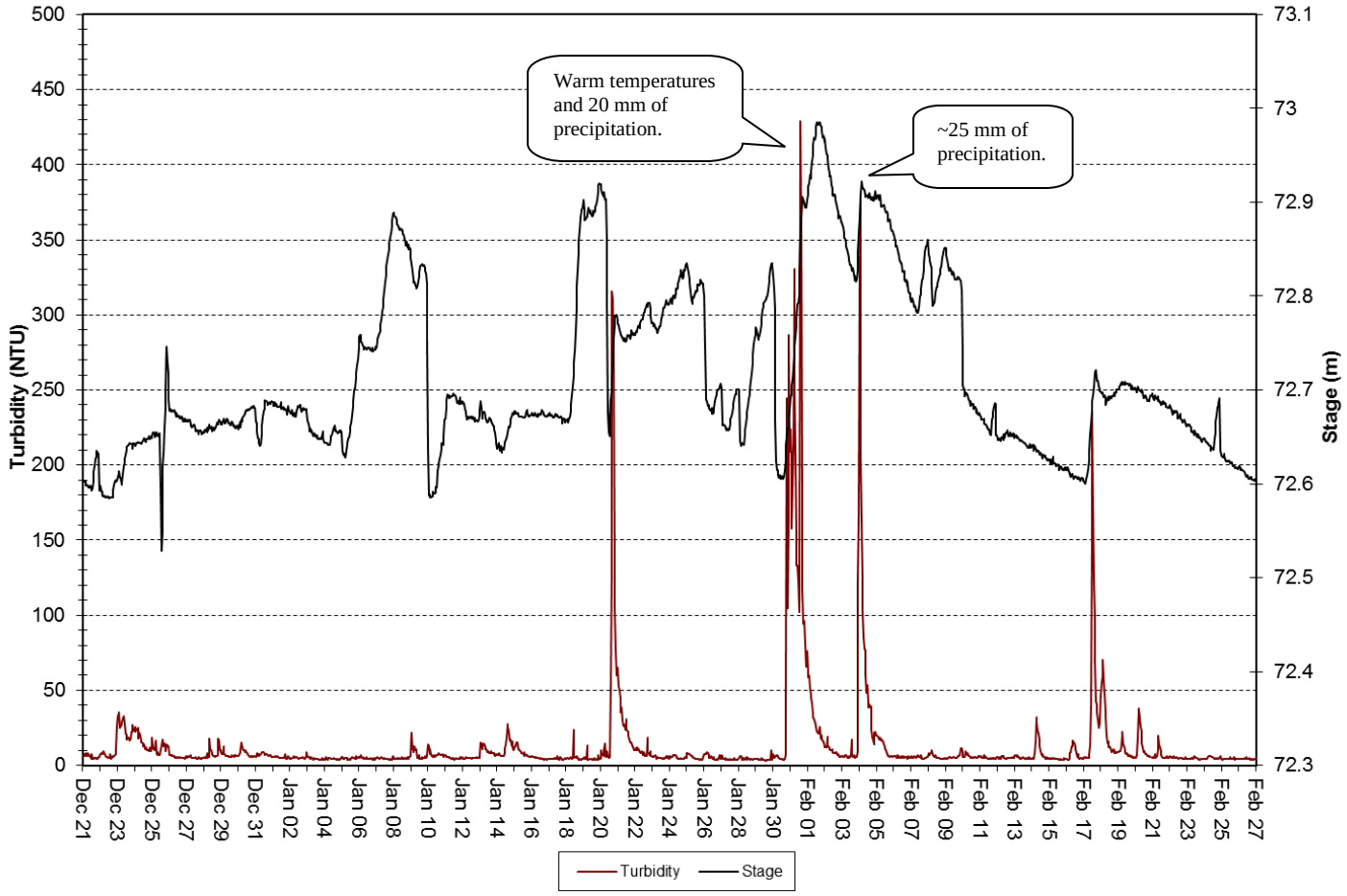


Parameter	Max	Min	Median
Turbidity (NTU)	170.6	1.7	3.4

- Variable turbidity was the norm from December 21st to February 27th at Bridge station with turbidity events primarily driven by precipitation events and destabilized sediments from previous work in Forgotten Pond.

Figure 15:

Water Turbidity and Stage Level



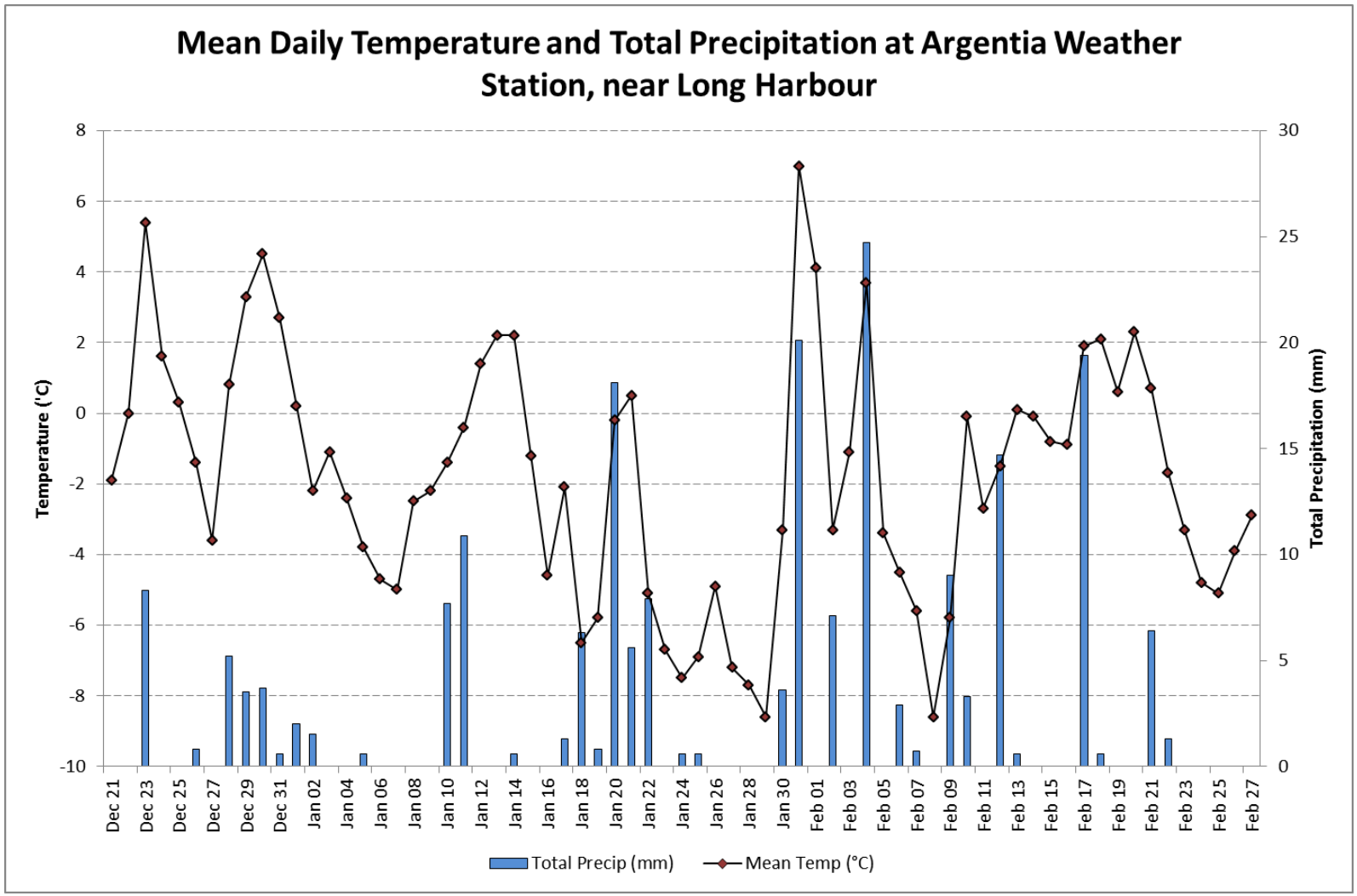
Parameter	Max	Min	Median
Turbidity (NTU)	429.0	3.0	5.5

- Turbidity levels were slightly higher at Plant Discharge station compared to Bridge station. Events were highly concurrent with increases in stage level, especially on January 31st and February 5th.

Conclusions

- Sediment disturbance from Forgotten Pond and construction is a continuous source of low-level variable turbidity at Bridge and Plant Discharge.
- This deployment period represents the coldest part of the year with highest dissolved oxygen levels and the most variable conductivity levels.
- Moving into the spring, high flows are to be expected during spring freshet. Periods of heavy precipitation and snow melt will redistribute some of the sediments moved about during the Forgotten Pond habitat compensation work.

Appendix



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