Real-Time Water Quality Deployment Report Rattling Brook Network

January 13, 2012 to February 16, 2012

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

Real-Time Water Quality Deployment Report

Rattling Brook Network

2012-01-13 to 2012-02-16

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- The deployment period for this report was 33 days in total.
- A fault with the deep discharge battery at Plant Discharge station caused intermittent communication and data loss due to power interruption.
- From January 13th to February 2nd, Specific Conductivity at Plant Discharge station was recorded in mS/cm as opposed to µS/cm. Due to the 1000 fold difference between mS and µS, units were rounded to the nearest 10 µS/cm following post-processing conversion.

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	2012-01-13	Deployment	Excellent	Poor*	Excellent	NA	Excellent
	2012-02-16	Removal	Fair	Fair	Excellent	Fair	Fair
Rattling Brook below Bridge	2012-01-12	Deployment	Good	Good	Excellent	NA	Excellent
	2012-02-16	Removal	Excellent	Good	Excellent	Excellent	Good
Rattling Brook below Plant Discharge	2012-01-13	Deployment	Excellent	Poor†	Good	Good	Excellent
	2012-02-16	Removal	Good	Excellent	Excellent	Fair	Poor‡

* Unusually low pH reading from QAQC sonde at Big Pond station led to deflated QAQC Ranking

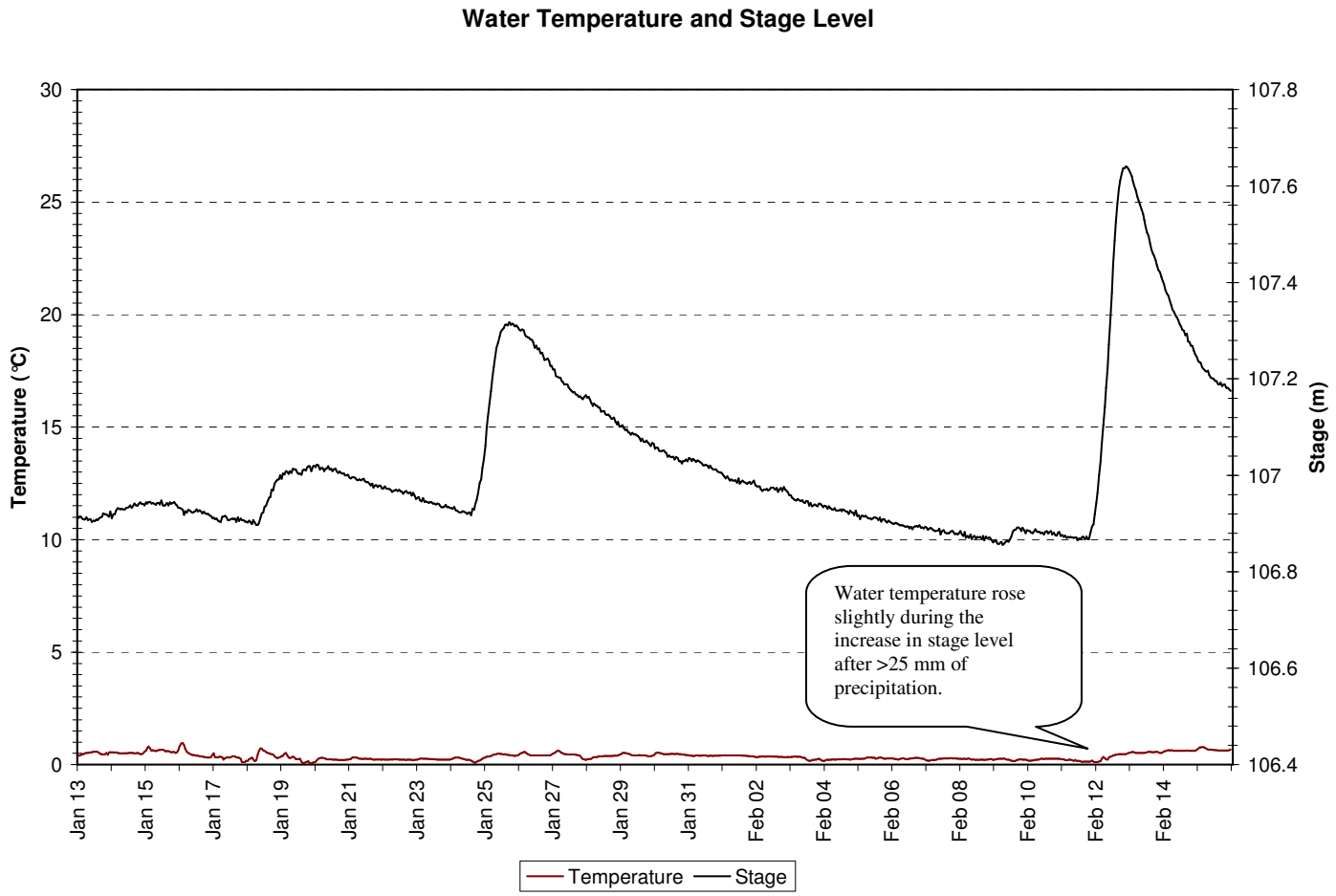
† Unusually high pH reading from QAQC sonde at Bridge station led to deflated QAQC Ranking.

‡ At removal, QAQC sonde turbidity reading (66.5 NTU) was significantly different from the Field sonde reading (12.9 NTU). Visual inspection of the river at removal supports the Field sonde.

Data Interpretation

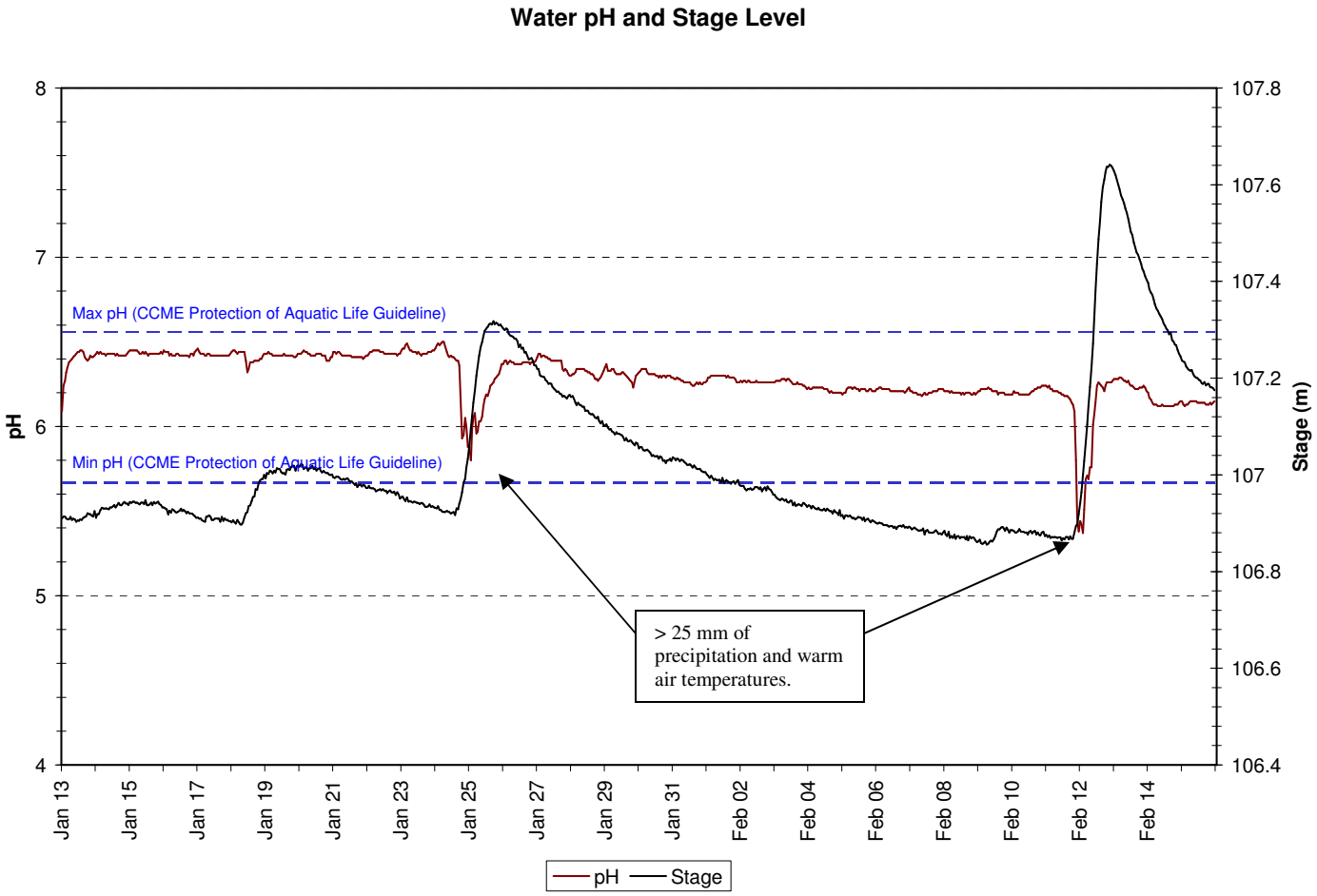
Rattling Brook Big Pond

Figure 1: Water Temperature at Rattling Brook Big Pond from January 13 to February 16



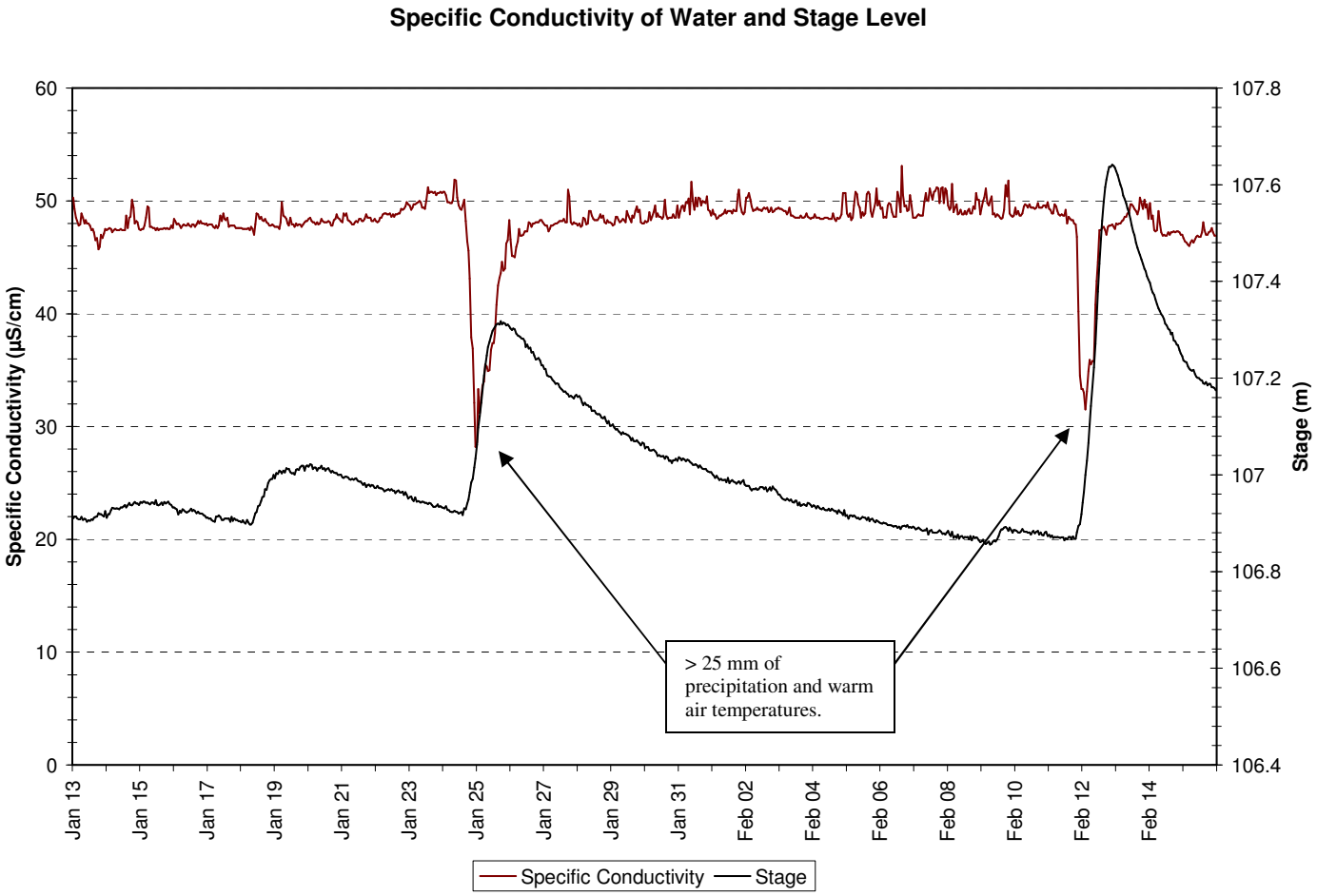
- No major changes were observed in water temperature during this month with a range of 0.05°C to 0.96°C with a median of 0.36°C. Ice cover was present at this time, moderating the effect of daily temperature cycles.

Figure 2: pH at Rattling Brook Big Pond from January 13 to February 16



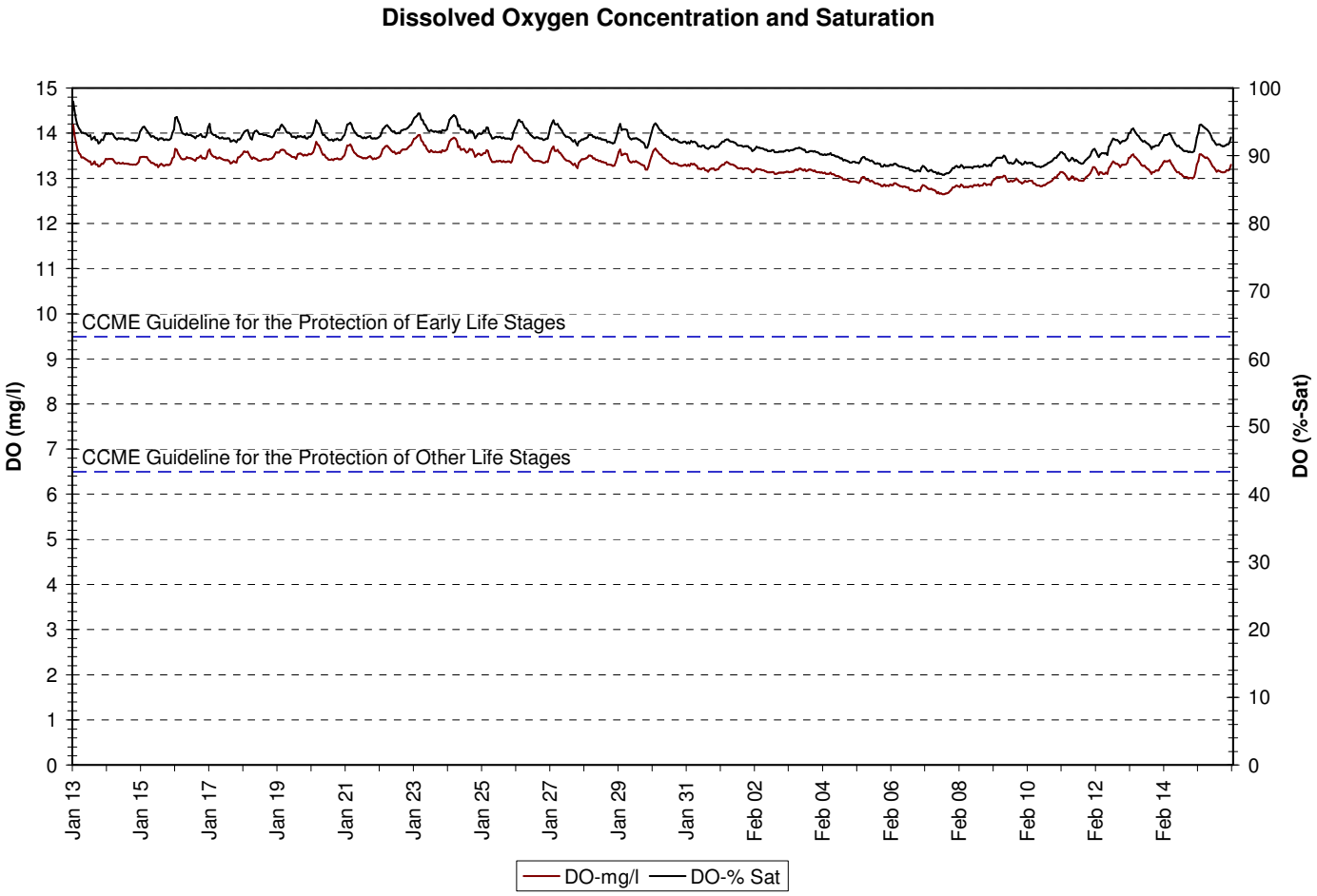
- pH values fell between 5.37 to 6.50 with a median value of 6.29. Most values were within the Site Specific Guidelines.
- More than 30 mm of precipitation fell between January 24th – 25th while the mean daily temperature was above 0^{o}C resulting in a large drop and subsequent recovery in pH. A similar situation occurred on February 12th with more than 25 mm of precipitation and a daily mean temperature of 6^{o}C.

Figure 3: Specific Conductivity at Rattling Brook Big Pond from January 13 to February 16



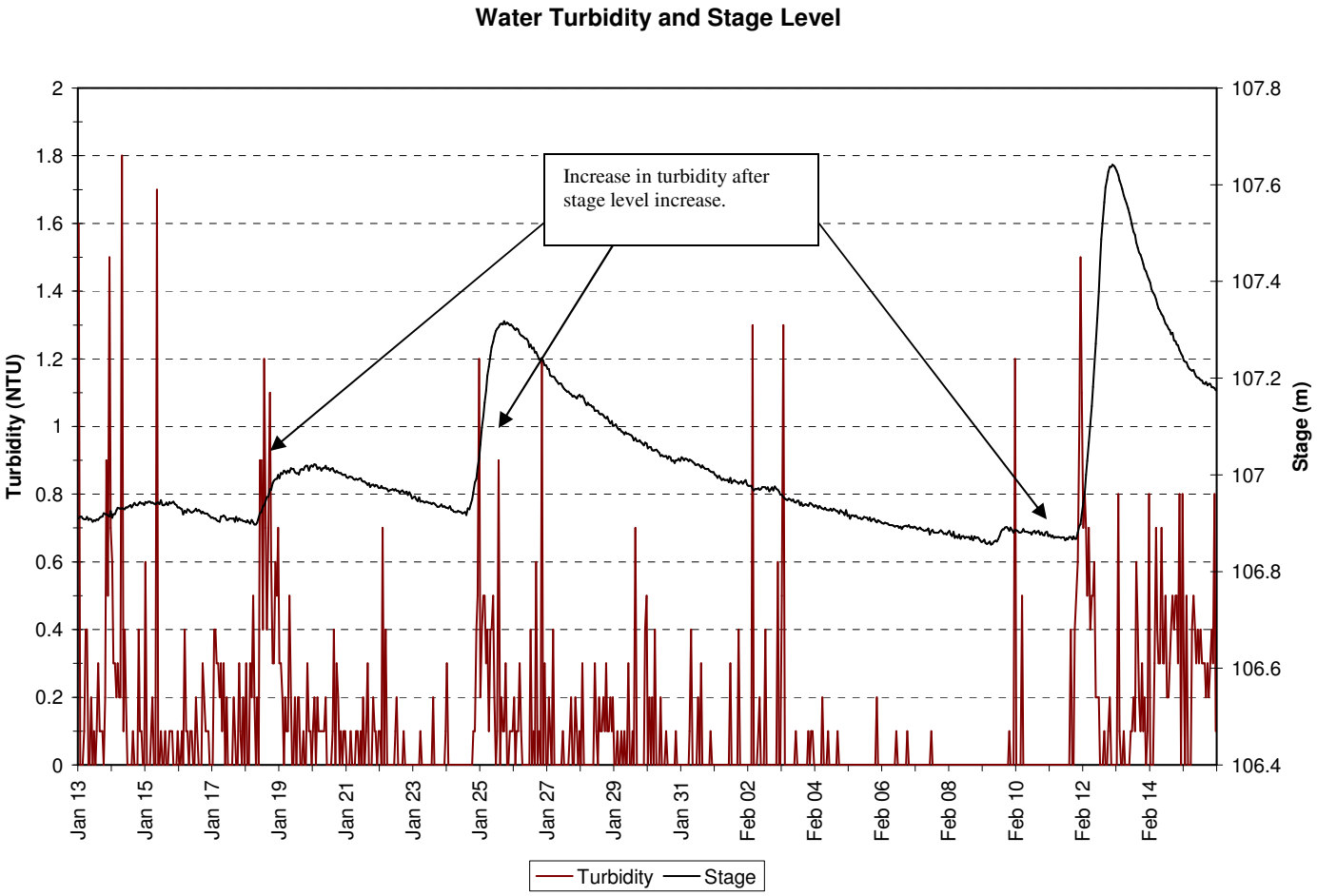
- Two large decreases in specific conductivity were observed during heavy precipitation and warm temperatures. Conductivity during the month ranged from 28.2 to 53.1µS/cm with a median value of 48.5 µS/cm.
- Heavy rain and warm temperatures on January 24th – 25th and February 12th resulted in a dilution effect at Big Pond station. Conductivity values plunged and subsequently rebounded within 24 hours.

Figure 4: Dissolved Oxygen at Rattling Brook Big Pond from January 13 to February 16



- Dissolved oxygen concentrations were entirely above the CCME guideline of 9.5 mg/l for the duration of this deployment. Values fell between 12.65 to 14.18 mg/l with a median value of 13.33 mg/l.
- A prolonged period of muted diel DO cycling from January 30th to February 11th may be caused by ice formation during a concurrent period of below-zero mean temperatures.

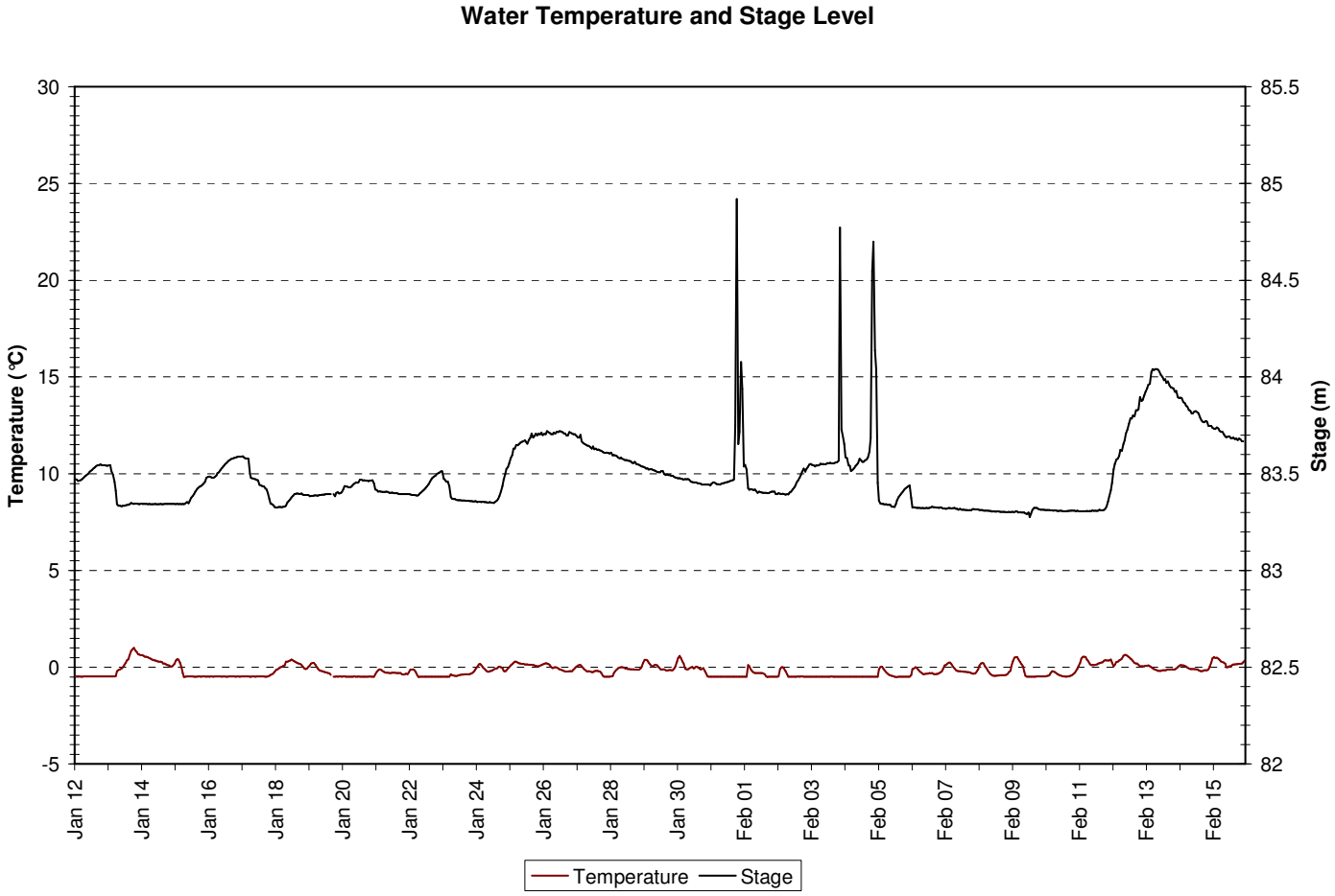
Figure 5: Turbidity at Rattling Brook Big Pond from January 13 to February 16



- Turbidity levels under the ice at Big Pond were very low and ranged from 0.0 NTU to 1.8 NTU with a median value of 0.0 NTU. Peaks in stage level seem to be associated with an increase in turbidity levels, as indicated above.

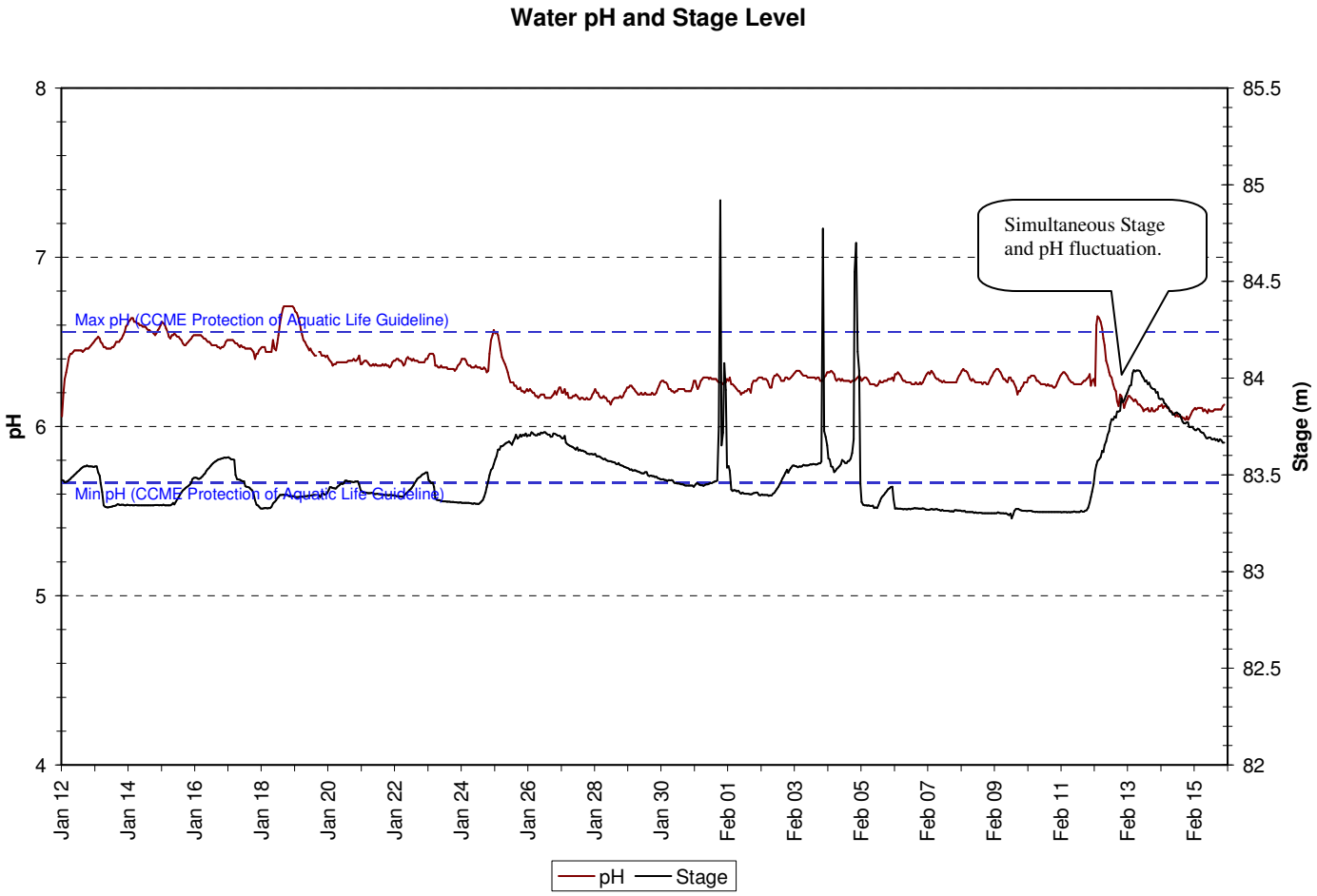
Rattling Brook below Bridge

Figure 6: Water Temperature at Rattling Brook below Bridge from January 12 to February 16



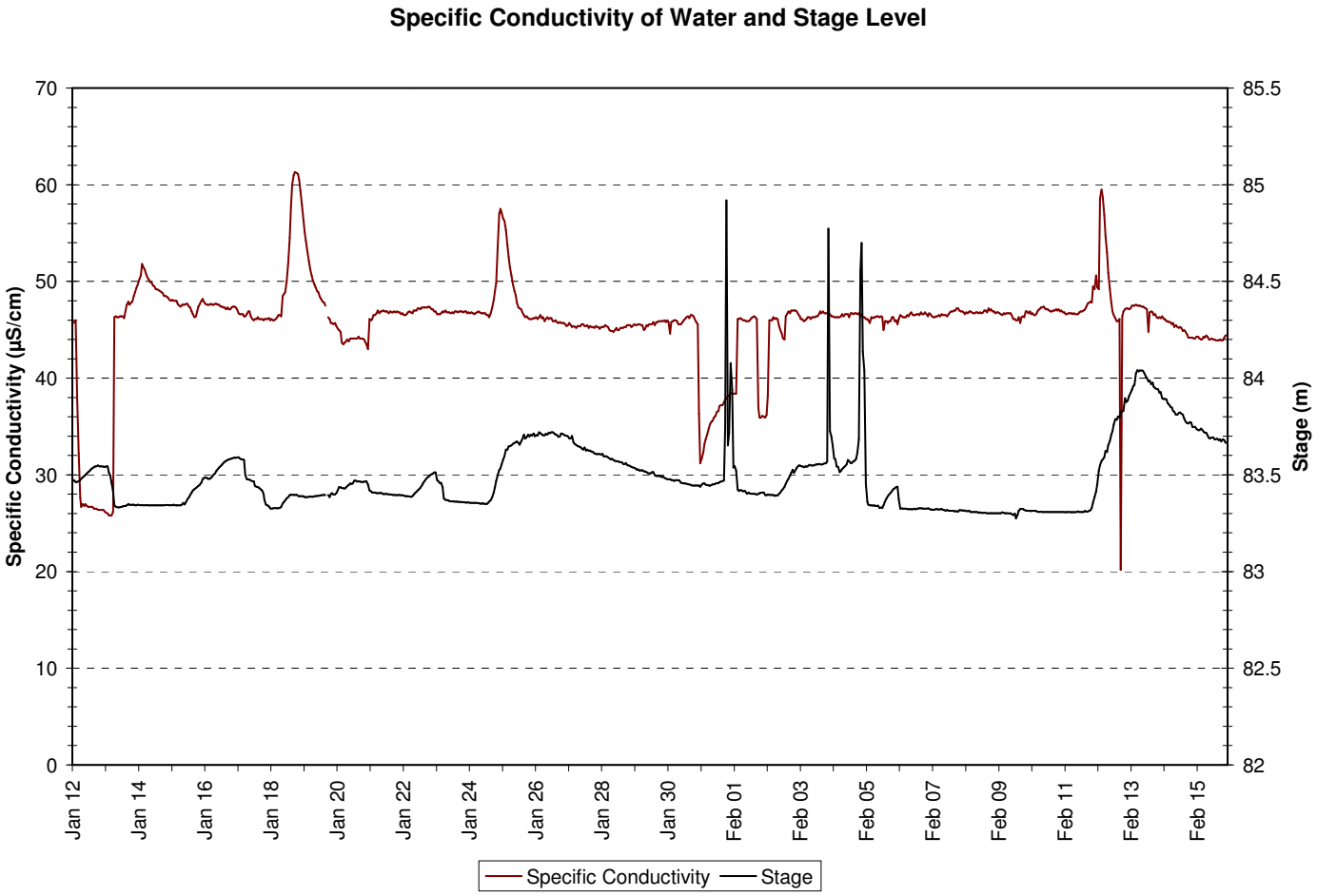
- A consistently low water temperature was observed during this deployment period. At this time, temperatures are expected to be at their annual low and fell in the range of -0.51°C to 1.00°C with a median of -0.22°C.

Figure 7: pH at Rattling Brook below Bridge from January 12 to February 16



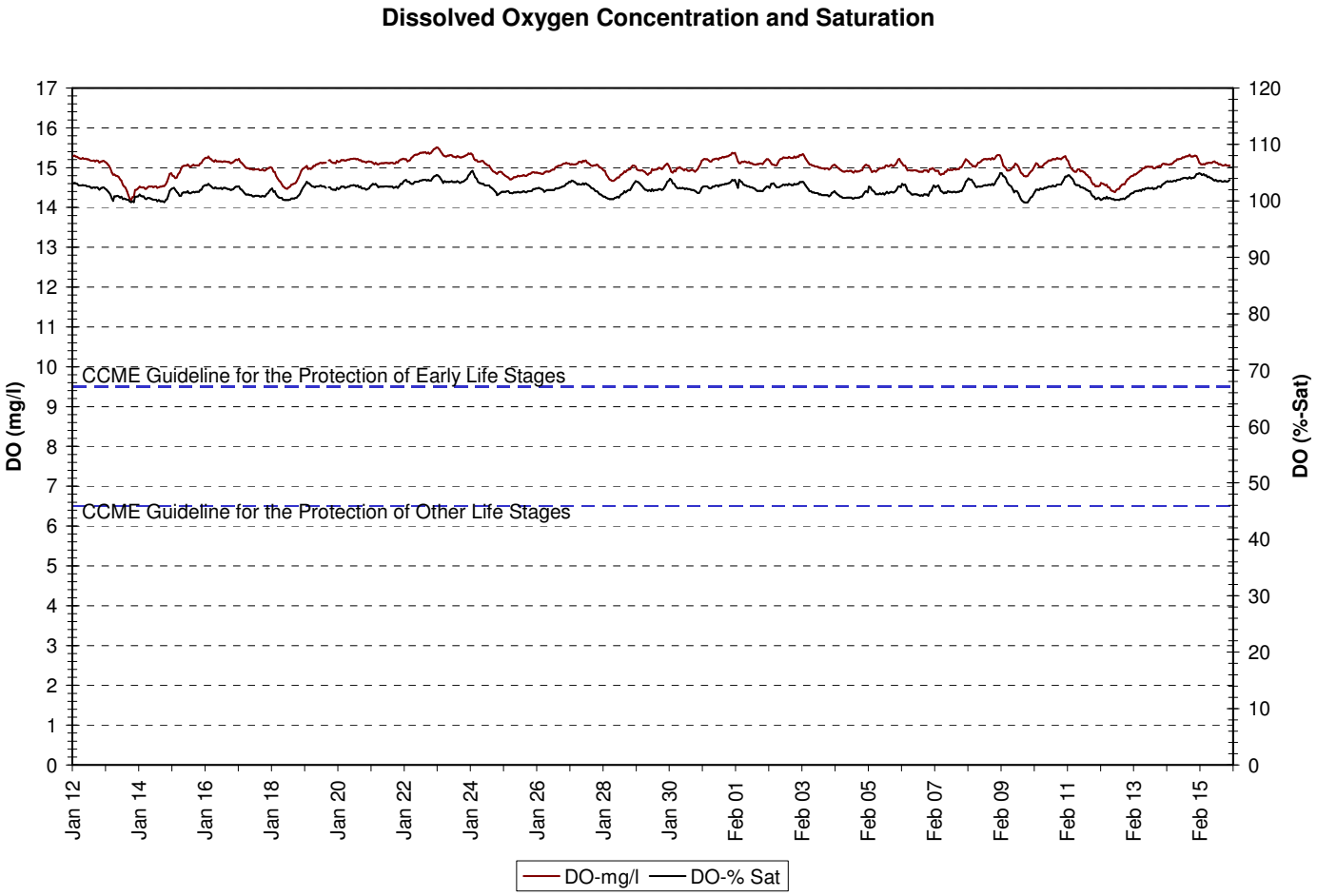
- pH values fell mostly within the Site Specific Guideline range of 5.67 – 6.56. A downward trend appears to be present during this deployment period. Despite some fluctuations in stage level during this deployment period, there was only one notable incidence of a simultaneous pH and stage fluctuation (indicated above). It is probable that a concurrent warm period and heavy rainfall is responsible for flushing acidic water through the Rattling Brook system.
- A range of 6.04 to 6.71 with a 6.29 median was observed from January 12th to February 16th.

Figure 8: Specific Conductivity at Rattling Brook below Bridge from January 12 to February 16



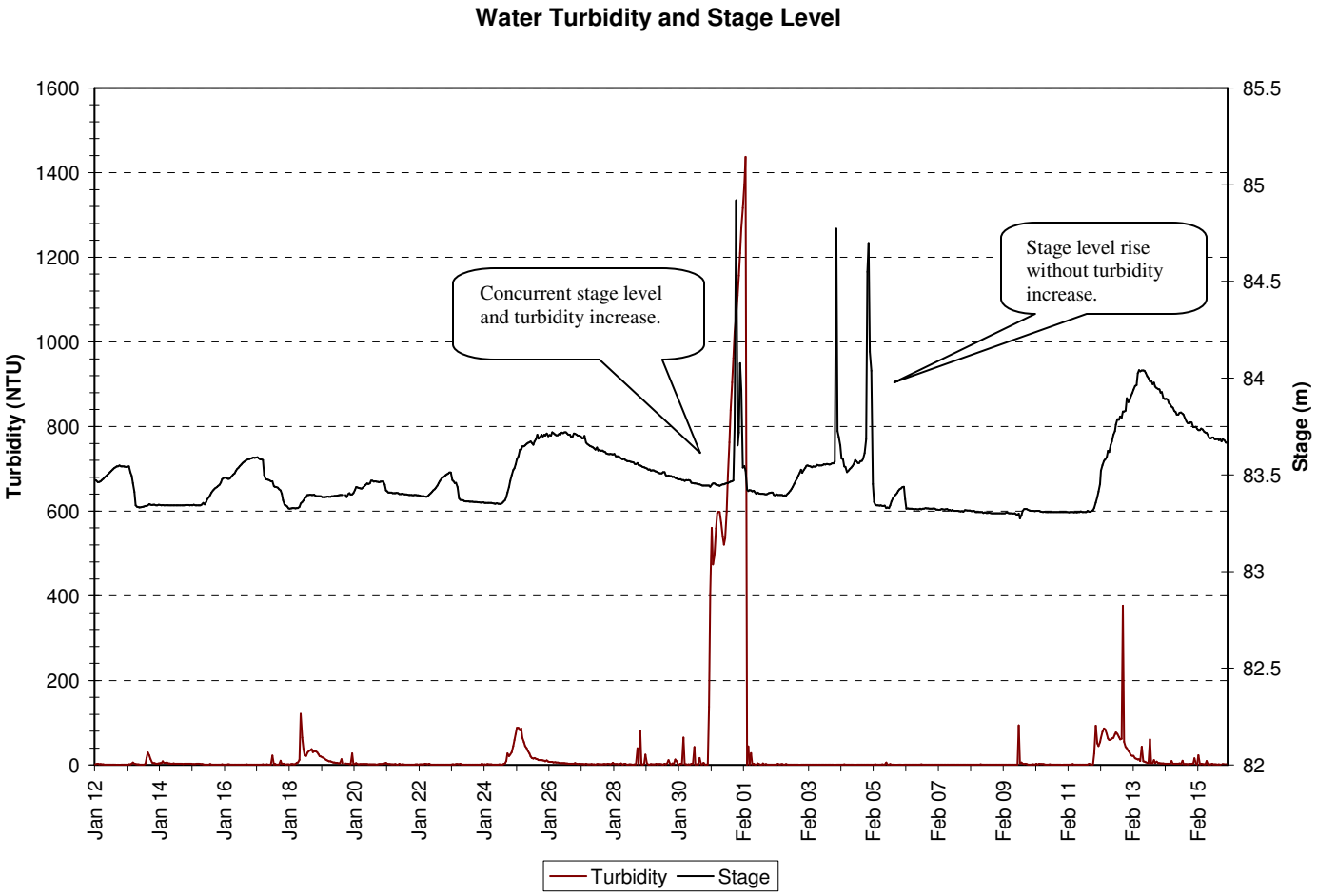
- A series of rapid drops in conductivity followed by swift recoveries is common in this deployment report. Most often, rapid changes are seen to be spikes during warm temperature and rain, washing dissolved solids into the waterway. These declines, however, may be the result of snowfall during cold temperatures which deposits freshwater directly into Rattling Brook while allowing dissolved solids to remain frozen and immobile on land.
- Conductivity fell between 20.2µS/cm to 61.3µS/cm (median value: 46.5µS/cm).

Figure 9: Dissolved Oxygen at Rattling Brook below Bridge from January 12 to February 16



- All dissolved oxygen values were above the CCME Guidelines for the protection of Early Life Stage and Other Life Stage cold water biota. DO was also found to be very consistent and level over the course of the deployment period. Concentrations were between 14.19 mg/l and 15.51 mg/l (median value: 15.05 mg/l).

Figure 10: Turbidity at Rattling Brook below Bridge from January 12 to February 16

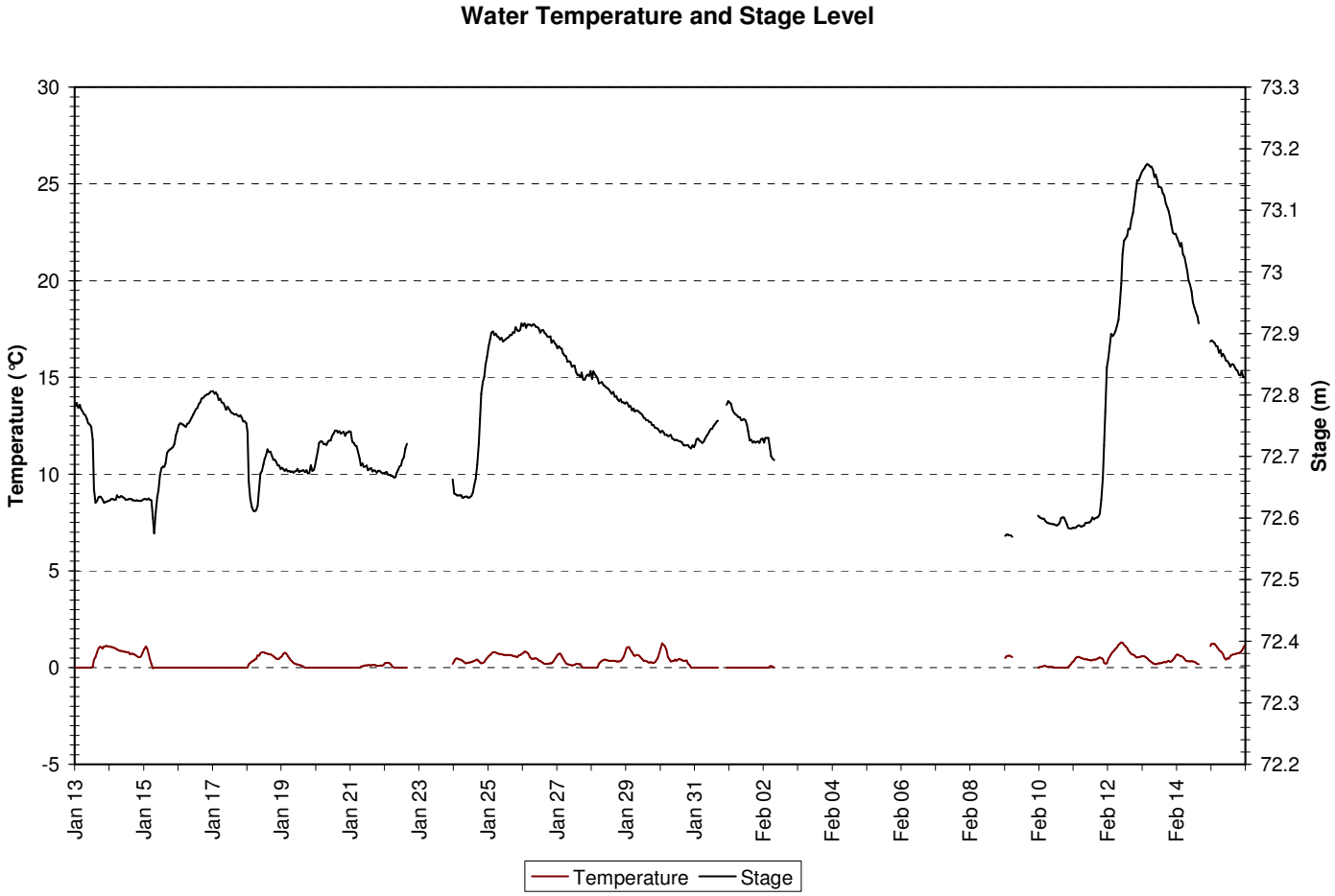


- Separating turbidity and stage level fluctuations is a difficult task: there does not appear to be a direct relationship between stage/flow and turbidity values. For instance, on January 31st, a clear relationship between stage level and turbidity is observed. Only days later, however, another series of stage rises (almost to the same degree seen on January 31st) are recorded with no major change to turbidity.
- Values this month fell between 0.1 NTU and 1437.0 NTU (median value: 1.7 NTU).

Rattling Brook below Plant Discharge

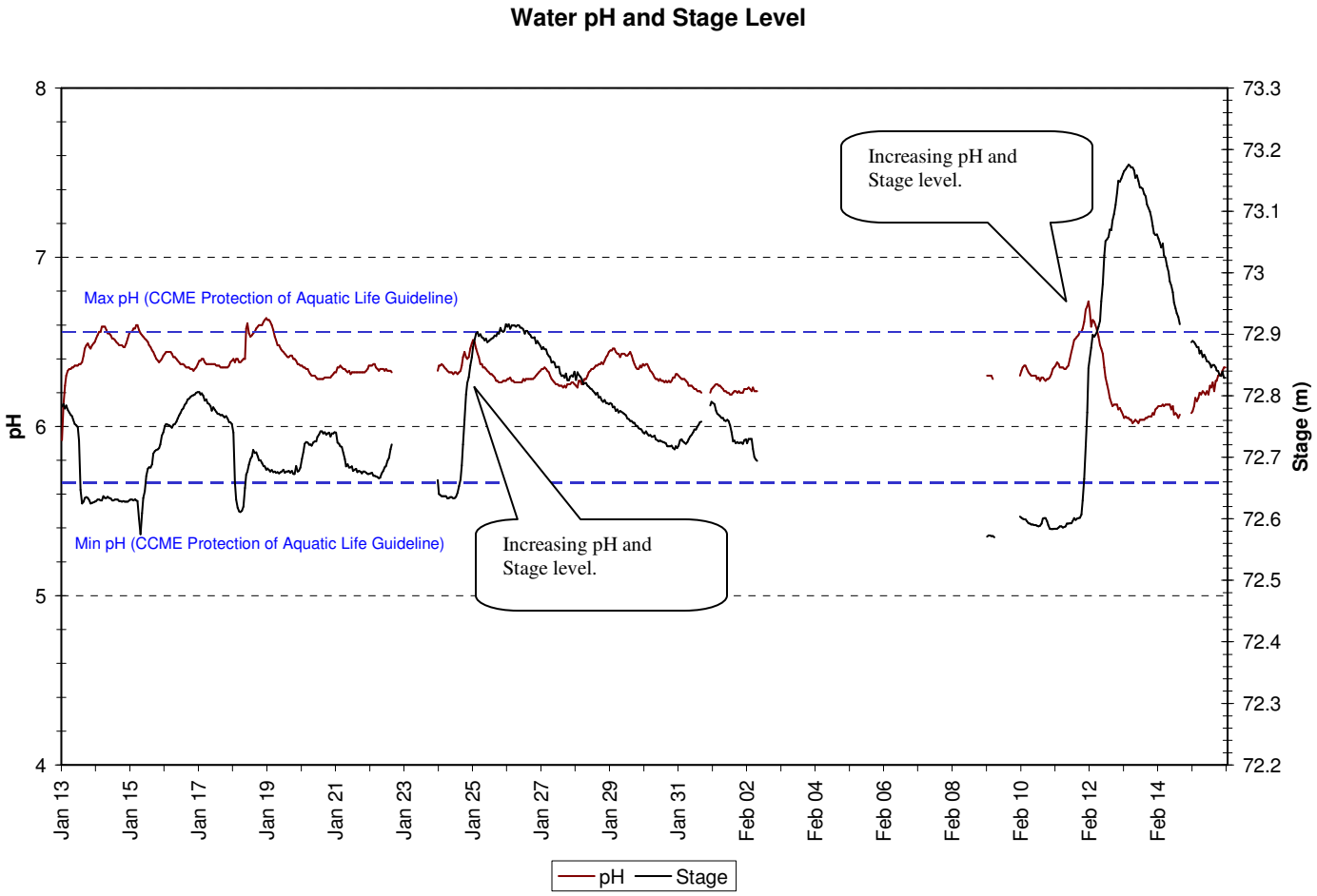
- The deployment period from January 12th to February 16th was marked by several periods of communication and data dropout. Because the instrument normally deployed at this station was being repaired at the time, the data was not logged internally.

Figure 11: Water Temperature at Rattling Brook below Plant Discharge from January 13 to February 16



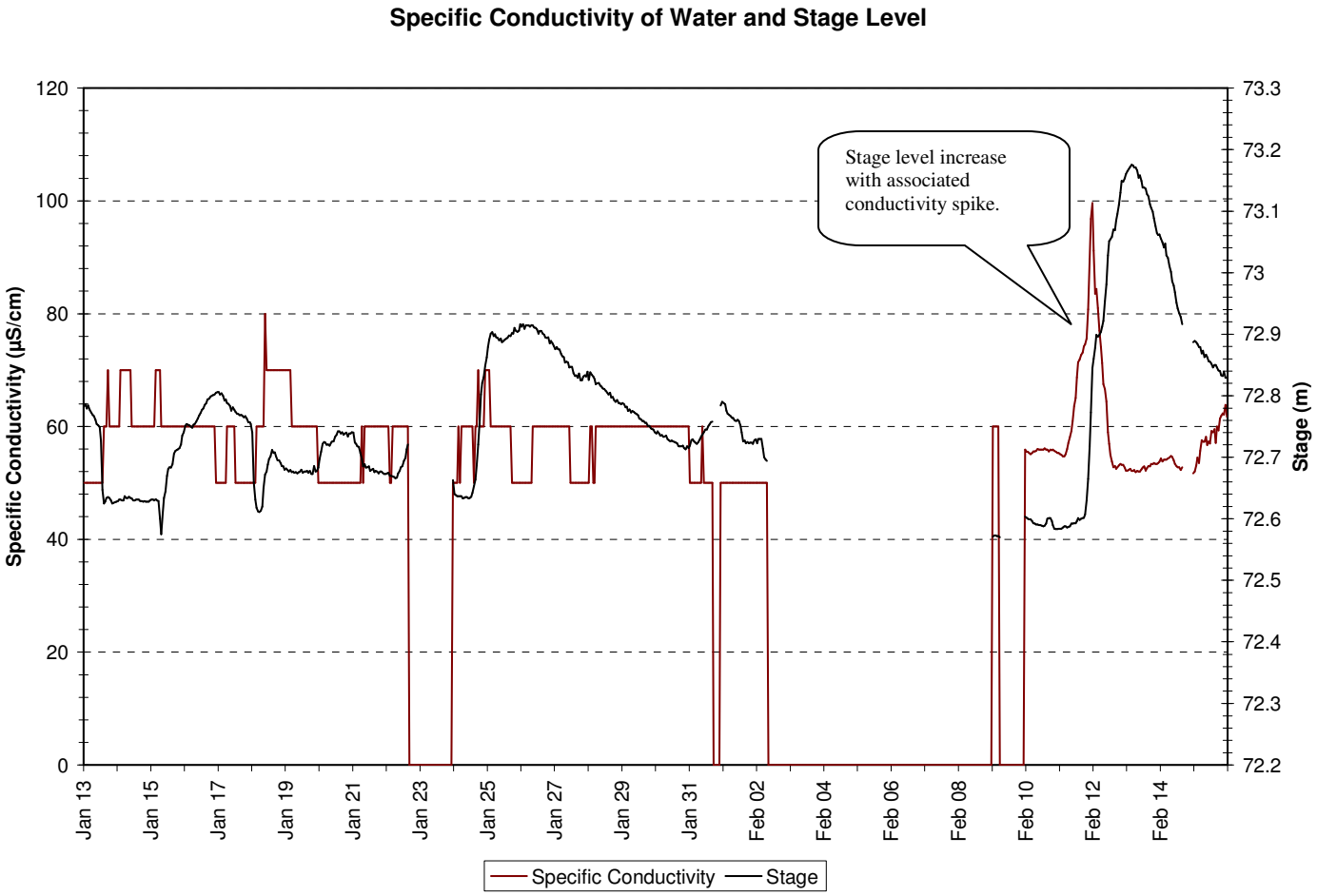
- Water temperatures at their annual low ranged from -0.03°C to 1.31°C (median value: 0.27°C). A warming trend appears to be present towards the end of the deployment period.

Figure 12: pH at Rattling Brook below Plant Discharge from January 13 to February 16



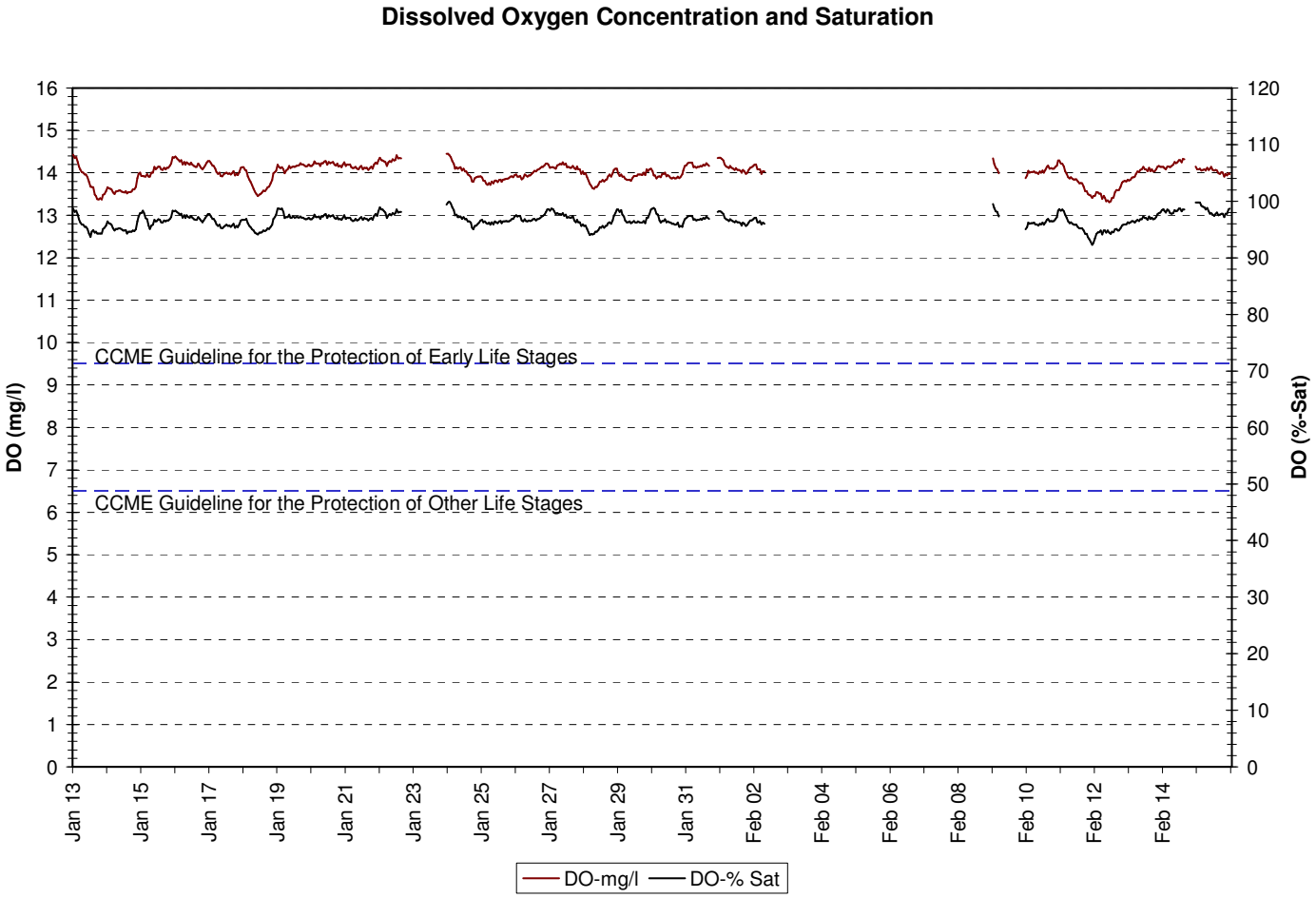
- pH largely fell within the Site Specific Guidelines for Rattling Brook below Plant Discharge station (94.1% of values). Values fell between 5.92 and 6.74 units (median value: 6.33).
- Some instances of stage level and pH increase are identified indicating that inflow into Rattling Brook is associated with alkalinity increase in the water.

Figure 13: Specific Conductivity at Rattling Brook below Plant Discharge from January 13 to February 16



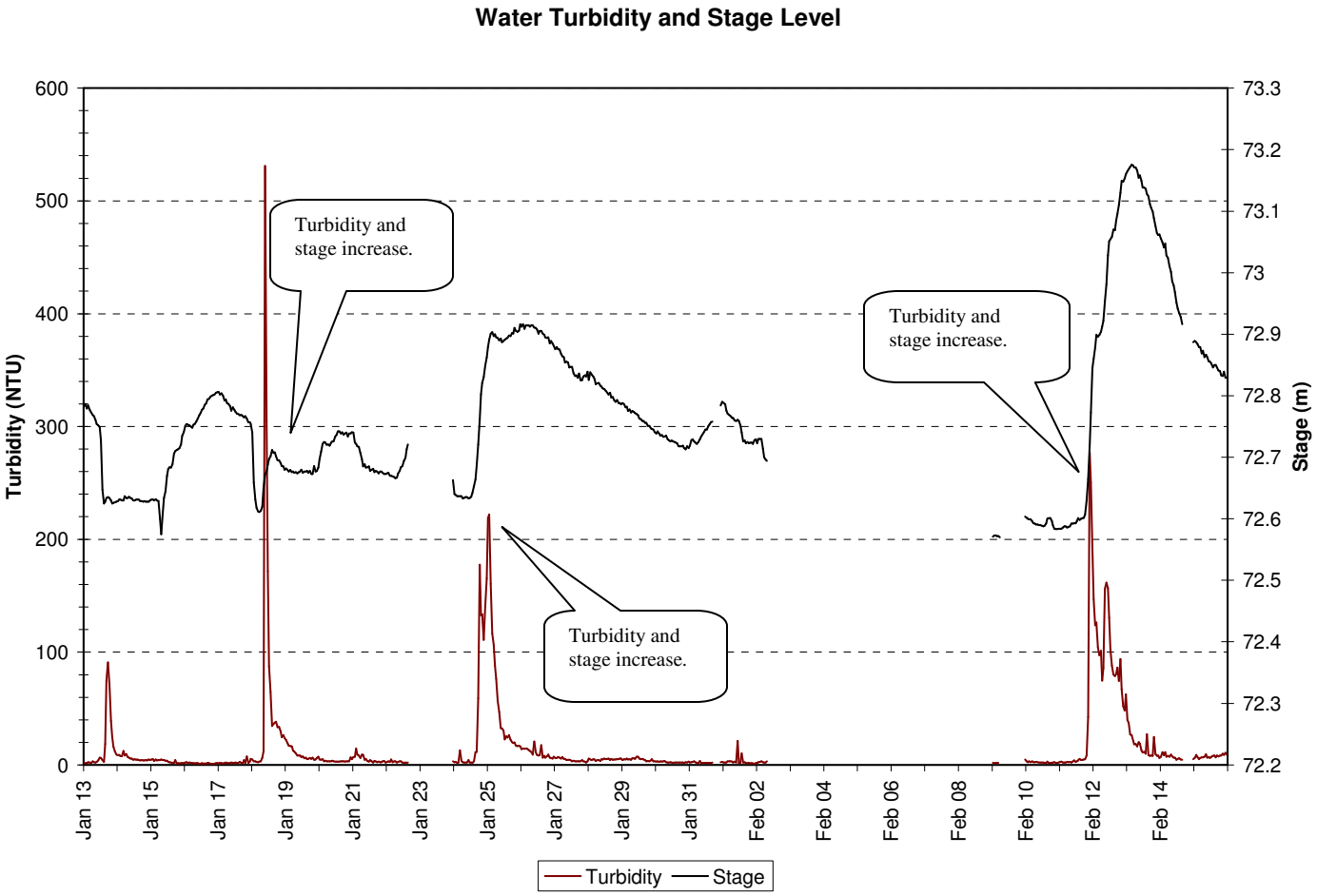
- Prior to February 2nd, it is difficult to decipher any notable events involving conductivity due to the censoring of data recorded in mS/cm.
- Conductivity ranged from 50.0 to 99.6 µS/cm with a median value of 60.0 µS/cm.

Figure 14: Dissolved Oxygen at Rattling Brook below Plant Discharge from January 13 to February 16



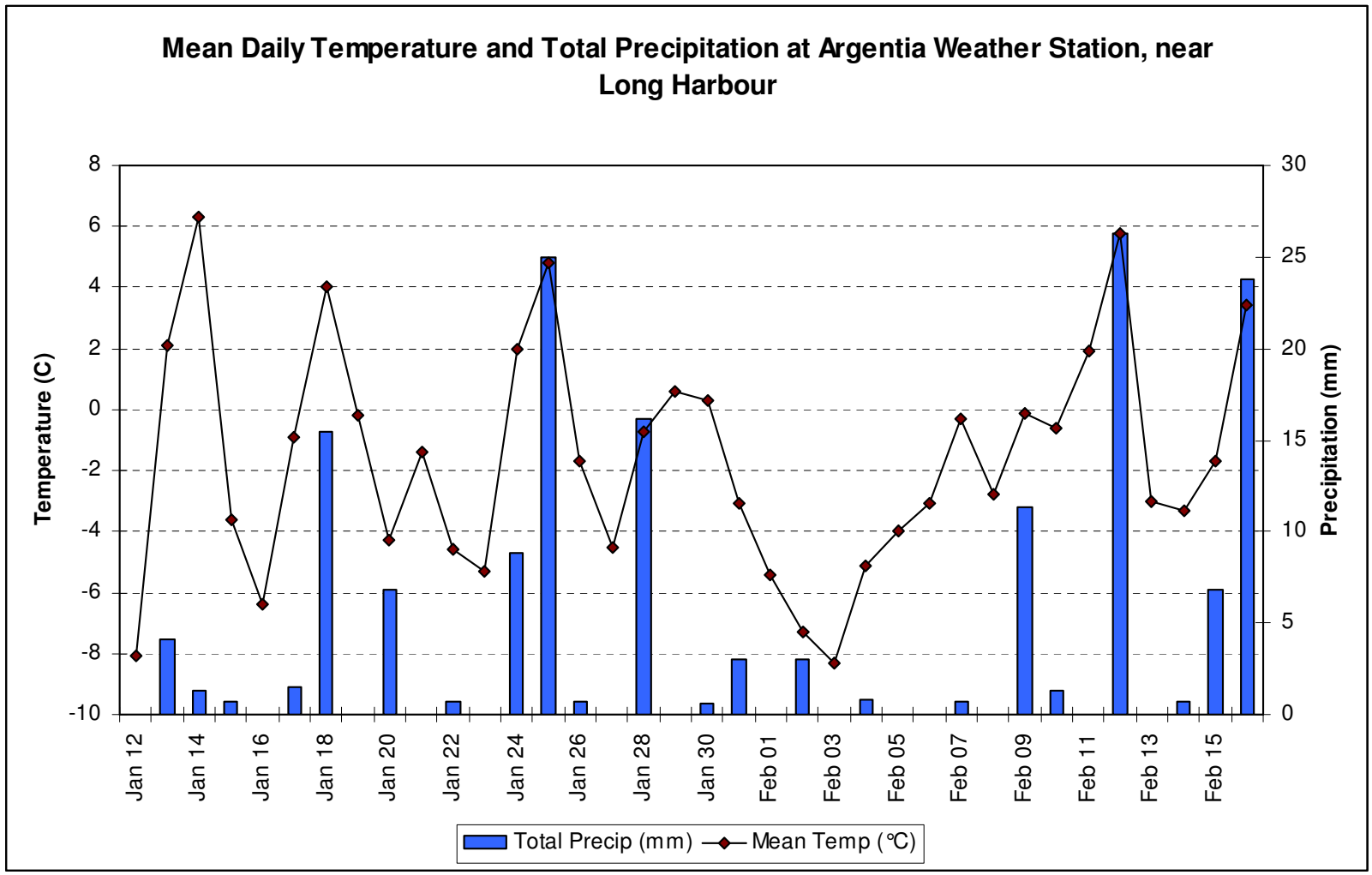
- At no time during this deployment period did dissolved oxygen concentrations fall below the CCME Guidelines for the protection of Early and Other Life Stage cold water biota. Concentration values fell between 13.31 mg/l to 14.45 mg/l (median value: 14.06 mg/l).

Figure 15: Turbidity at Rattling Brook below Plant Discharge from January 13 to February 16



- Four notable periods of turbidity were observed from January 13th to February 16th. Three of these four instances are associated with increasing stage/flow in Rattling Brook.
- Values ranged from 1.1 NTU to 531.0 NTU (median value: 4.5 NTU).

Appendix



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