Real-Time Water Quality Deployment Report

Rattling Brook Network

December 17, 2010 – January 20, 2011

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.
- The duration of this monthly report spans deployment on December 17th, 2010 and removal on January 20th, 2011, a period of 33 days.
- A set of Site Specific Guidelines (SSGs) for pH were calculated for the Rattling Brook system. Briefly, the method used to calculate this set of guidelines was established using the entire set of pH data from establishment of each station until January 2011. From this large set of ~40 000 data points, 95th and 5th percentiles were drawn and set as the upper and lower limits, respectively. As a result, the SSGs for pH at Rattling Brook range 5.67 – 6.56 units, instead of the original CCME 6.5 – 9.0. The new guidelines should allow for a more representative examination of pH flux in the future.

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.
  - Upon deployment, a QA/QC Sonde is temporarily deployed along side the Field Sonde. Values for temperature, pH, conductivity, DO and turbidity are compared between the two instruments. A grab sample is also taken for reference between to the field sonde. Based on the degree of difference between parameters recorded by the Field Sonde and QAQC Sonde a qualitative statement is made on the data quality in Table 1.
  - At the end of a deployment period, a newly calibrated QA/QC Sonde is deployed along side the Field Sonde. All parameters are compared between the two instruments and a qualitative statement is made regarding data quality and presented in Table 1.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	December 17, 2010	Deployment	Good	Good	Excellent	Excellent	Excellent
	January 20, 2011	Removal	Good	Good	Excellent	Excellent	Excellent
Rattling Brook below Bridge	December 17, 2010	Deployment	Excellent	Good	Fair	Excellent	Excellent
	January 20, 2011	Removal	Excellent	Good	Fair	Excellent	Poor
Rattling Brook below Plant Discharge	December 17, 2010	Deployment	Good	Marginal	Excellent	NA	Marginal
	January 20, 2011	Removal	Good	Excellent	Good	NA	Marginal

- Due to moisture under the lens cap of the DO sensor at Plant Discharge station, data quality for the DO sensor indicates NA.
  - Due to the failure of this senor, a discussion of DO at Rattling Brook below Plant Discharge will be omitted.
- Turbidity was ranked as “Poor” during removal of the Field sonde at Bridge station. Furthermore, turbidity was ranked as “Marginal” during deployment and removal of Plant Discharge station. The QAQC sonde

appears to produce turbidity rankings substantially lower than the Field Sonde in many cases, despite perfect calibration.

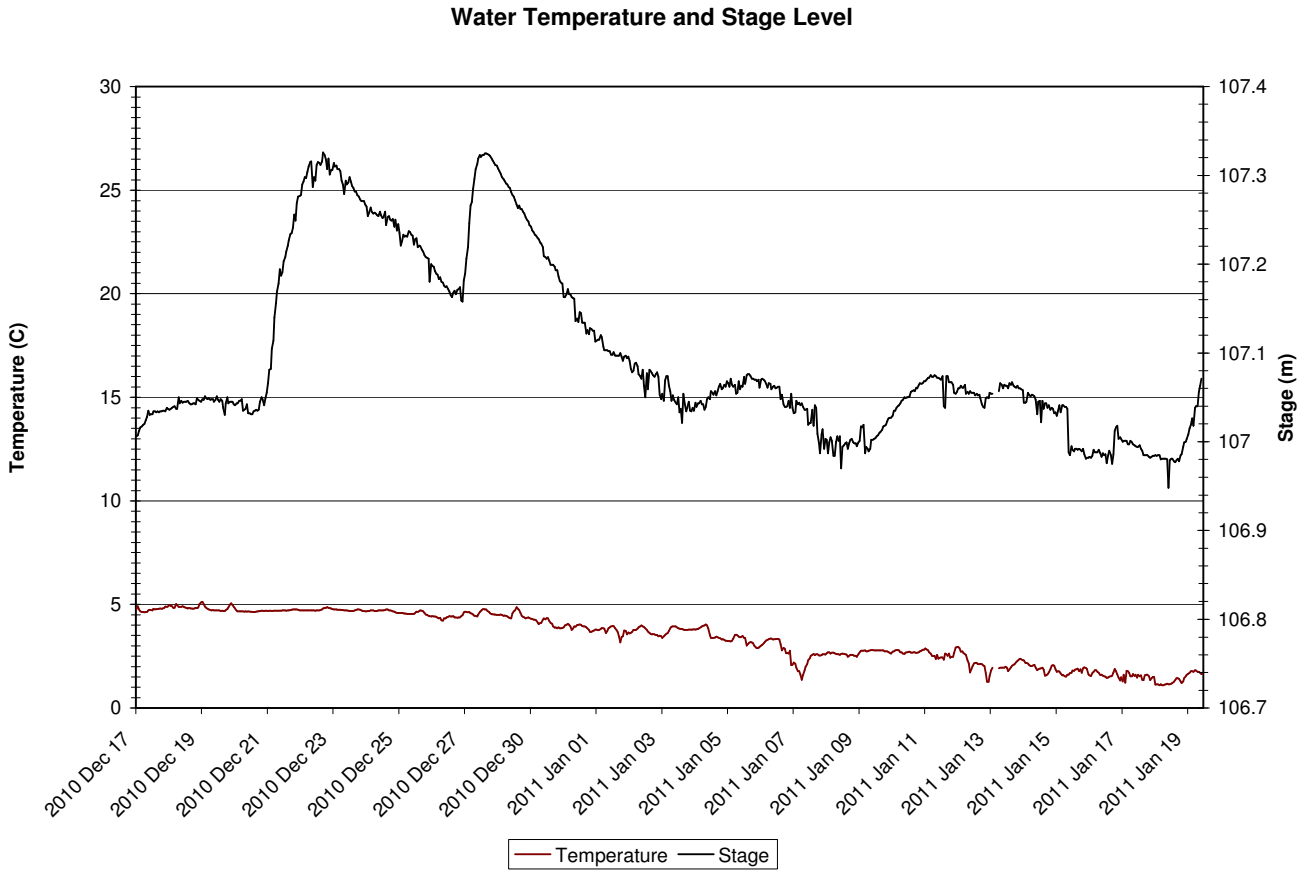
Data Interpretation

- The following discussion and figures refer to significant water quality events from December 17th, 2010 to January 20th, 2011.

Rattling Brook Big Pond

- Water temperature underwent a decline over this time period from a high of 5.13°C to a low of 1.09°C. A comparison between water temperature and air temperature shows a similar trend.

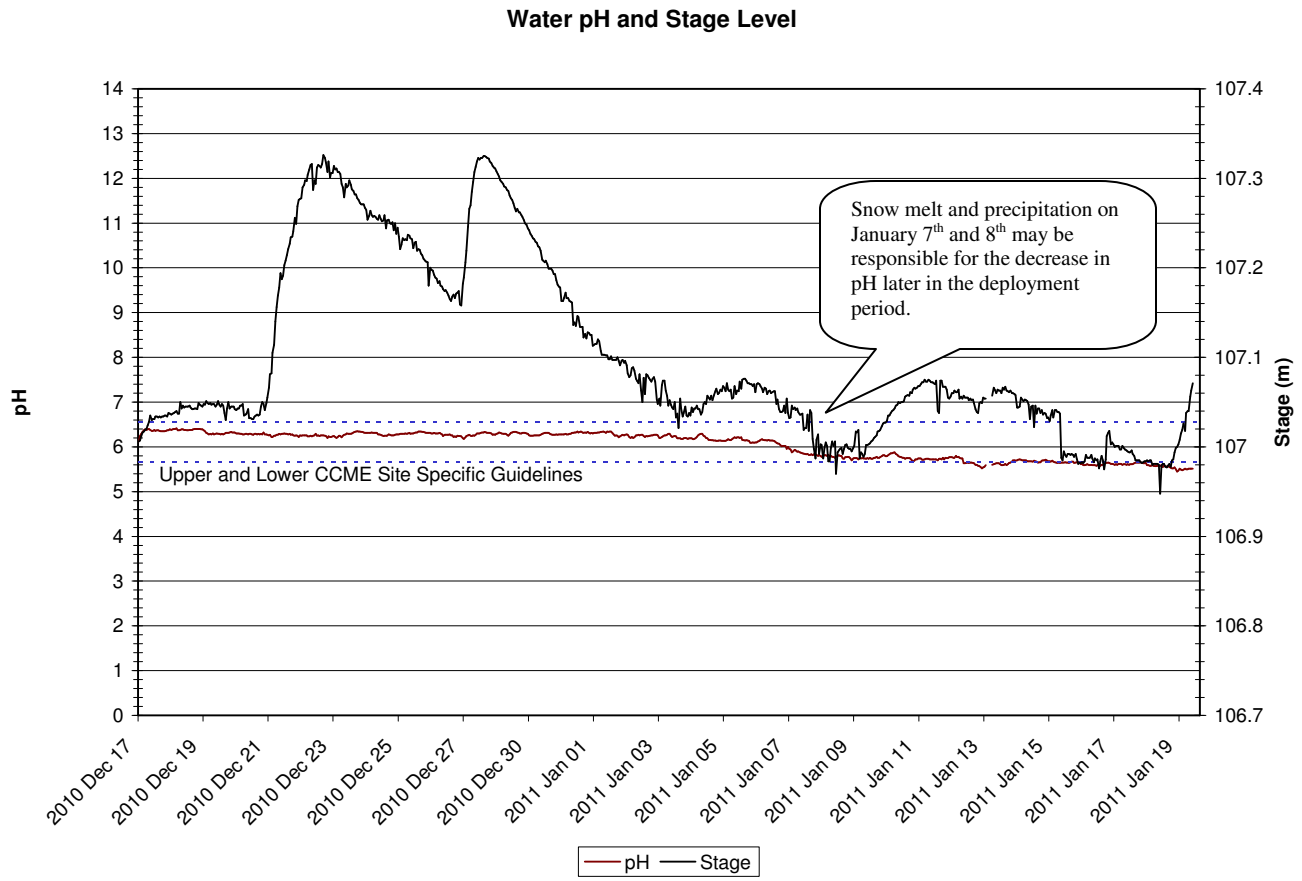
Figure 1: Water temperature at Rattling Brook Big Pond



- pH showed a slight downward change in pH over this deployment period. Values ranged from 6.41 to 5.45 units with a median of 6.22.
- Most values fell within the SSGs for pH. In some instances, values less than the minimum guideline of 5.67 were recorded towards the end of the deployment period. Snow melt and precipitation on January 7th and 8th may be responsible for the decrease in pH below SSGs.

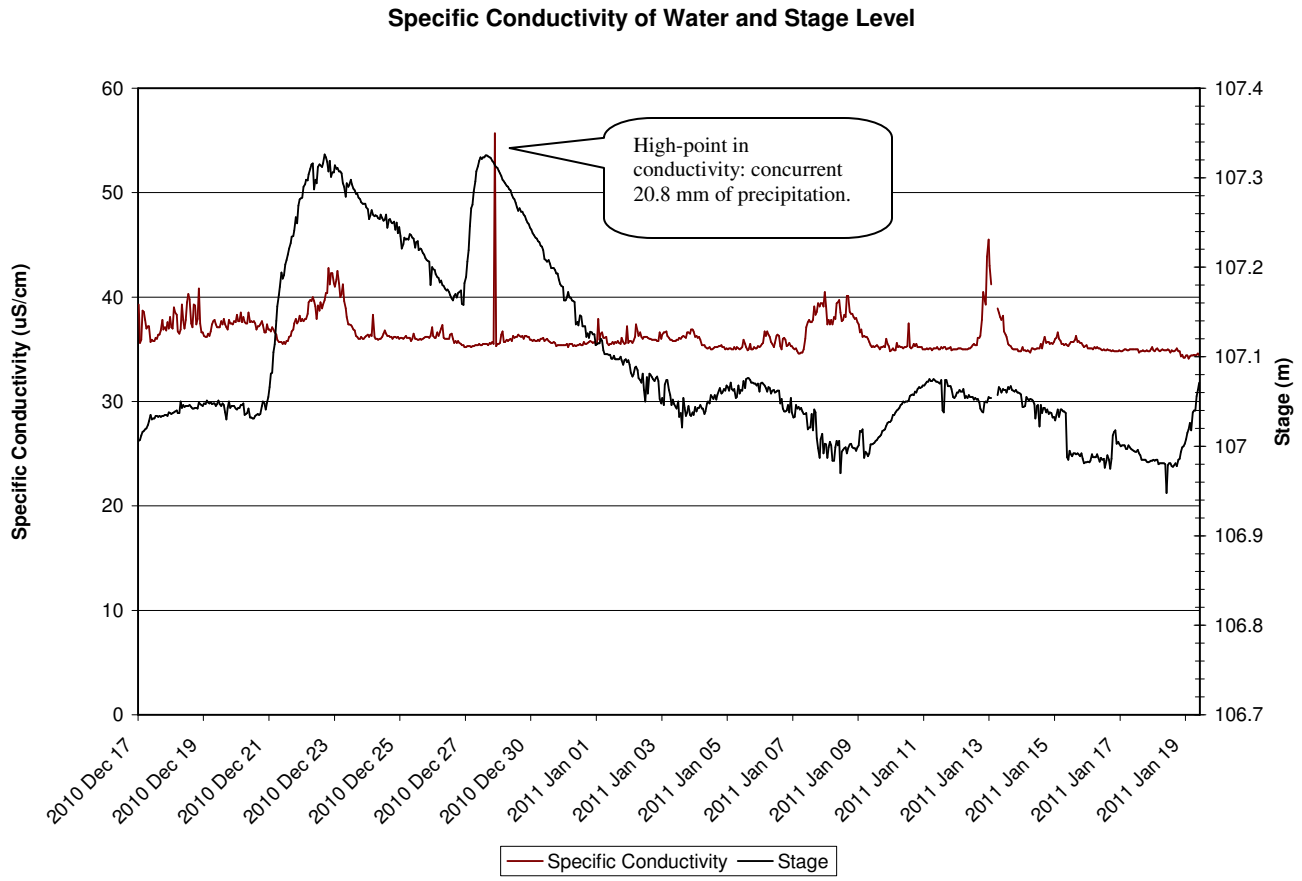
- Since the SSGs are constructed to contain 90% of previously encountered pH values, it is expected that there will be occasional examples of below- and above guideline recordings.

Figure 2: pH at Rattling Brook Big Pond



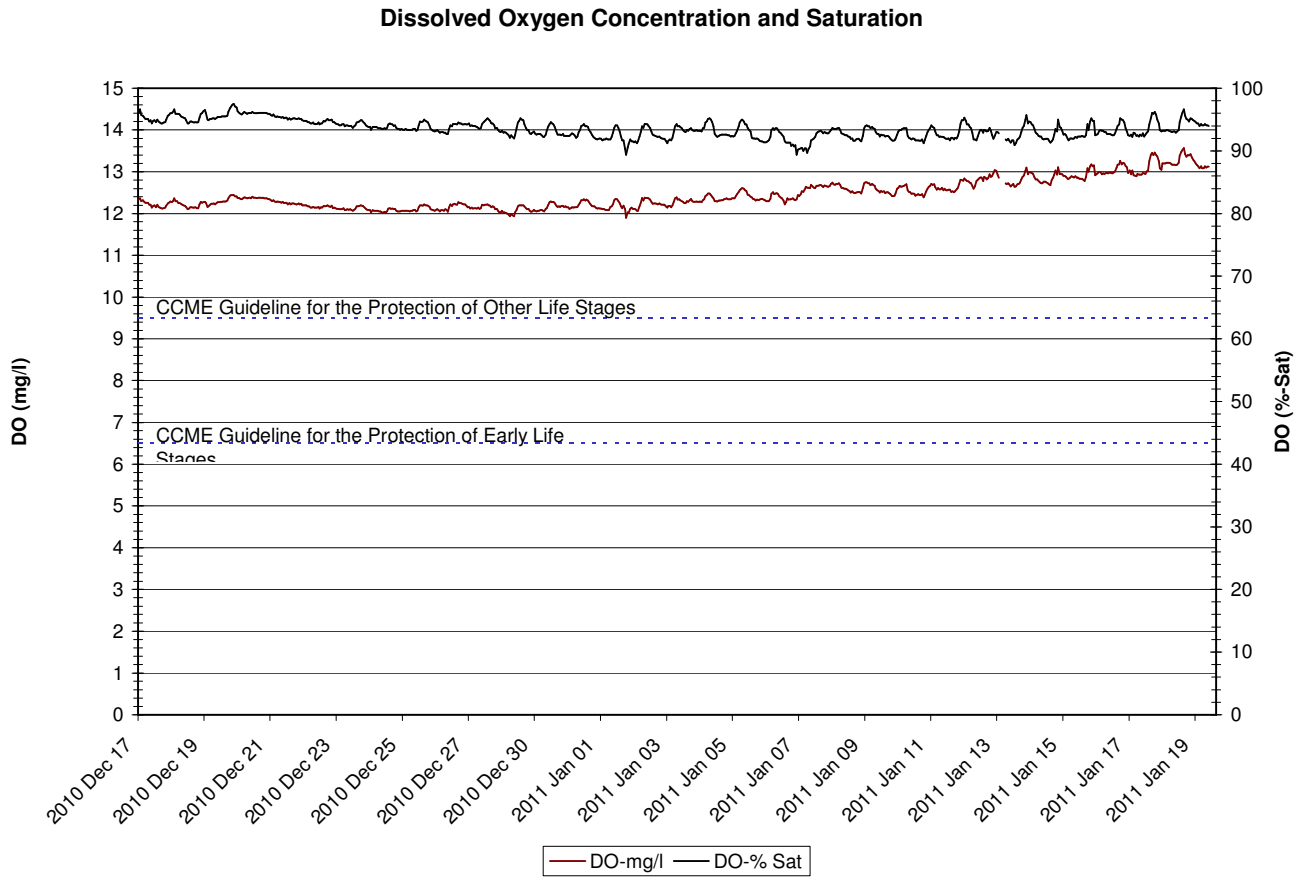
- Specific conductivity hovered around a relatively consistent mark between December 17th and January 20th. In some cases, rainfall events triggered peaks in conductivity. On December 28th, conductivity reached a high-point following 20.8 mm of precipitation. A clear association between stage and conductivity is indicated.
- Values fell between 34.1 and 55.7 µS/cm with a median of 35.8 µS/cm.

Figure 3: Specific Conductivity at Rattling Brook Big Pond



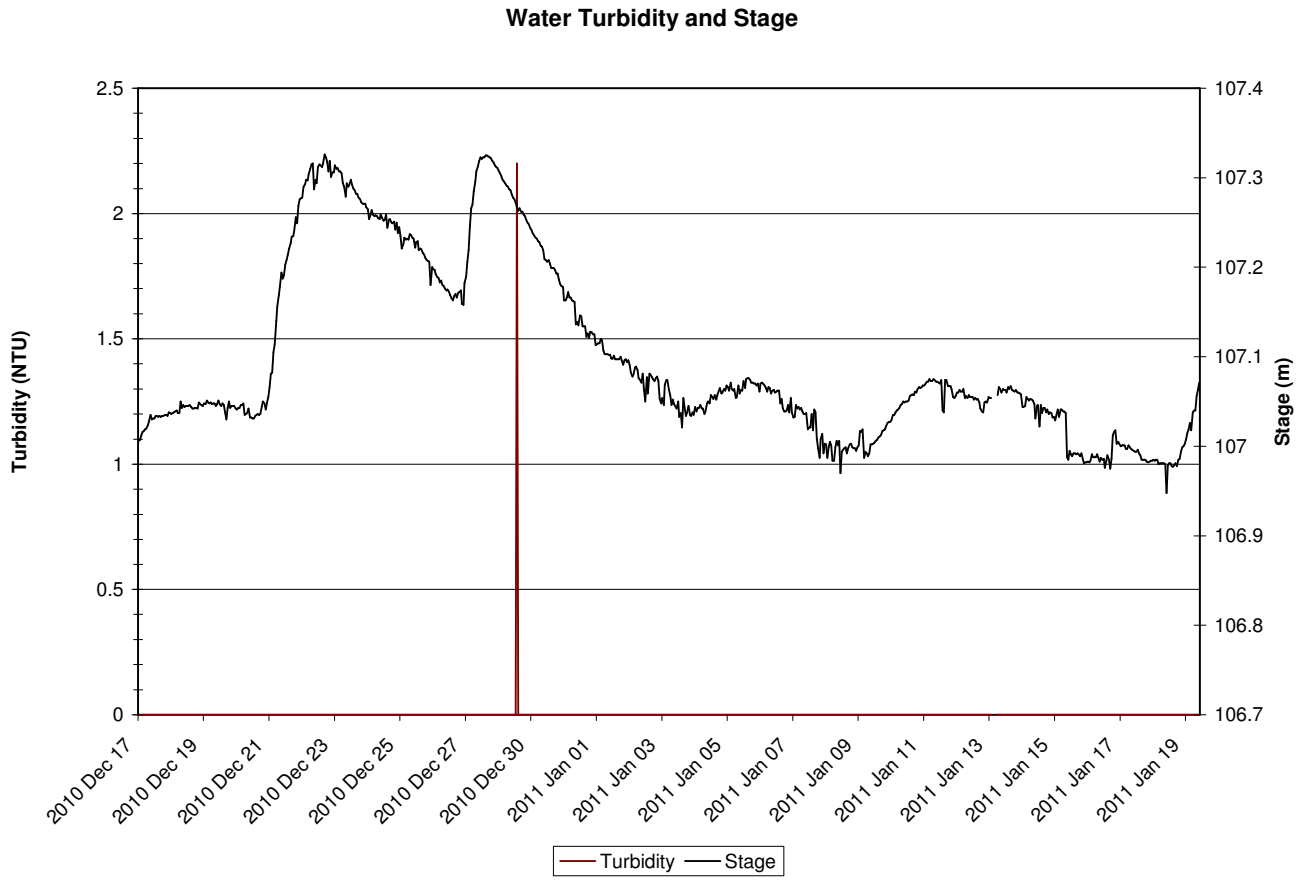
- Dissolved oxygen concentration and saturation were at nominal levels for this time of year.
- Saturation ranged between 89.4 and 97.5%, while the concentration fell between 11.90 and 13.57 mg/l. A minor increasing trend is indicated in the concentration of DO; as expected given the declining air temperatures.
- All DO levels met and exceeded CCME expectations for the Protection of Aquatic Life.

Figure 4: Dissolved Oxygen at Rattling Brook Big Pond



- All turbidity values during the time period were recorded as 0.0 NTU, except a single incidence of 2.2 NTU. Such an isolated blip is likely the result of random chance in terms of drifting debris in the water column.

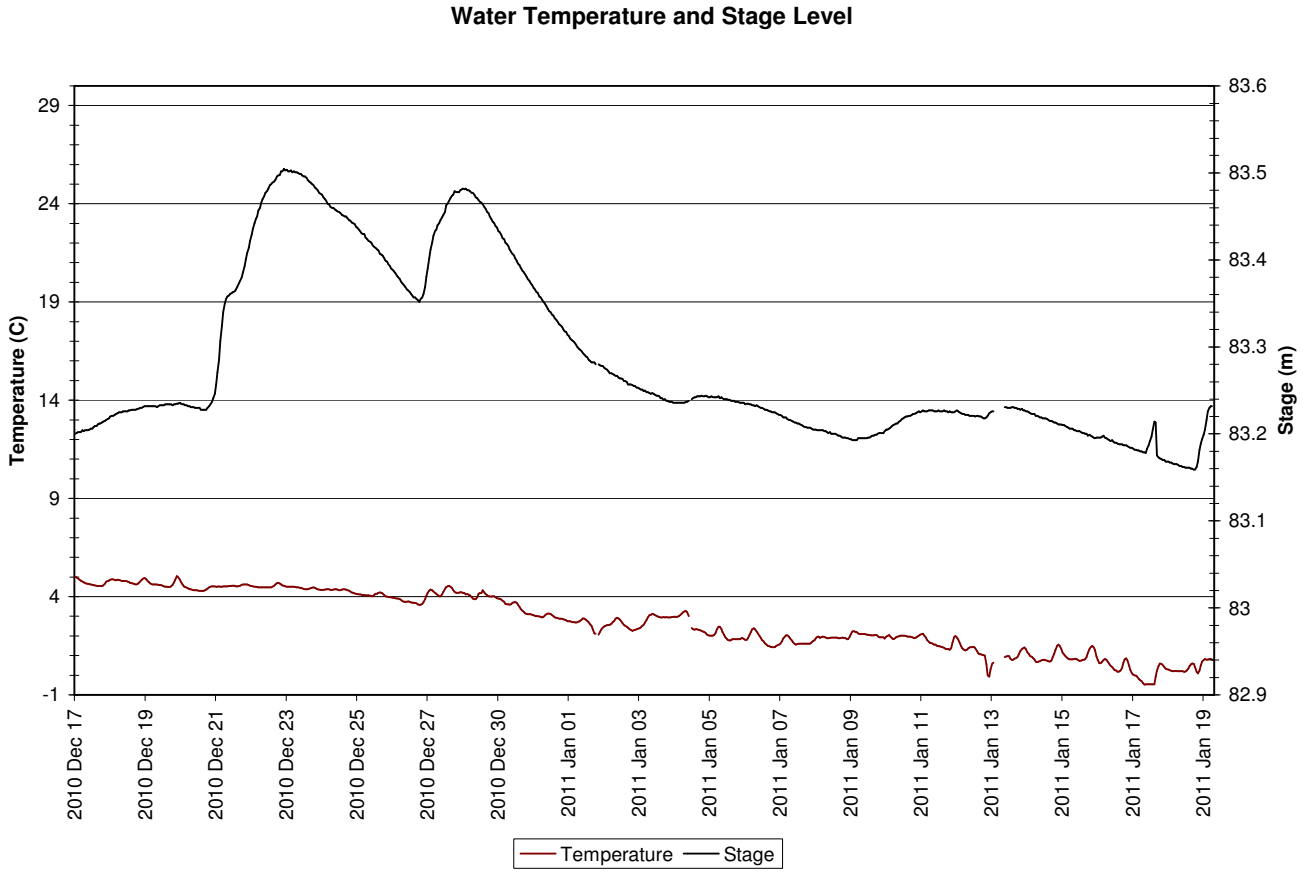
Figure 5: Turbidity at Rattling Brook Big Pond



Rattling Brook below Bridge

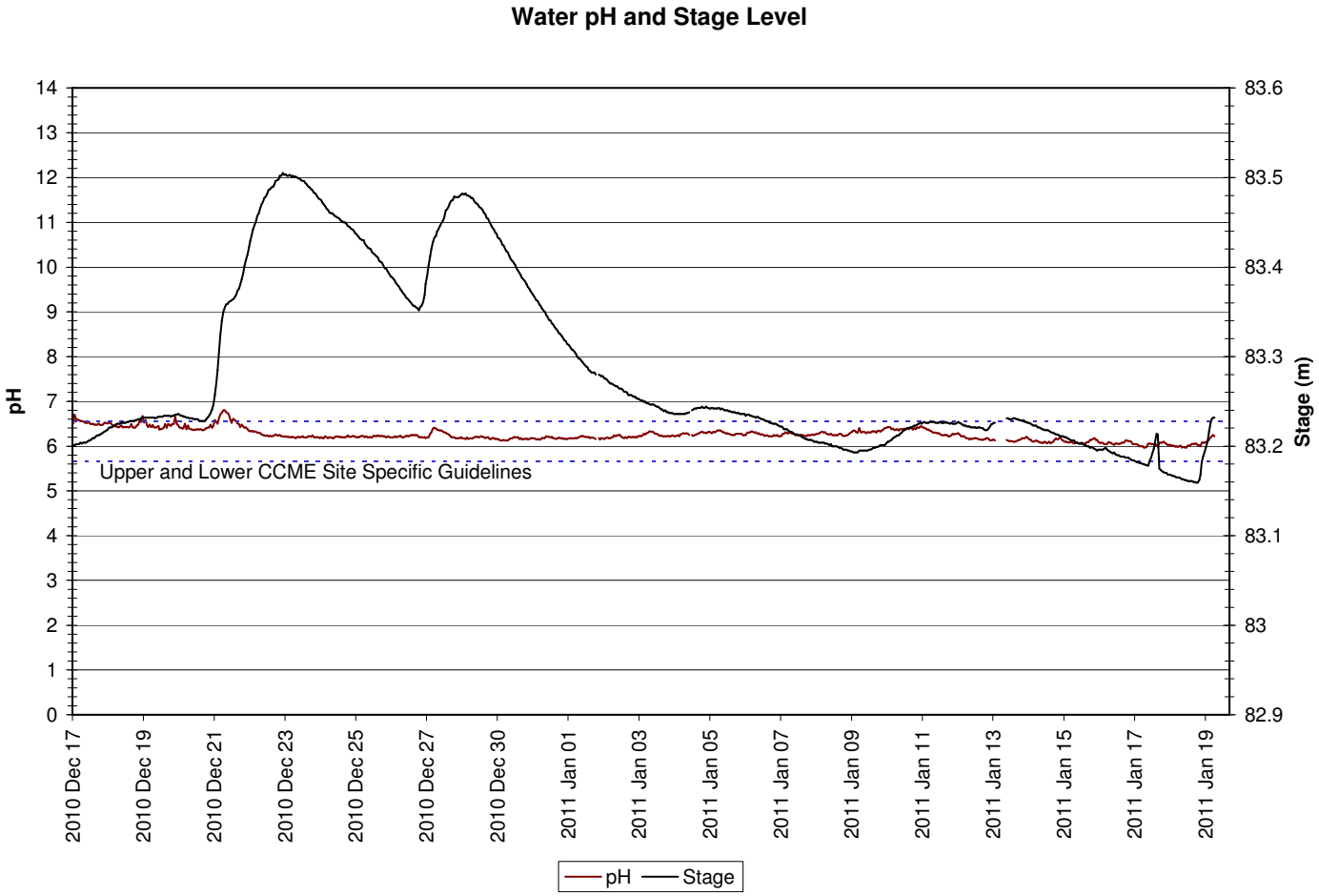
- Instances of vigorous water flow can allow water temperatures to fall below the freezing point of freshwater. In this case, water temperatures were recorded from 5.04 to as low as -0.48°C.

Figure 6: Water temperature at Rattling Brook below Bridge



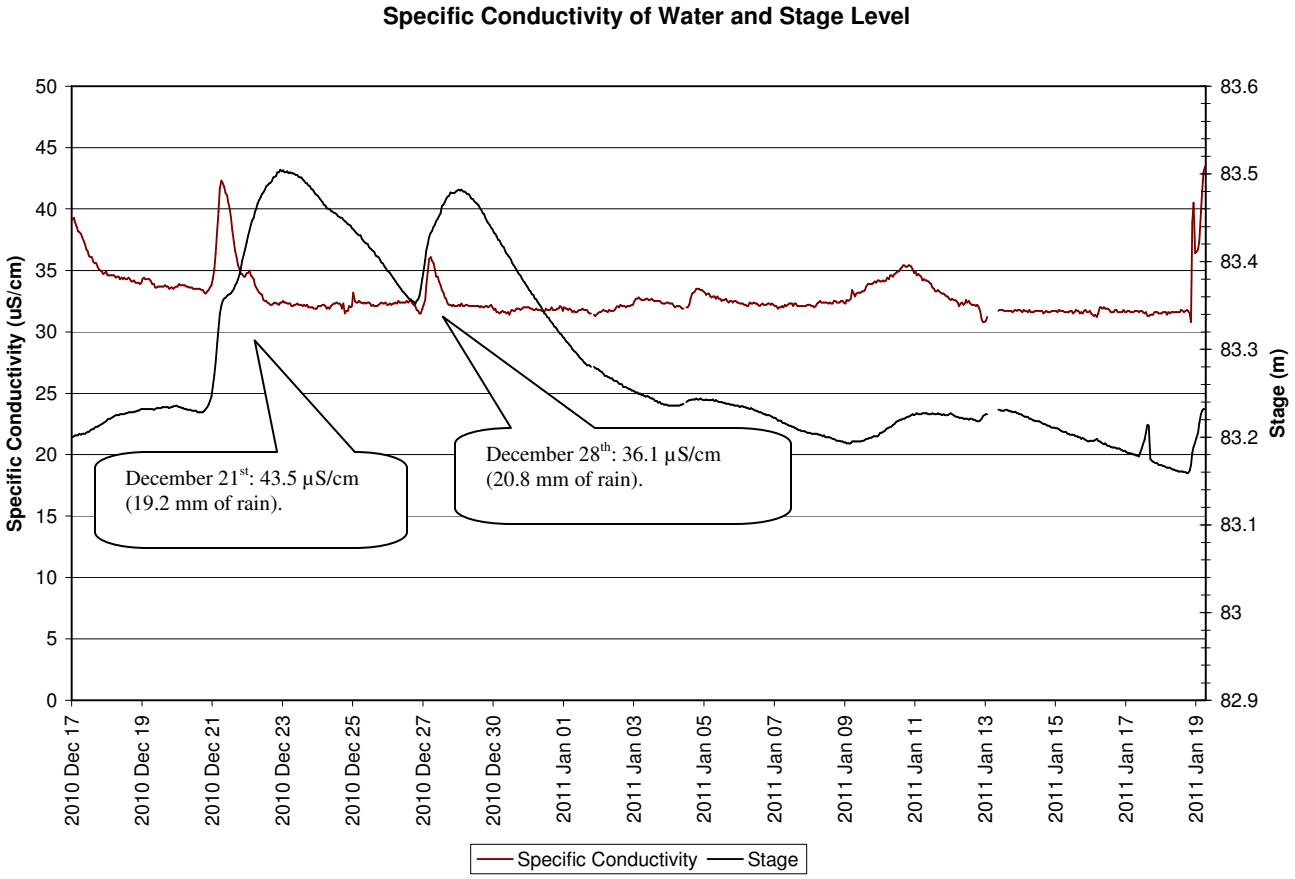
- pH values fell mostly within the SSGs for this month at Bridge station. The range fell between 5.97 and 6.80 pH units with a median value of 6.22.
- A few scattered incidences of pH values greater than the upper SSG limit occurred during the early part of the deployment. At least one spike above the upper limit was in relation to 19.2 mm of precipitation on December 21st.

Figure 7: pH at Rattling Brook below Bridge



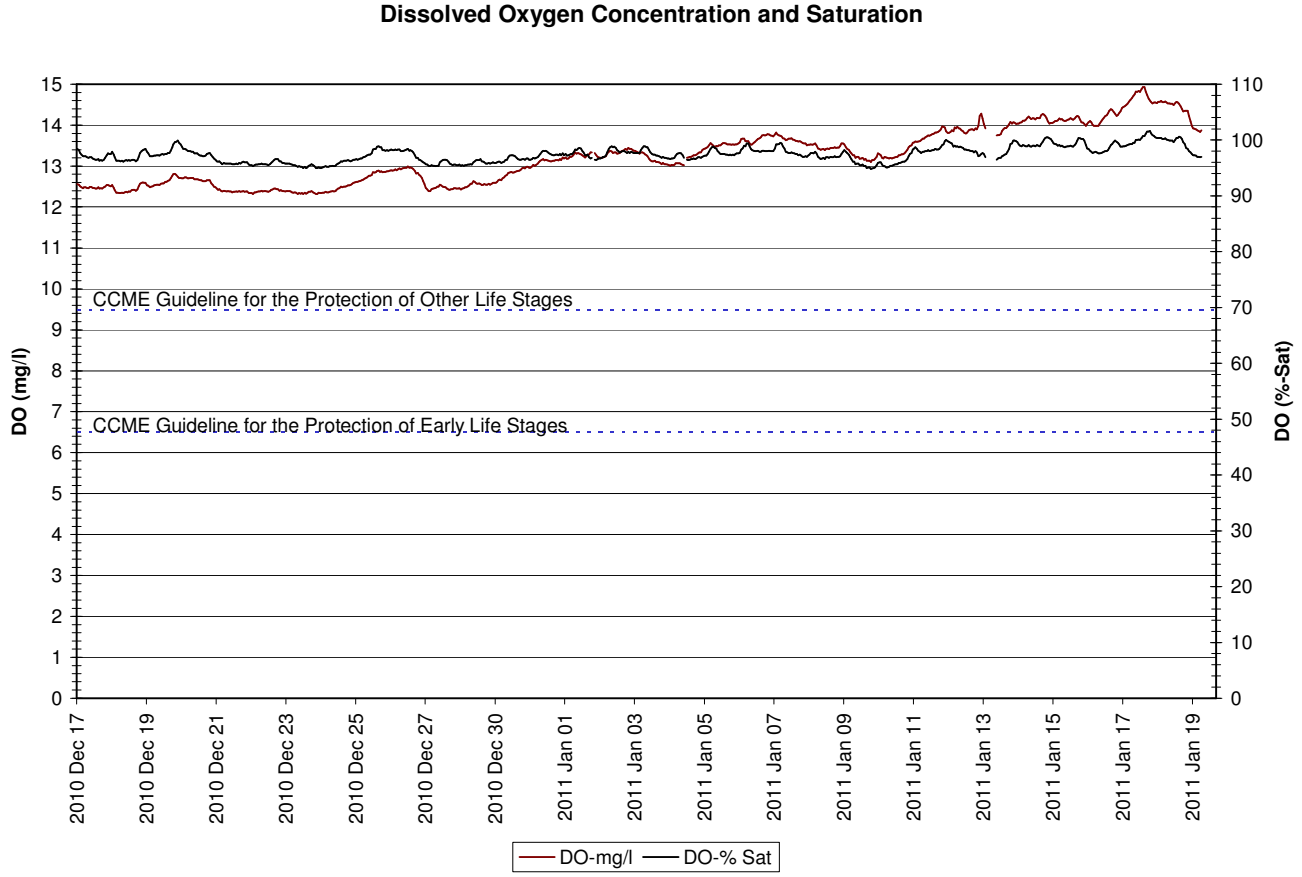
- A marginal downward trend in specific conductivity is observed at Bridge station. Despite the overall decline in conductivity from 43.5 to 30.8 µS/cm (median = 32.2 µS/cm) over the course of 33 days, a few notable instances of peaks were recorded as indicated below.

Figure 8: Specific Conductivity at Rattling Brook below Bridge



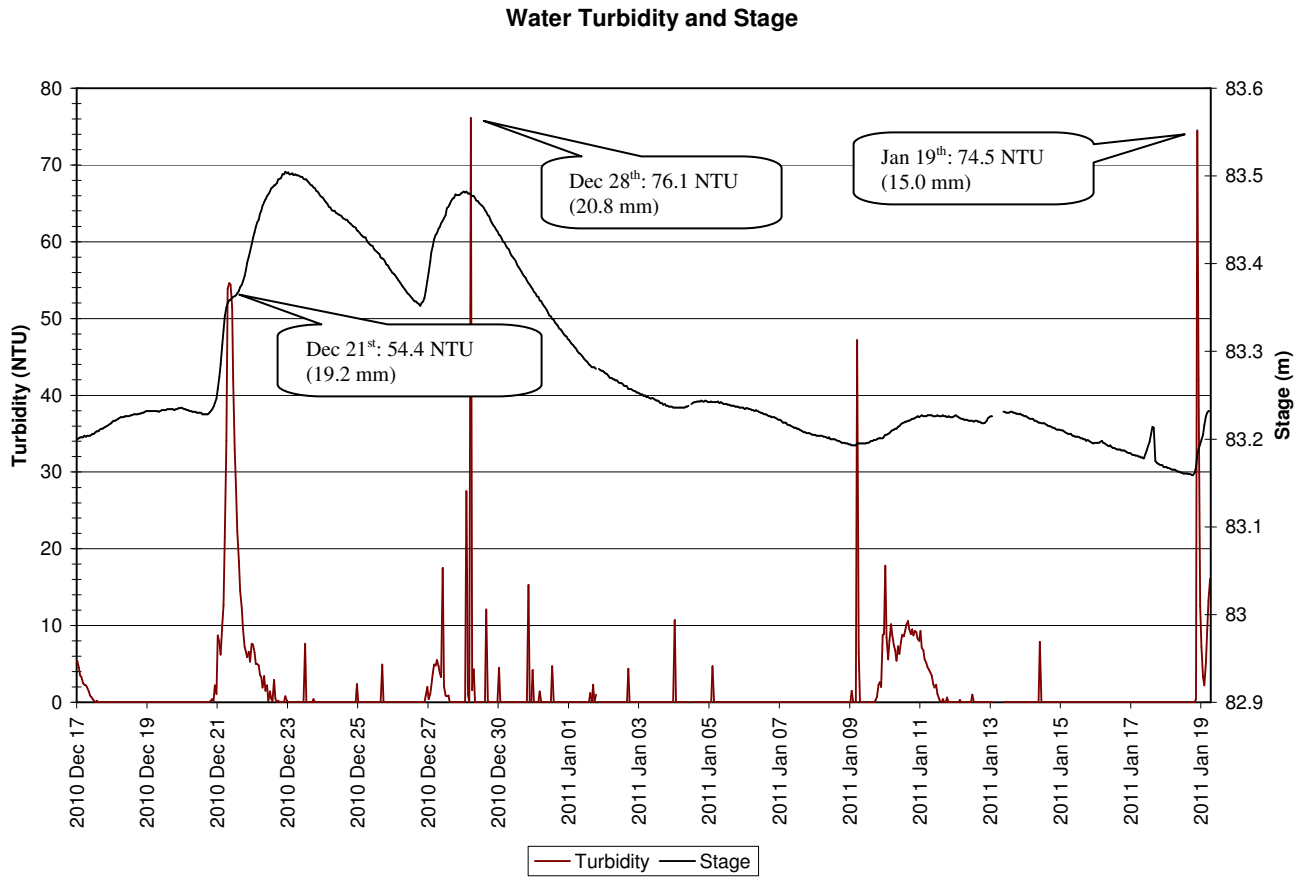
- Dissolved Oxygen saturation remained within expected levels for this month. It is expected that, at this time of year, saturation will remain above 90%. In this case, saturation ranged from a low of 94.6% to a high of 101.6%.
- Concentrations ranged from 12.32 to 14.93 mg/l over 33 days with a median level of 13.20 mg/l. The concentration of DO increased over the duration of the deployment, likely due to the general decrease in air temperature. All recordings were above the CCME Guideline of 6.5 and 9.5 mg/l for the protection of Early and Other Life Stage cold water biota.

Figure 9: Dissolved Oxygen at Rattling Brook below Bridge



- Turbidity was found to be somewhat variable at Bridge station, especially in comparison with Big Pond (where only a single instance of turbidity was recorded). Values ranged from 0.0 to 76.1 NTU. However, since the median value was calculated to be 0.0 NTU, turbidity was zero for at least 50% of the time.
- Three notable peaks in turbidity are seen to coincide with increases in stage level as indicated below.

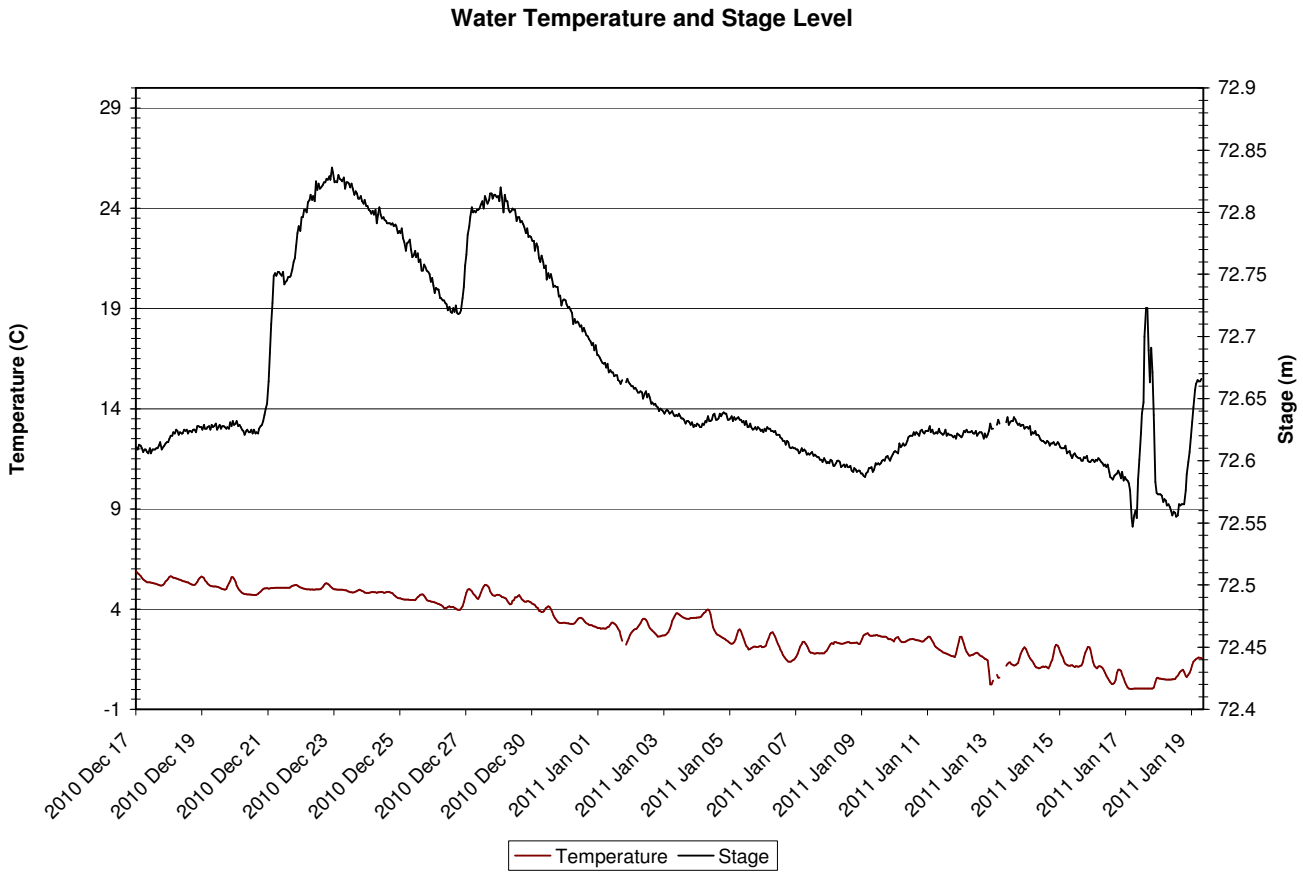
Figure 10: Turbidity at Rattling Brook below Bridge



Rattling Brook below Plant Discharge

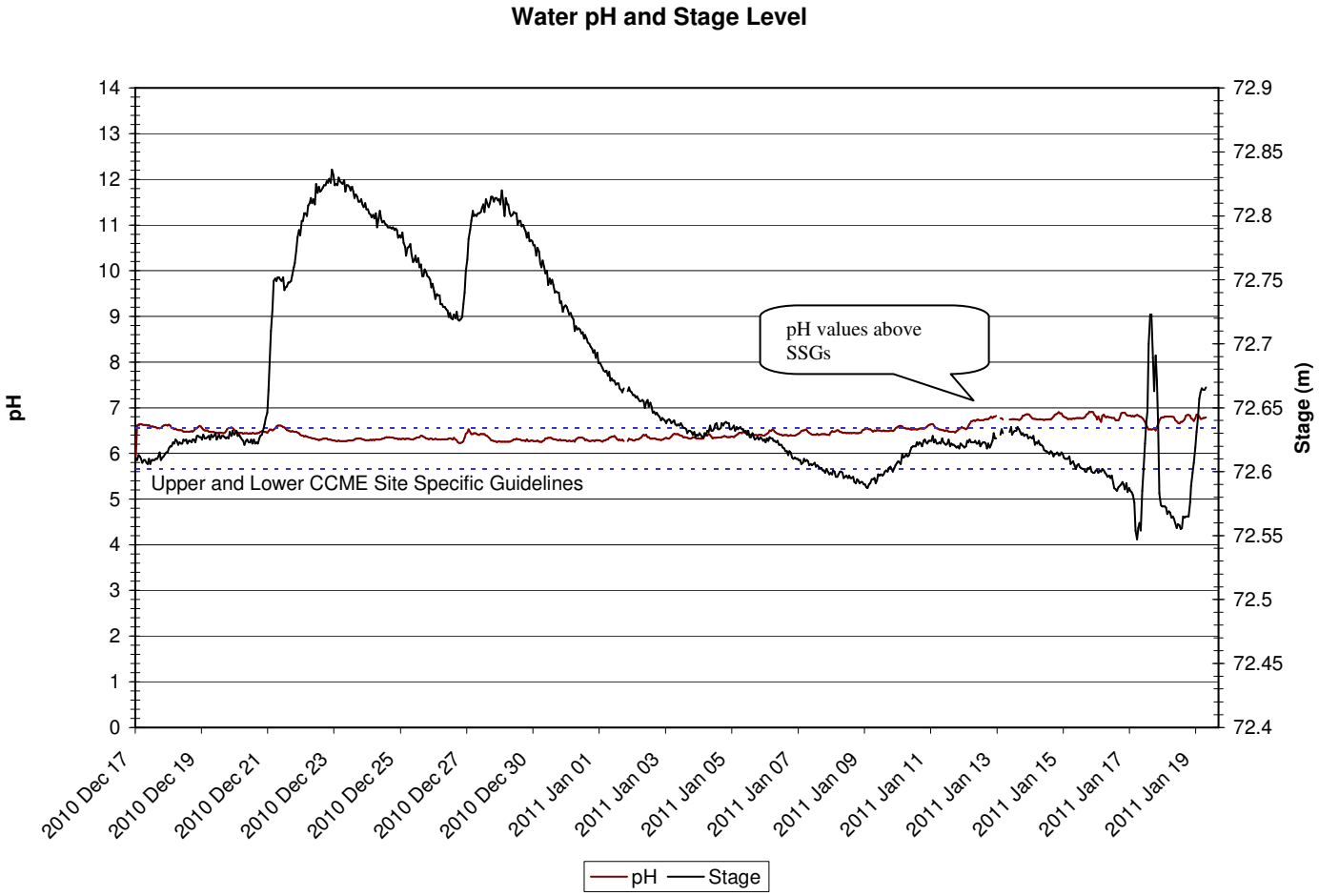
- Water temperature declined steadily during the 33 day deployment period at Plant Discharge station. At deployment, temperature was a high of 5.88°C but fell to as low as 0.02°C before removal.

Figure 11: Water temperature at Rattling Brook below Plant Discharge



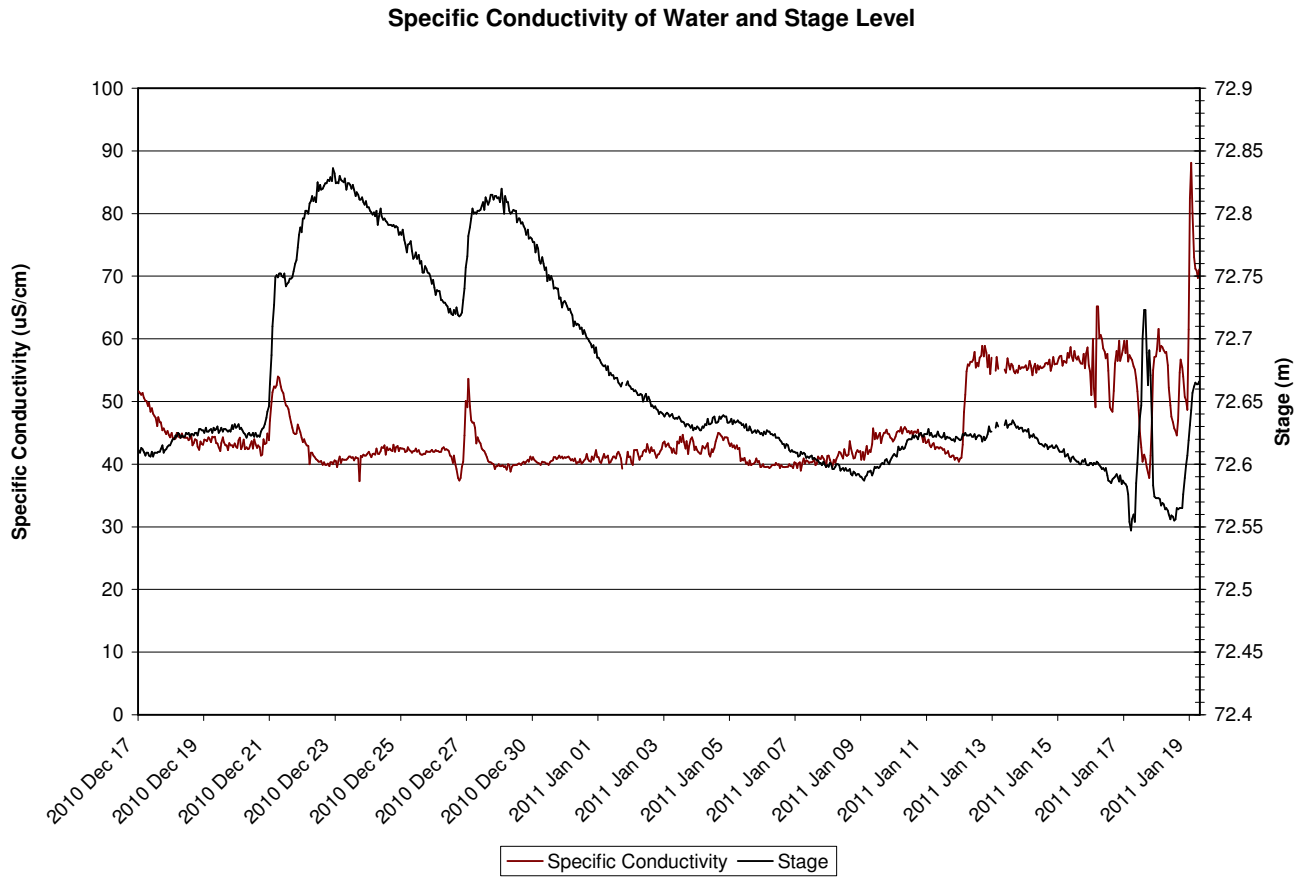
- pH appeared to increase slightly from December 17th to January 20th from 5.95 to 6.91 units. A median value of 6.45 units was calculated.
- Though pH appears to be above the SSGs for this station towards the end of deployment, the upward trend appears to have levelled off by this time.

Figure 12: pH at Rattling Brook below Plant Discharge



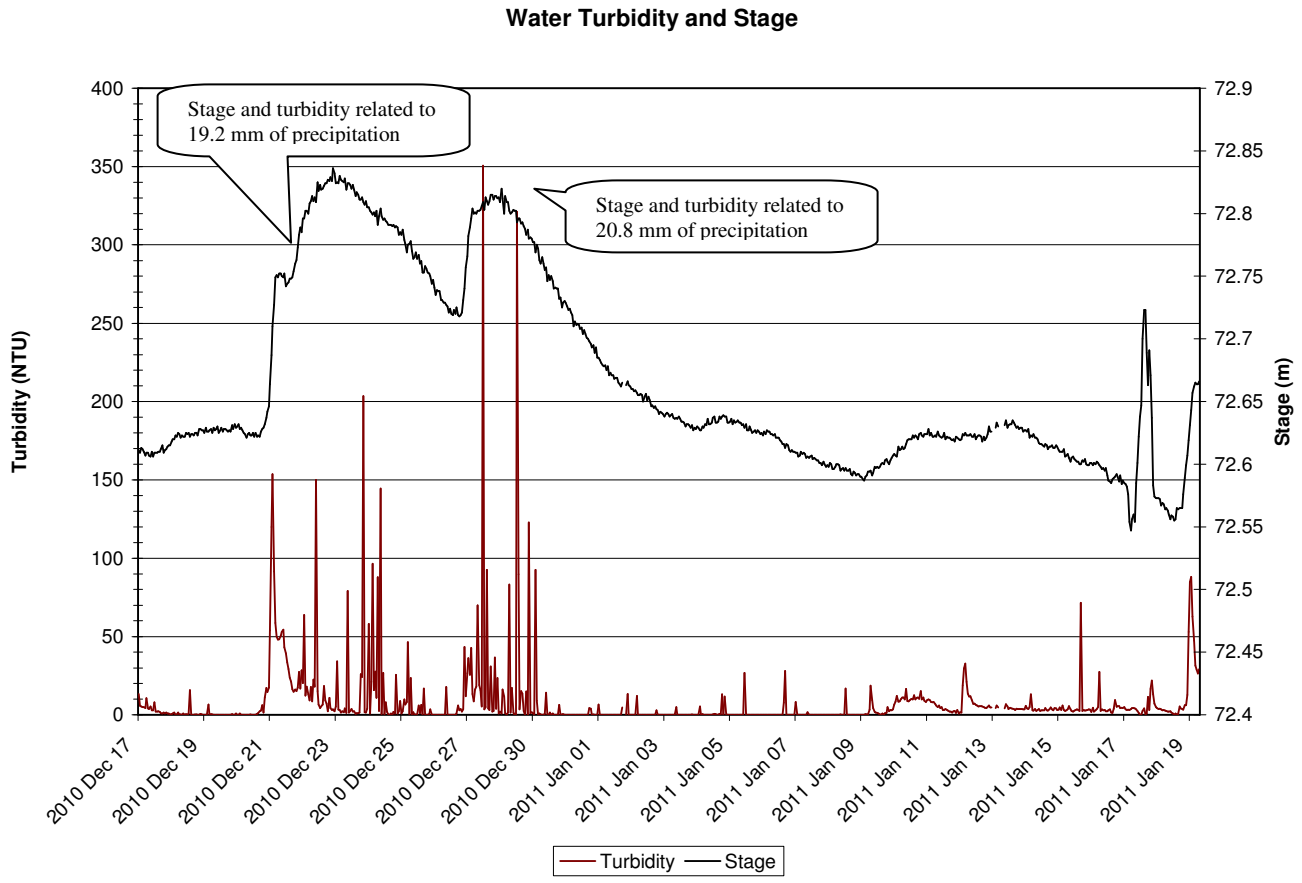
- A plateau in conductivity values towards the end of the deployment period ending with very large fluctuations in values suggests fouling of the sensor. Discounting the fouled period, values ranged from 37.3 to 54.0 µS/cm.

Figure 13: Specific Conductivity Rattling Brook below Plant Discharge



- Turbidity values at Plant Discharge station were higher than those upstream at Bridge station. Here, the range was found to be 0.0 to 350.6 NTU with a median level of 1.8 NTU. Upstream, the maximum turbidity level was found to be 76.1 NTU with a median value of 0.0 NTU.
- Turbidity values tended to follow stage level: the large peaks in stage were concurrent with the largest turbidity spikes.

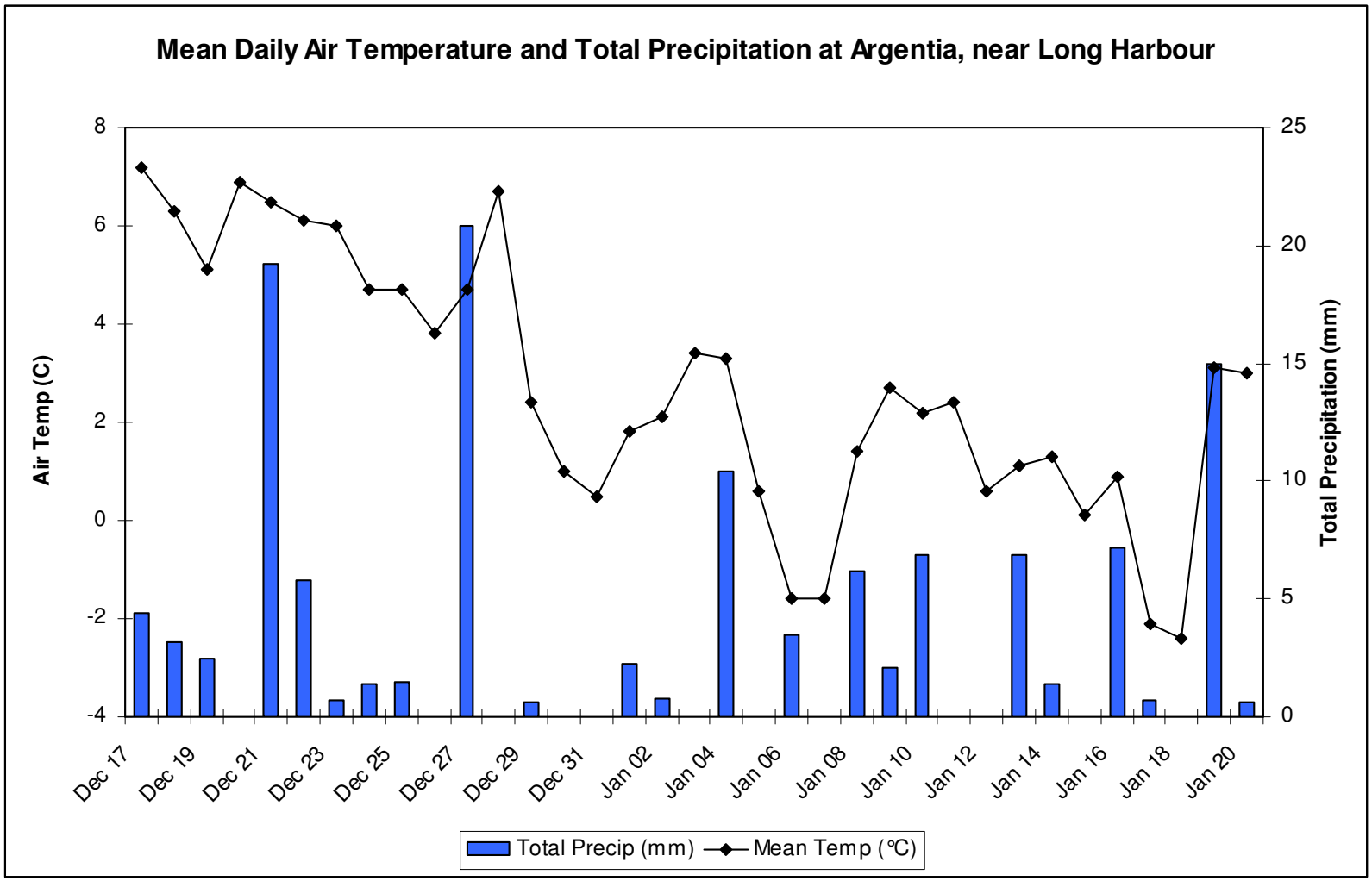
Figure 14: Turbidity Rattling Brook below Plant Discharge



Conclusions

- New SSGs for pH based on 95th and 5th percentiles of pH values produce a better fit than original CCME Guidelines. Values tend to fall within the guidelines as expected, rather than consistently failing.
- A fault with the dissolved oxygen probe at Plant Discharge Station prevented an examination of this variable during the deployment period. By extrapolation from Big Pond and Bridge stations, however, it is a reasonable assertion that DO levels downstream should be within expected range as well. A replacement instrument will be launched during the next deployment.

Appendix



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