Real-Time Water Quality Deployment Report

Rattling Brook Network

June 11th, 2010 to July 15th, 2010

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.
- Vale Inco will be apprised of any significant water quality events, including automated turbidity alerts.
- This report interprets water quality data from June 11th, 2010 to July 15th, 2010, a period of 35 days.
- The CCME Guidelines for the Protection of Aquatic Life are published and approved nationally by provincial and federal Ministers of Environment. The guidelines are based on toxicity studies using a variety of organisms representative of Canadian biota from coast to coast. In practice, it has been found that CCME Guidelines are often transgressed by water bodies in Newfoundland and Labrador even in their ambient state. Usually, this is due to lack of buffering capacity and exposed bedrock. To combat unnecessary violations for CCME Guidelines, a process to compute Site-Specific Guidelines is under way.

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 along side the Field Sonde. Values for temperature and dissolved oxygen are compared between the two instruments. A grab sample is taken to compare with the Field Sonde for specific conductivity, pH and turbidity parameters. Based on the degree of difference between parameters recorded by the Field Sonde, QAQC Sonde and grab sample a qualitative statement is made on the data quality in Table 1 upon Deployment.
  - At the end of a deployment period, readings are taken in the water body from the Field Sonde before and after a thorough cleaning in order to assess the degree of biofouling. During calibration in the laboratory, an assessment of calibration drift is made and the two error values are combined to give Total Error (T_e). If T_e exceeds a predetermined data correction criterion, a correction based on T_e is applied to the dataset using linear interpolation. Based on the value for T_e, a qualitative statement is also made on the data quality in Table 1 upon Removal.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook below Plant Discharge	June 11, 2010	Deployment	Good	Excellent	Good	Excellent	Excellent
	July 15, 2010	Removal	Excellent	Excellent	Excellent	Excellent	NA
Rattling Brook below Bridge	June 11, 2010	Deployment	Good	Excellent	Excellent	Excellent	Excellent
	July 15, 2010	Removal	Excellent	Excellent	Good	Excellent	NA

Rattling Brook Big Pond	June 11, 2010	Deployment	Excellent	Good	Good	Excellent	Excellent
	July 15, 2010	Removal	Excellent	Excellent	Excellent	Excellent	NA

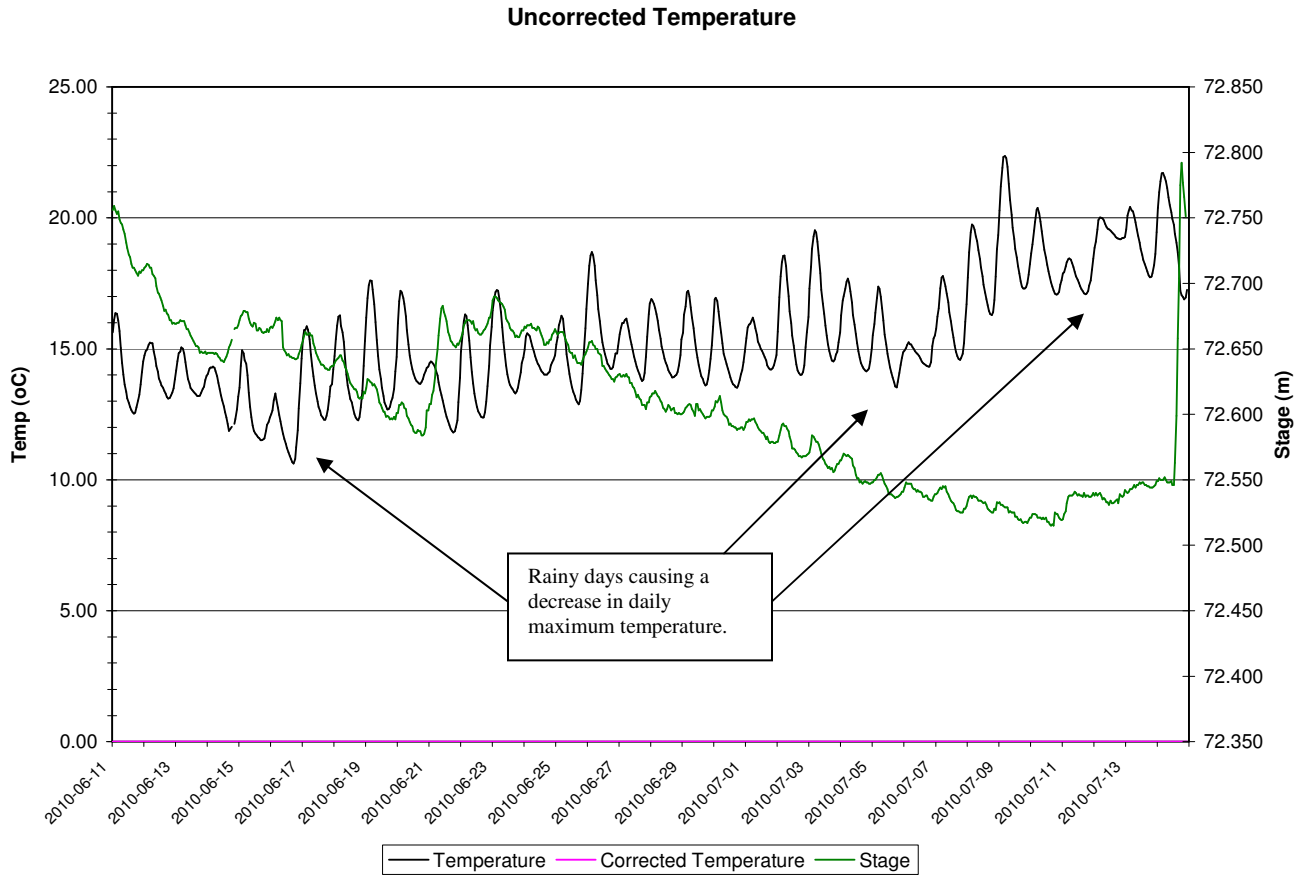
- QAQC rankings were "Excellent" and "Good" for all parameters at the beginning and end of deployment for all three stations. Note: Turbidity rankings were not available upon removal due to the absence of a turbidity probe on the QAQC sonde used.

Data Interpretation

Rattling Brook below Plant Discharge

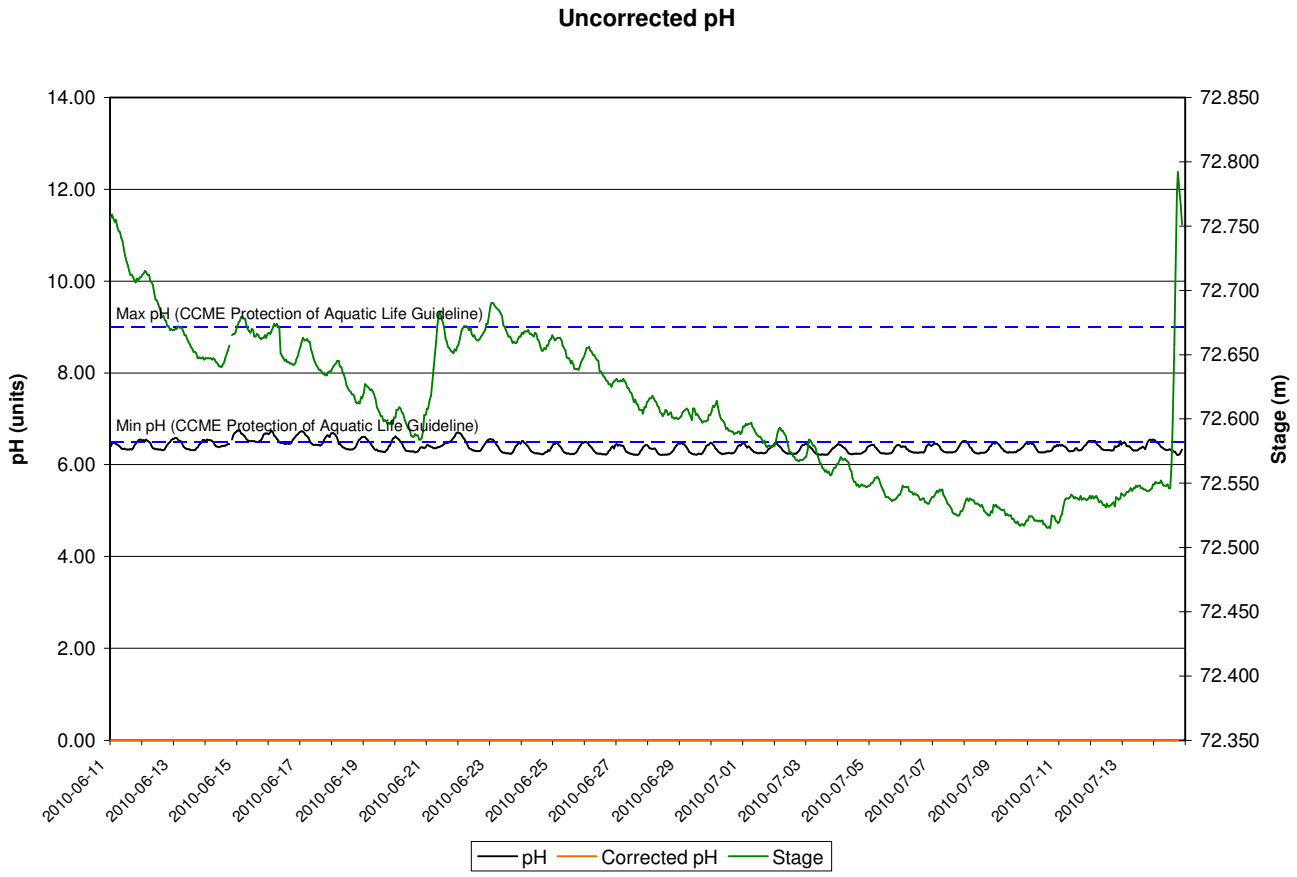
- The following figures and discussion interprets water quality data from Rattling Brook below Plant Discharge station.

Figure 1: Water Temperature at Rattling Brook below Plant Discharge from June 11th to July 15th



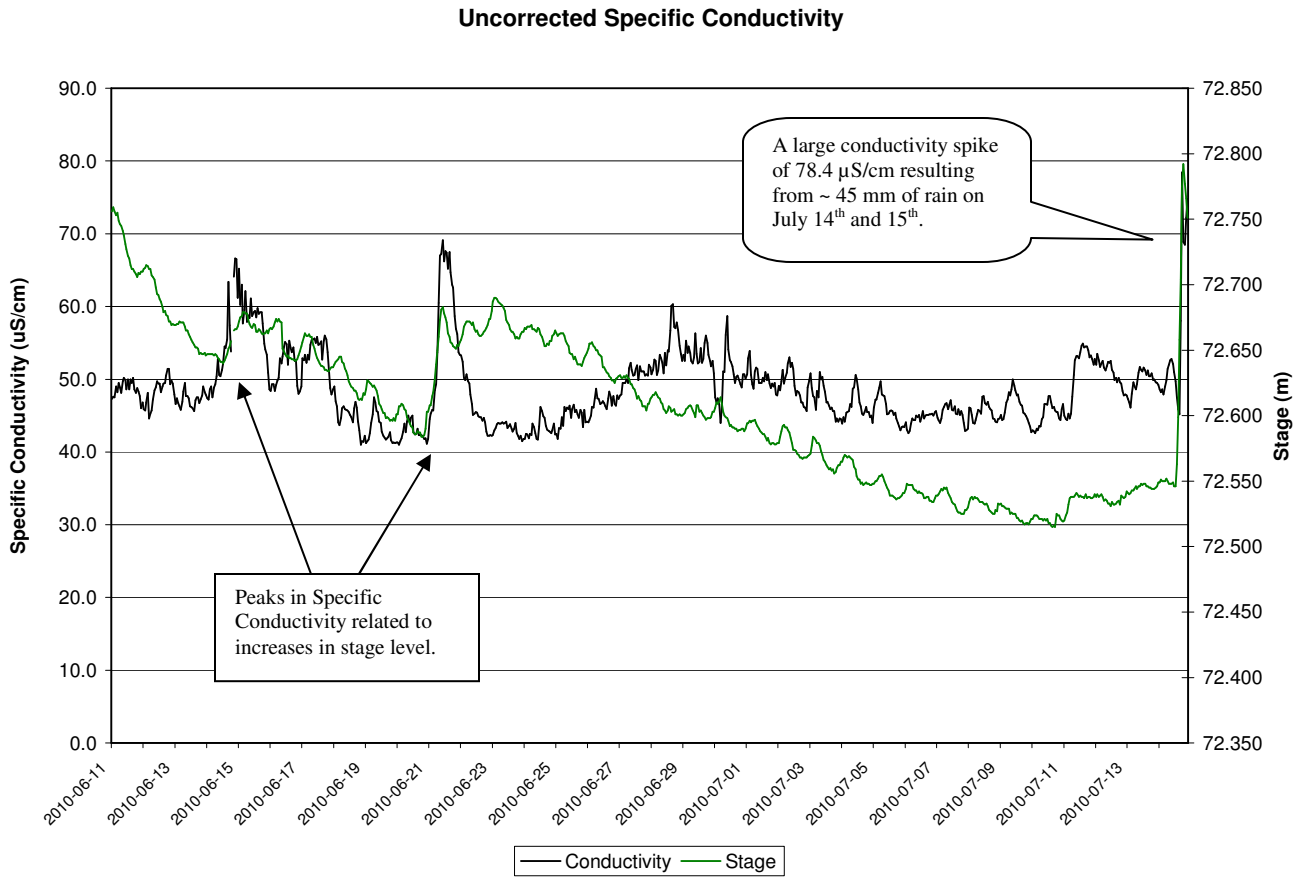
- No correction was applied to temperature for this deployment period and the data presented is raw.
- Water temperature at Plant Discharge station ranged from a low of 10.62°C to 22.36°C for this deployment period. A notable upward trend is obvious in this figure punctuated with periods of depressed diurnal cycles related to cloudy rainy days, notably June 14th – 15th, July 4th -- 5th, and July 10th – 11th.

Figure 2: pH at Rattling Brook below Plant Discharge from June 11th to July 15th



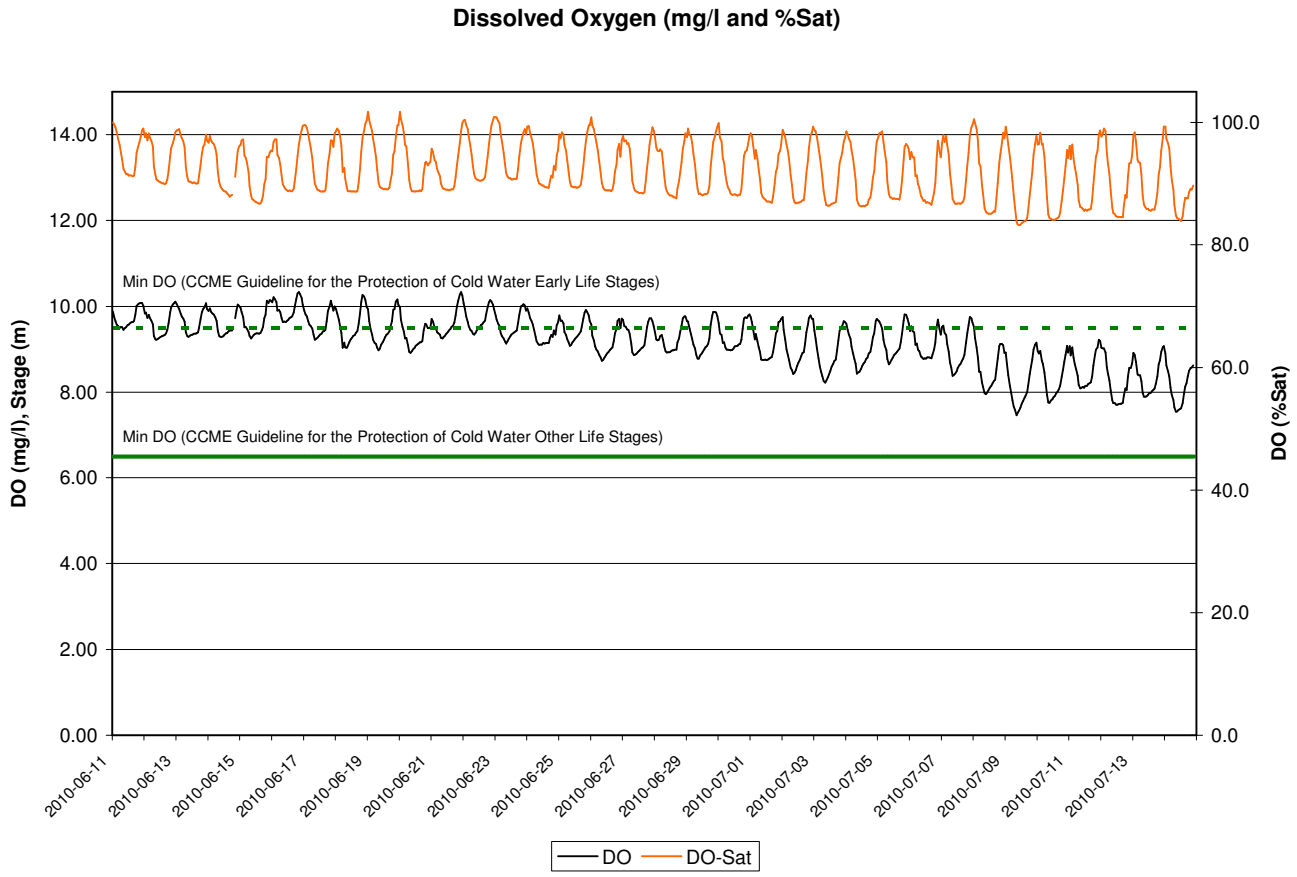
- During the assessment for biofouling and calibration drift, it was found that the error was less than the data correction criterion for pH. Therefore, no correction was applied and raw data is presented.
- pH ranged from 6.21 to 6.75 during this deployment period with a median pH of 6.37. Therefore, more often than not, the pH was found to be below the CCME Guideline of 6.5 for the Protection of Aquatic Life. This is considered to be the norm for this station, however.
- No significant events related to pH were identified during this deployment period.

Figure 3: Specific Conductivity at Rattling Brook below Plant Discharge from June 11th to July 15th



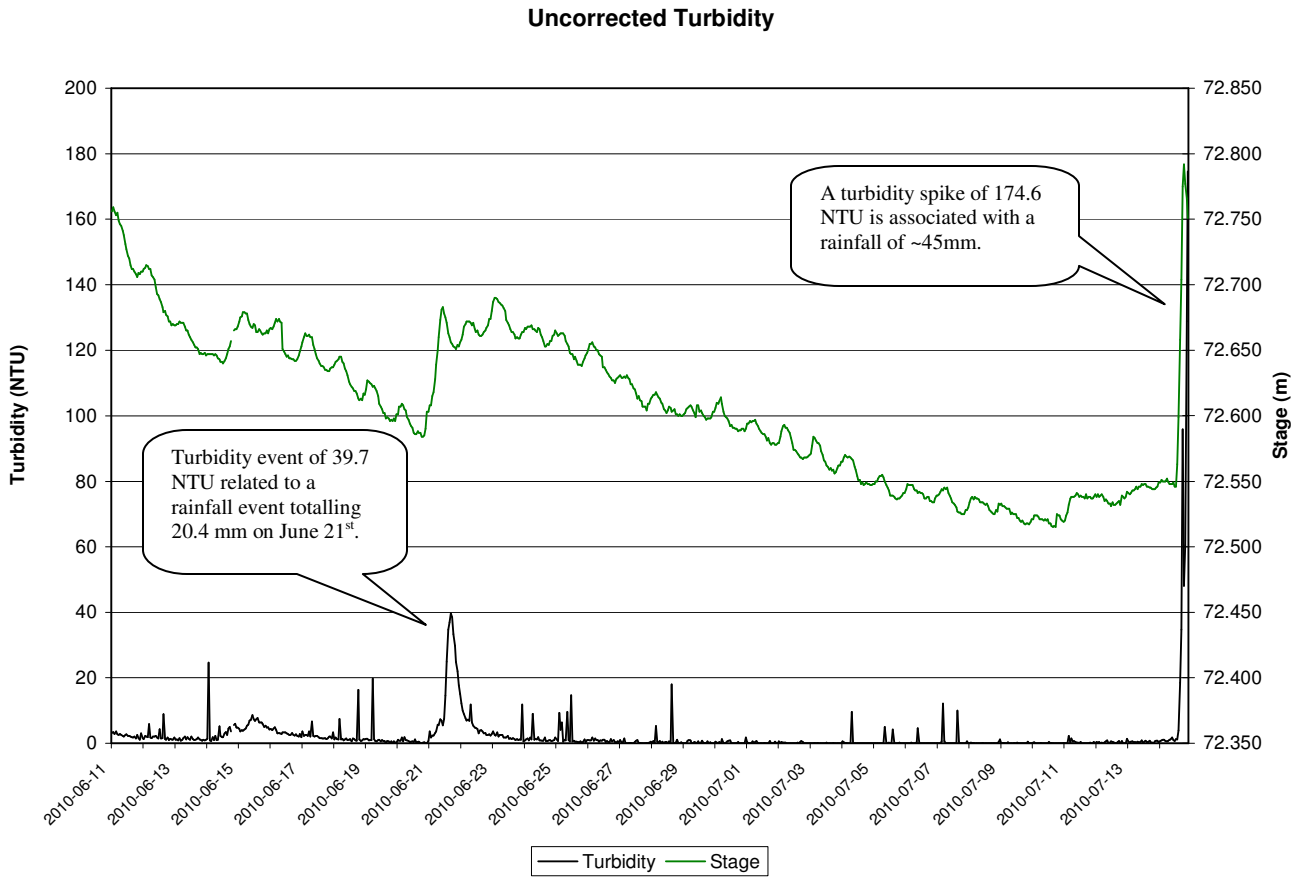
- Specific conductivity was rated as "Excellent" at the end of the deployment record. Therefore, no correction was applied and the data presented is raw.
- Corrected specific conductivity ranged from 41.0 to 78.4 µS/cm with a median of 47.7 over the course of the deployment. A few instances of conductivity spikes related to peaks in stage level.

Figure 4: Dissolved Oxygen at Rattling Brook below Plant Discharge from June 11th to July 15th



- During this deployment period, the percentage saturation of dissolved oxygen ranged from 83.2 to 101.7% during mid-day when oxygen production is at its maximum due to photosynthetic processes. During the same time period, the concentration of dissolved oxygen ranged from 10.33 to 7.46 mg/l.
- According to the CCME Guidelines for the Protection of Aquatic Life, dissolved oxygen should not drop below 9.5 mg/l for the protection of early life stage, cold water biota. To date, there have been no indications of adverse effects on aquatic organisms. This trend will be monitored closely by WRMD staff.

Figure 5: Turbidity at Rattling Brook below Plant Discharge from June 11th to July 15th

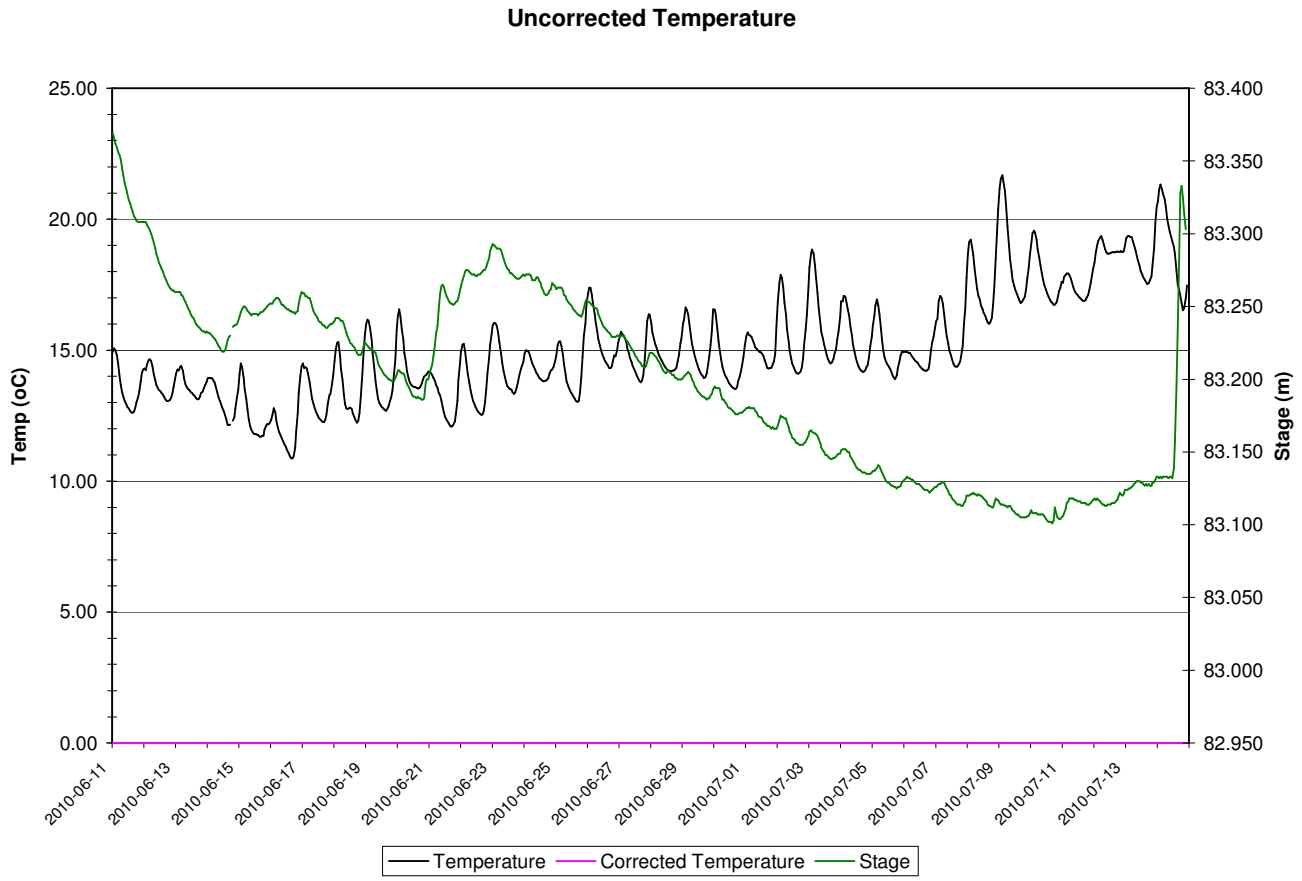


- During the removal process of the water quality instrument on July 15th, the QAQC sonde used did not possess a turbidity probe. For this reason, the proper correction process could not be undertaken and the data presented is raw.
- Turbidity was recorded as low as 0.0 NTU and as high as 174.6 with a median of 0.6 NTU. Such a low median indicates that 50% of the recordings for this month were 0.6 NTU or lower.

Rattling Brook below Bridge

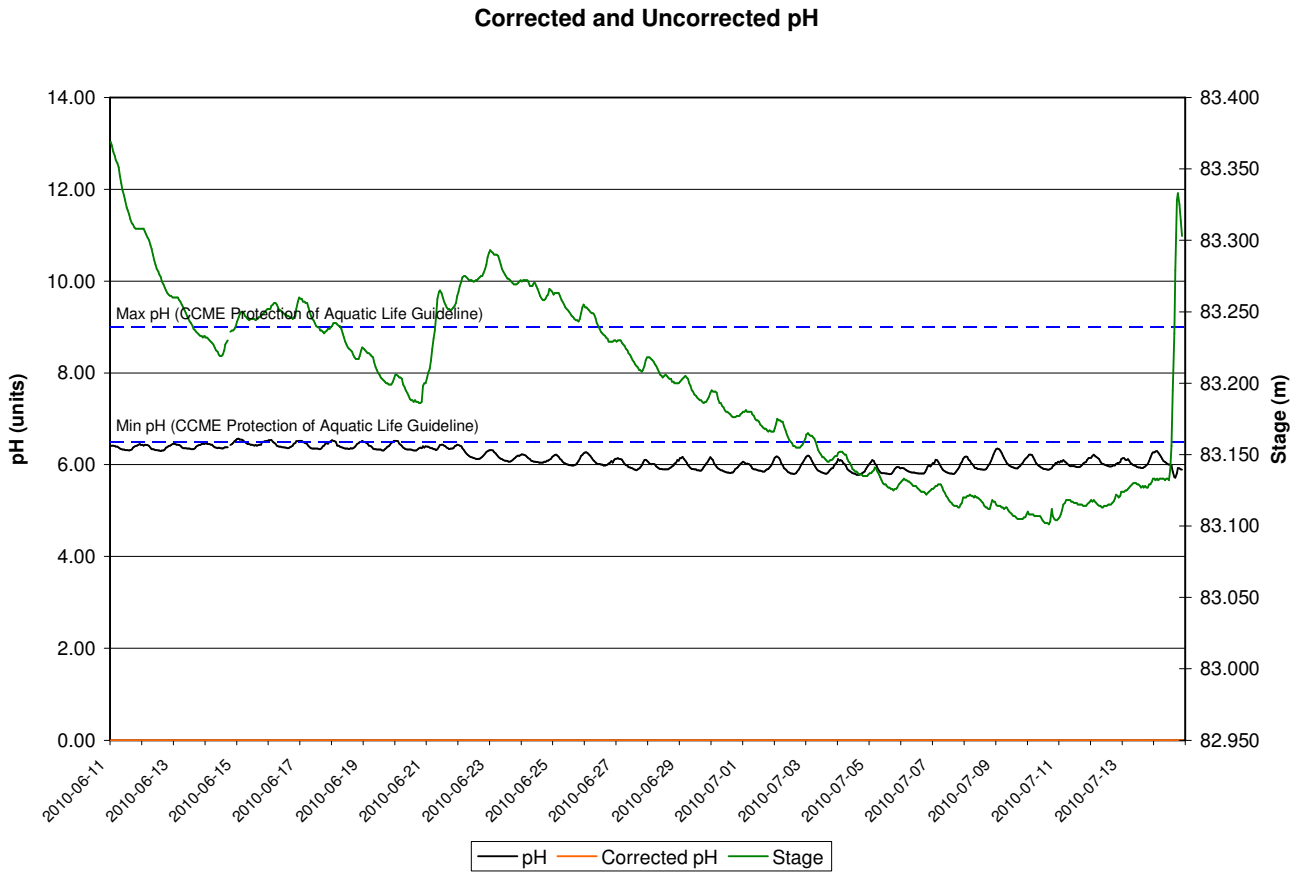
- The following figures and discussion interprets water quality data at Rattling Brook below Bridge station.

Figure 6: Water Temperature at Rattling Brook below Bridge from June 11th to July 15th, 2010



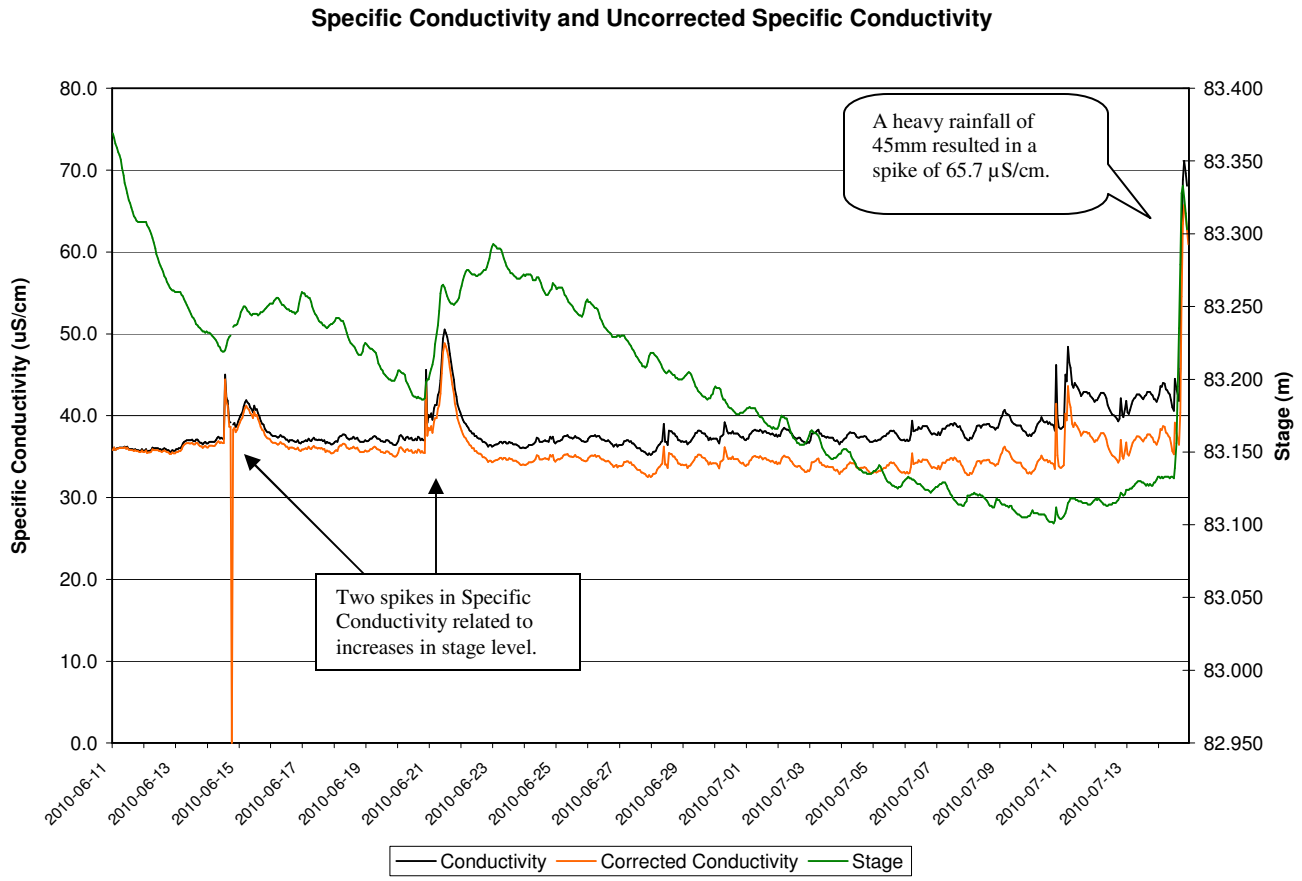
- An upward trend is recognized in water temperature for this deployment period as summer progressed from mid-June to mid-July. Water temperature was recorded as low as 10.86°C to 21.68°C.

Figure 7: pH at Rattling Brook below Bridge from June 11th to July 15th, 2010



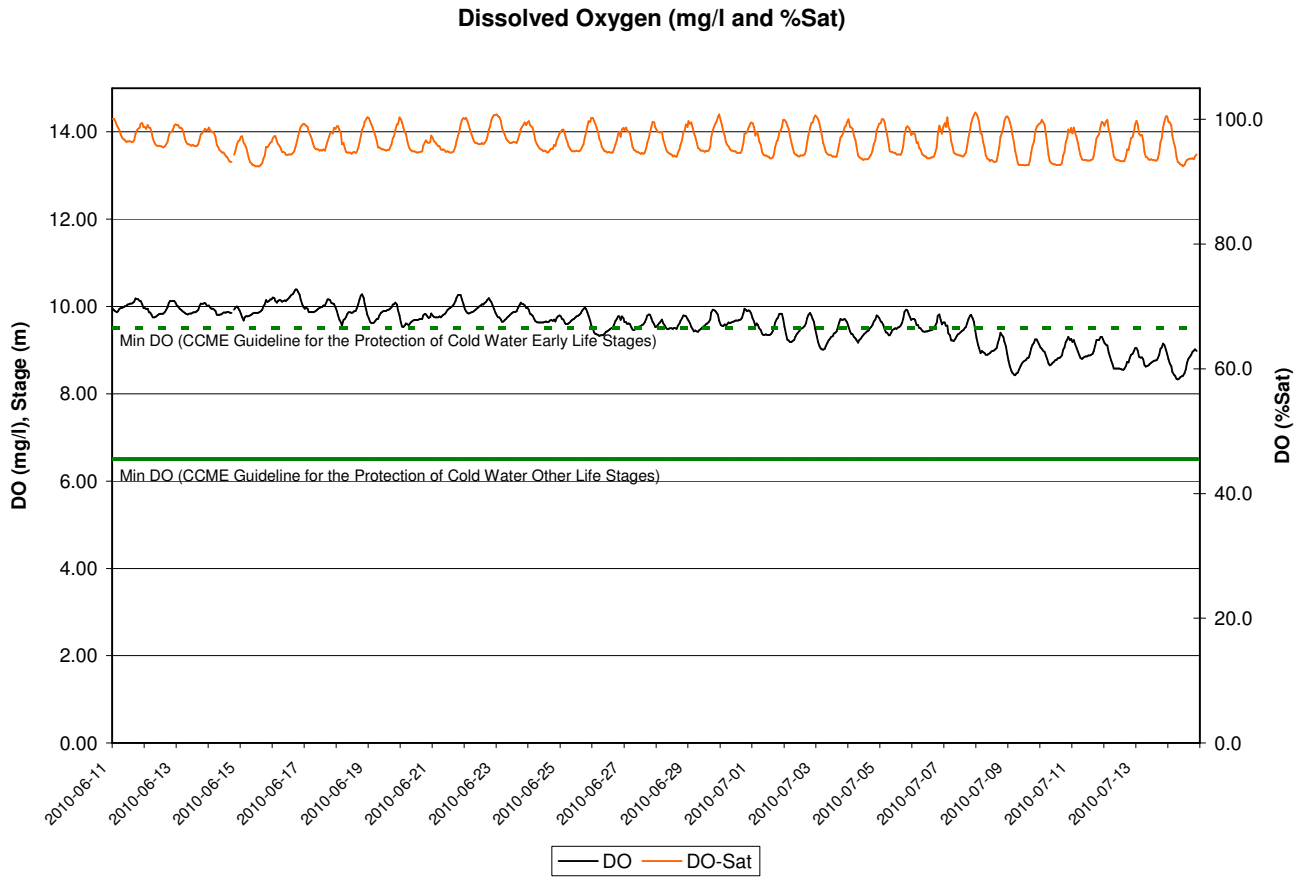
- No correction was applied to pH for this deployment period. The data presented is raw.
- A slightly downward trend is recognized from a maximum of 6.57 to a minimum of 5.72. With a median pH of 6.1, most values were found to be below the CCME Guideline of 6.5 for the Protection of Aquatic Life.

Figure 8: Specific Conductivity at Rattling Brook below Bridge from June 11th to July 15th, 2010



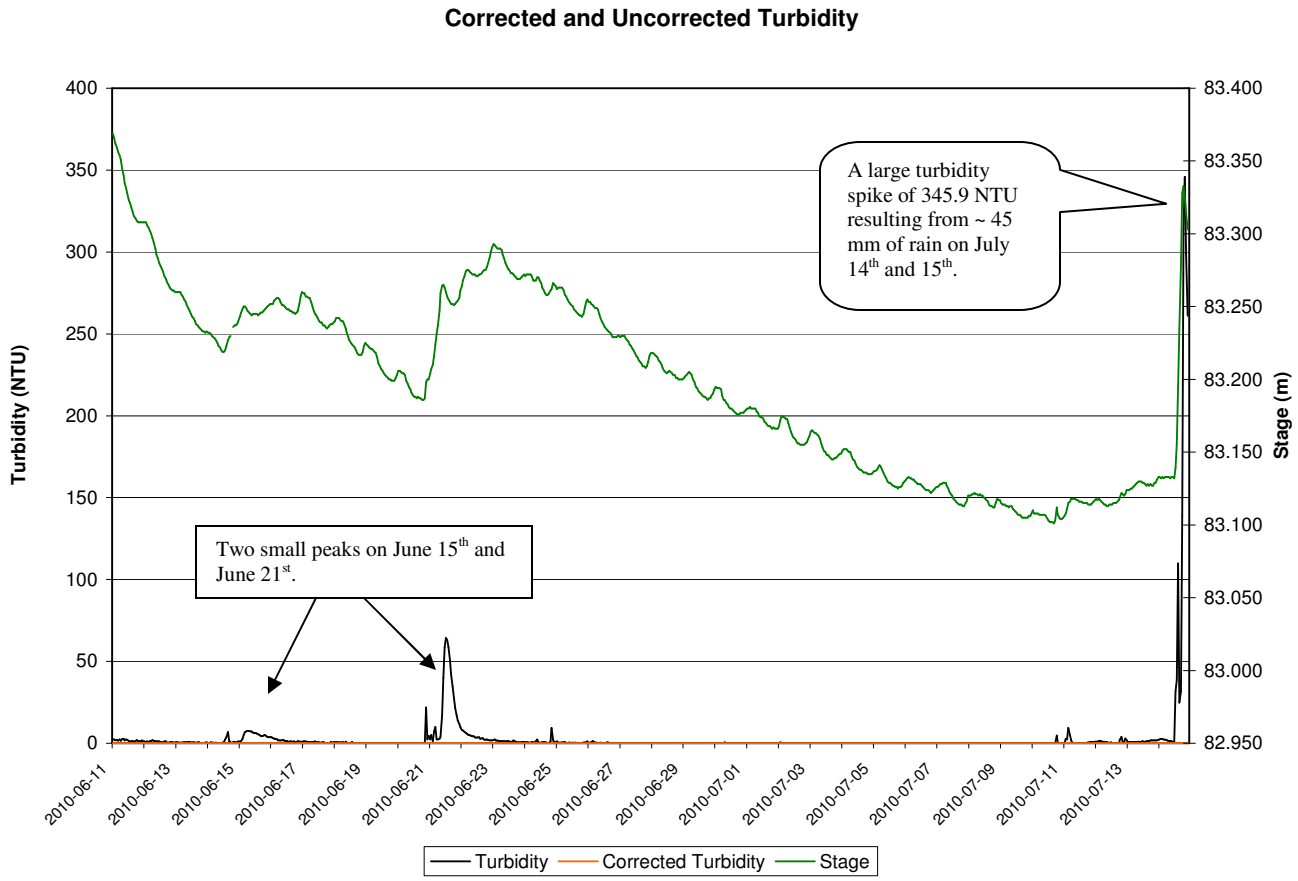
- A correction of -2.20 µS/cm was applied to the record for specific conductivity for this deployment. Raw and corrected specific conductivity are presented.
- A slightly upward trend is found from June 11th to July 14th with a range of 32.5 to 65.7 µS/cm. Two large fluctuations in conductivity are recorded in conjunction with peaks in specific conductivity, indicating a flush of charged ions entering the stream with the overland flow.

Figure 9: DO at Rattling Brook below Bridge from June 11th to July 15th, 2010



- The concentration of dissolved oxygen at Rattling Brook below Bridge started the deployment above the CCME Guideline of 9.5 mg/l for dissolved oxygen but fell as water temperature increased towards the end of the deployment. DO ranged from 10.39 to 8.33 mg/l.

Figure 10: Turbidity at Rattling Brook below Bridge from June 11th to July 15th, 2010

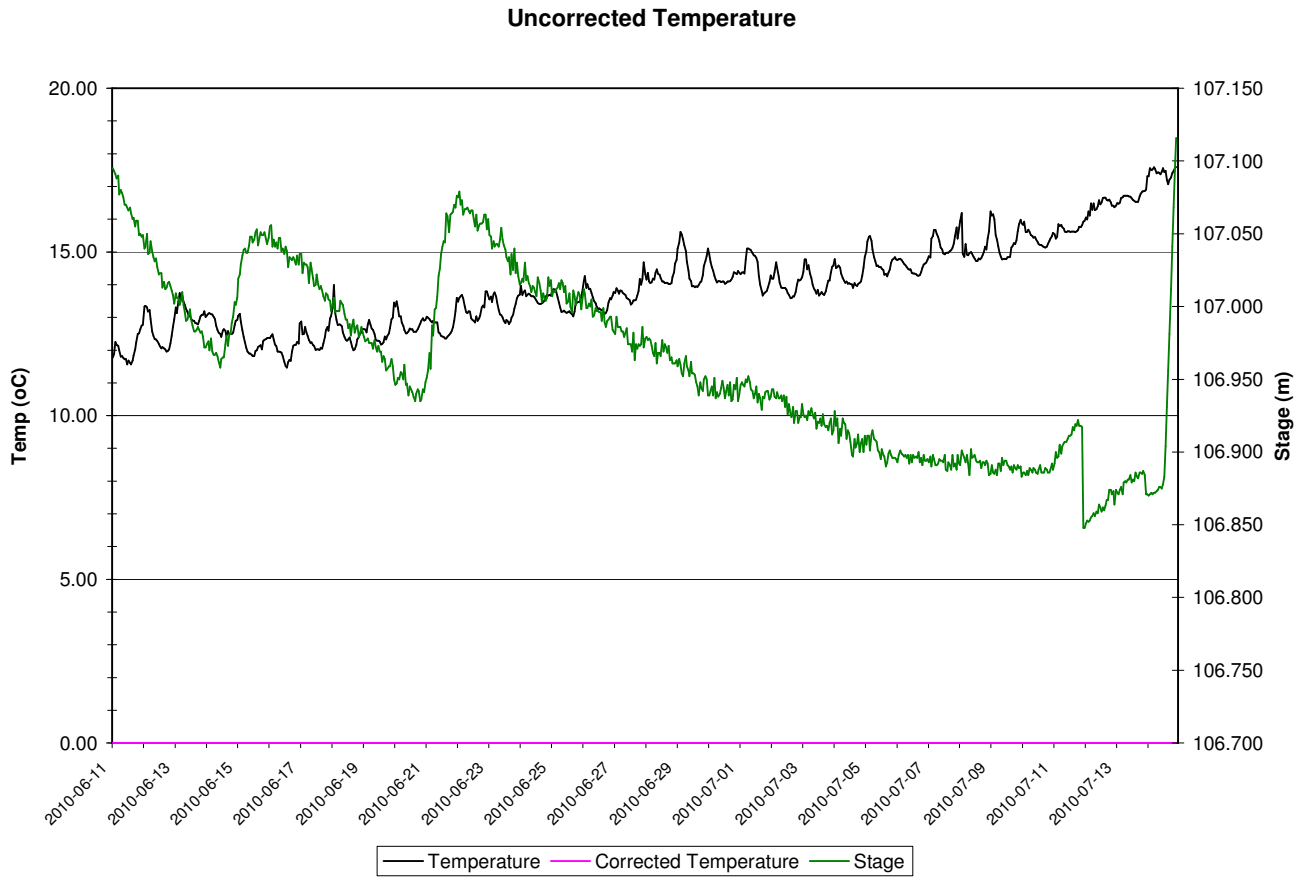


- Due to a lack of QAQC turbidity readings, no correction could be applied for this deployment period.
- Turbidity ranged from 0.0 to 345.9 NTU with a median of 0.2 NTU. A broad range in values coupled with a low median indicates a high skew in measurements. Turbidity at this station has been low for this time period.
- A few peaks in turbidity are associated closely with precipitation events, including the three highlighted in the figure above.

Rattling Brook below Big Pond

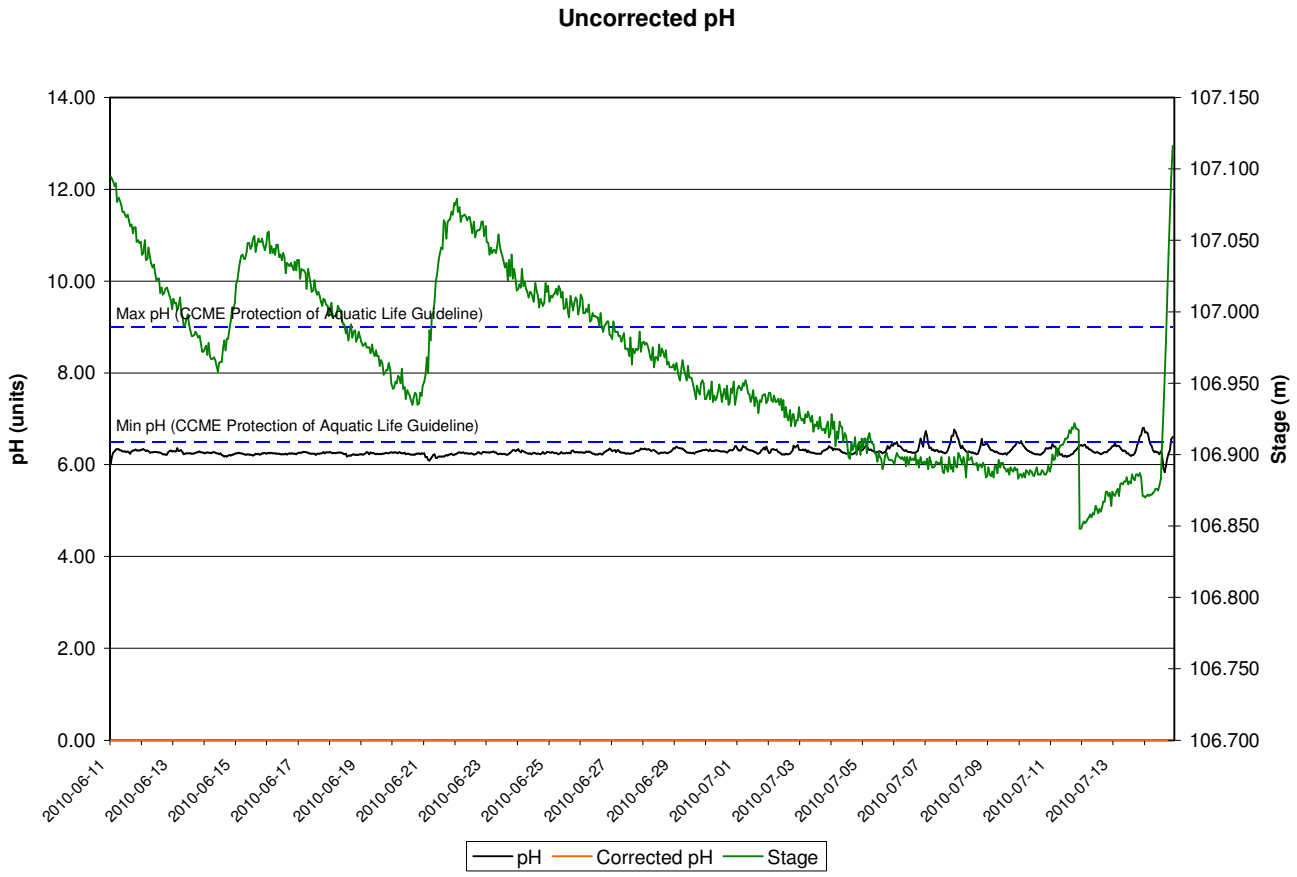
- The following discussion and figures interpret water quality data recorded at the Rattling Brook Big Pond station.

Figure 11: Water Temperature at Rattling Brook Big Pond from June 11th to July 15th



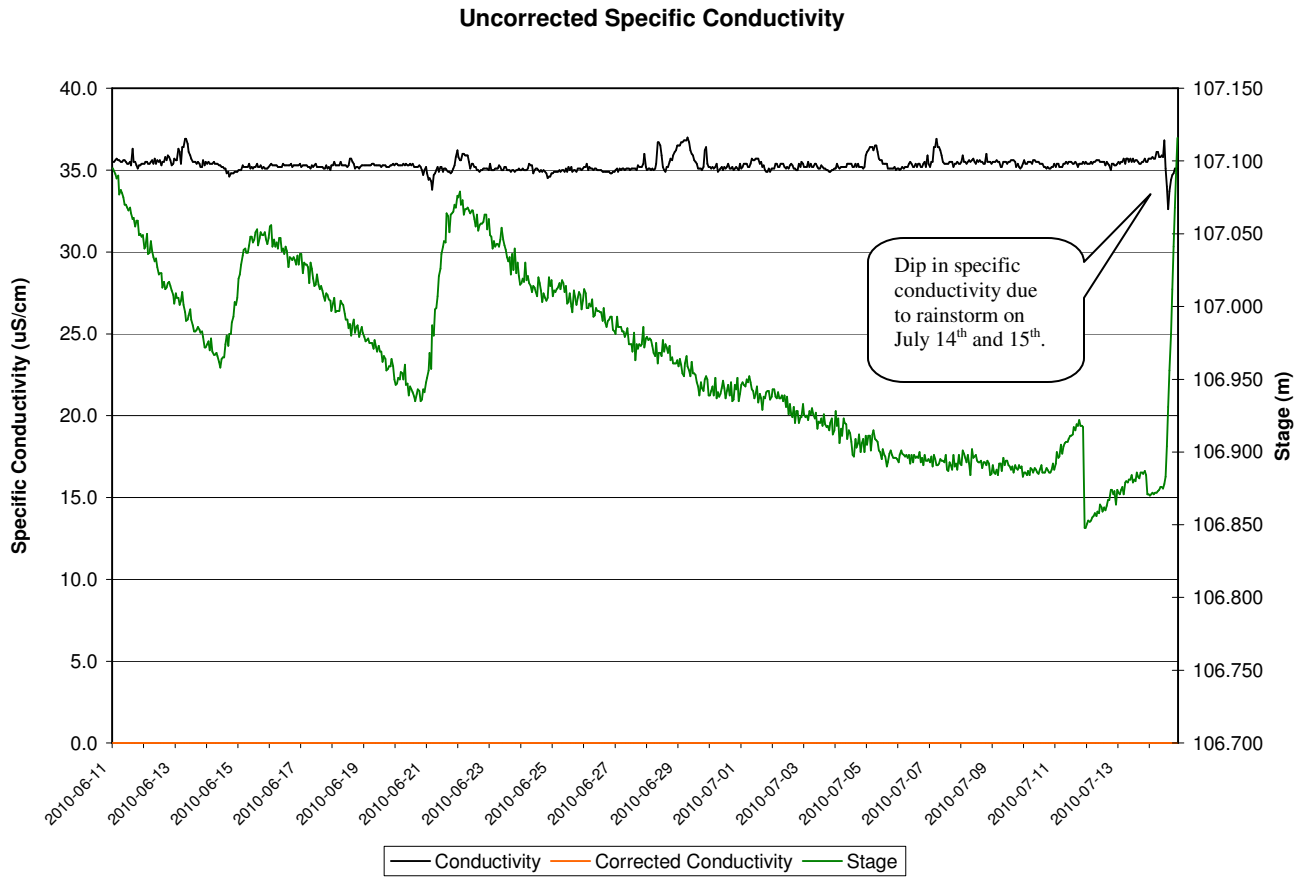
- No correction has been applied to the temperature record at Rattling Brook Big Pond for this deployment. Therefore, the data presented is raw data.
- A steady upward trend in water temperature is identified as expected. Daily cycles in temperature at this station are smaller than those found downstream. Resulting in a 'smoother' graph, this is due to the thermal inertia set up by the large and deep water body of Rattling Brook Big Pond.
- Water temperature ranged from 11.47°C to 17.60°C for this deployment period.

Figure 12: pH at Rattling Brook Big Pond from June 11th to July 15th



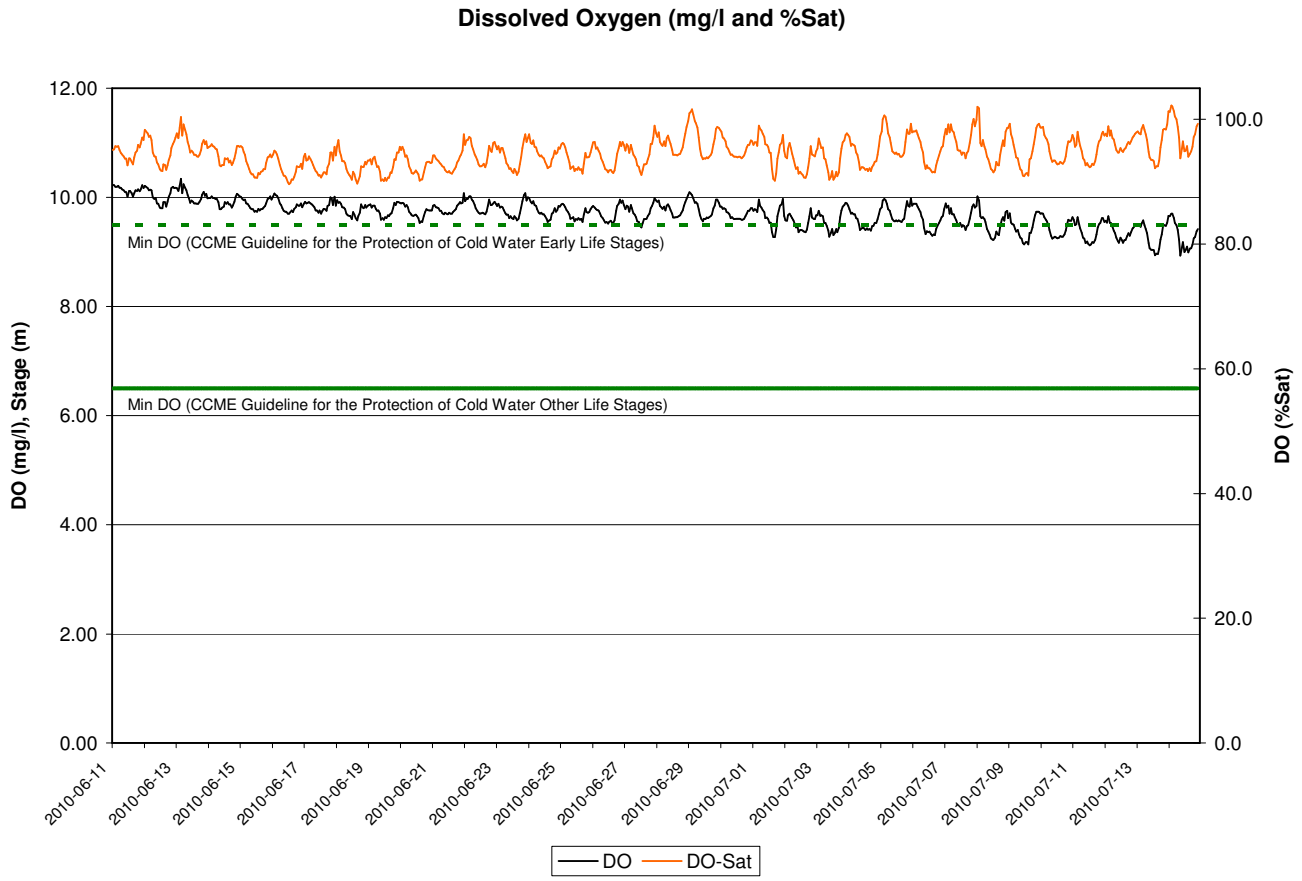
- A correction was not required for pH for this deployment period.
- Values for pH ranged from 5.84 to 6.80 with a median of 6.27, indicating that most values were below the CCME Guideline of 6.5 Since monitoring has began on Rattling Brook Big Pond, this has been the norm. Site-specific guidelines are being computed for this station.

Figure 13: Specific Conductivity at Rattling Brook Big Pond from June 11th to July 15th



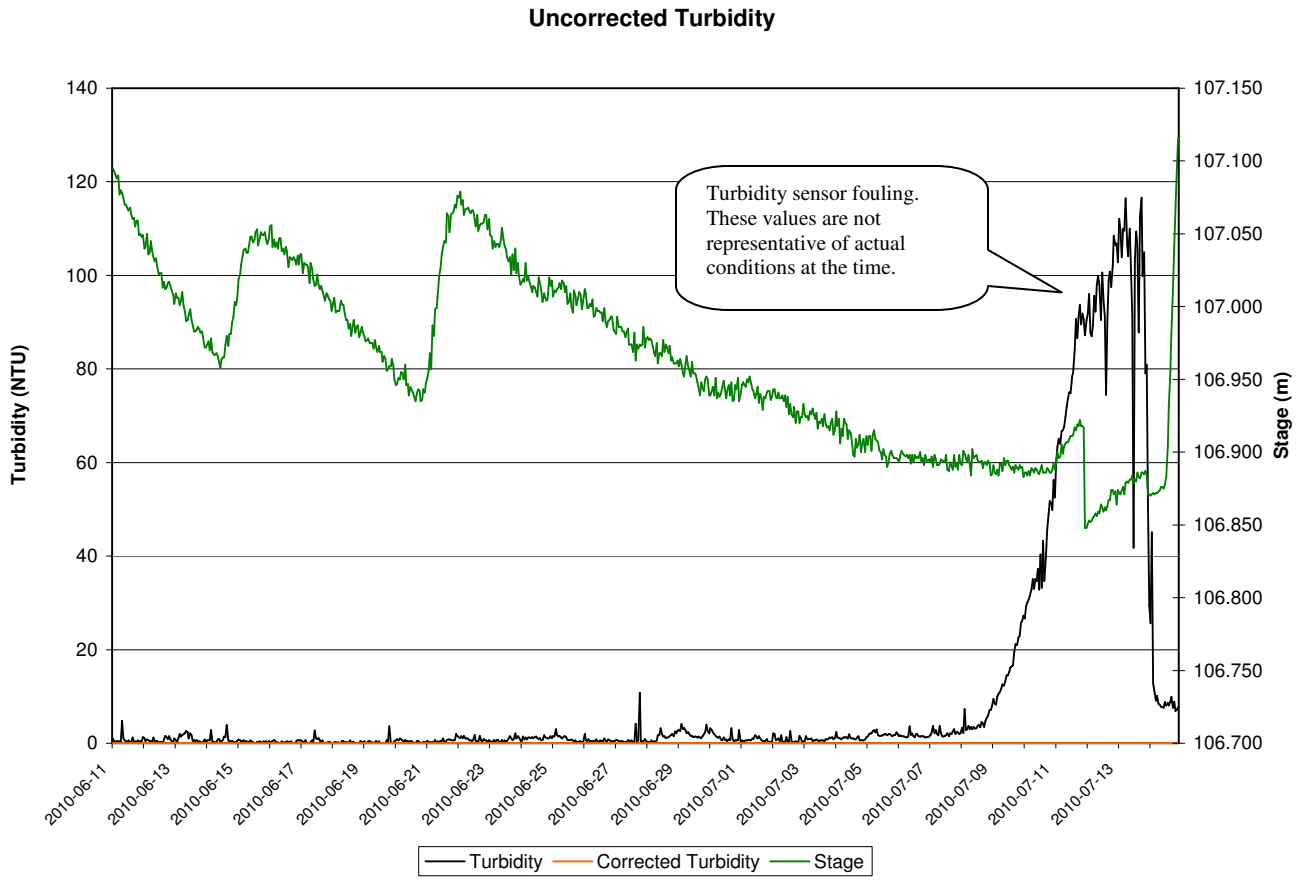
- Specific conductivity was not corrected during this deployment period.
- No trend was identified in the Specific Conductivity record for this month and very few notable fluctuations were recorded. A slight drop in specific conductivity was recorded with an increase in stage level indicating a dilution effect from the precipitation.

Figure 14: Dissolved Oxygen at Rattling Brook Big Pond from June 11th to July 15th



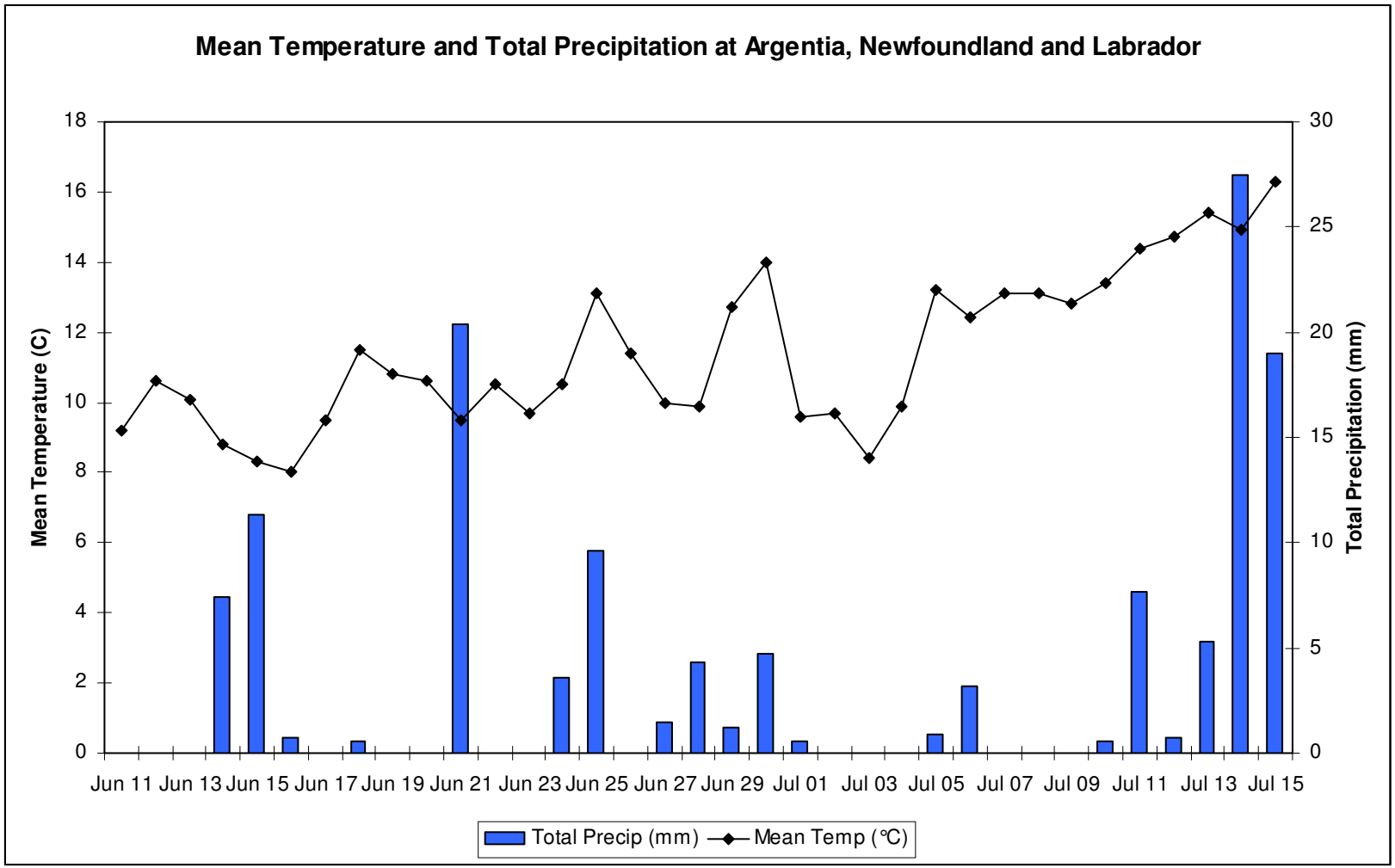
- A slow decline in the concentration of dissolved oxygen is observed at Rattling Brook Big Pond for this deployment period. In late June, values begin to fall below the CCME Guideline of 9.5 mg/l for DO content for the Protection of Early Life Stage Cold Water Biota.
- This situation will continue to be monitored closely; however, there does not appear to be any deleterious effect on the system so far. The concentration of DO ranges from 10.34 to 8.93 mg/l.

Figure 15: Turbidity at Rattling Brook Big Pond from June 11th to July 15th



- Rattling Brook Big Pond naturally shows a low level turbidity greater than that found downstream. For the first three quarters of this deployment period, no significant turbidity events were recorded.
- In the last quarter of deployment, however, a large plateau in turbidity was recorded. This large plateau of turbidity was likely related to a fouling of the sensor that was evidently cleared by some natural process during a rainfall event, as evidenced by the return to normal turbidity values as stage level increased.
- Turbidity ranged from 0.0 to 116.6 NTU with a median of 1.0 NTU.

Appendix



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