

# Real-Time Water Quality Deployment Report Rattling Brook Network

November 18<sup>th</sup>, 2010 to December 16<sup>th</sup>, 2010



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#### General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- This report discusses data gathered from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010, a period of 28 days. During this time, no significant communications dropouts were found.

# **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<sub>e</sub>). If T<sub>e</sub> exceeds a predetermined data correction criterion, a correction based on T<sub>e</sub> is applied to the dataset using linear interpolation. Based on the value for T<sub>e</sub>, a qualitative statement is also made on the data quality in Table 1 upon Removal.

Station	Date	Action	Comparison Ranking				
			Temperature	pН	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	November 18, 2010	Deployment	Good	Excellent	Excellent	Excellent	Excellent
	December 16, 2010	Removal	Good	Good	Good	Excellent	Excellent
Rattling Brook below Bridge	November 18, 2010	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	December 16, 2010	Removal	Excellent	Excellent	Excellent	Excellent	Excellent
Rattling Brook below Plant Discharge	November 18, 2010	Deployment	Good	Good	Good	Good	Excellent
	December 16, 2010	Removal	Good	Excellent	Excellent	Excellent	Excellent

# **Data Interpretation**

Rattling Brook Big Pond

• A marginal downward trend is present in the figure below from a high of 7.35°C on November 18<sup>th</sup> to a low of 3.73°C on December 14<sup>th</sup>. The median temperature was calculated to be 4.89°C.





Water Temperature and Stage Level

PH values ranged from 6.47 to 5.79 for this deployment period with a median value of 6.30. All values were found to be below the CCME Guideline of 6.5 for the Protection of Aquatic Life; however, this is the normal and expected range for the Rattling Brook system.

# Figure 2: pH at Rattling Brook Big Pond from November 18<sup>th</sup> to December 16, 2010



Water pH and Stage Level

• Conductivity appears to be stable or with a very slight upward trend for this deployment period with a range from a low of  $33.2 \,\mu$ S/cm on November  $23^{rd}$  to a high of  $35.2 \,\mu$ S/cm on December  $2^{nd}$ .

#### Figure 3: Specific Conductivity at Rattling Brook Big Pond from November 18th to December 16, 2010



Specific Conductivity of Water and Stage Level

- Dissolved Oxygen (DO) ranged between 89.6 to 97.8% saturation at Rattling Brook Big Pond, falling to a low on November 20<sup>th</sup>, 2010 at 11:30pm.
- The concentration of DO was consistently above the minimum CCME Guideline values for the protection of both Early life stage and Other life stage cold water biota. Values fell between 11.12 and 12.58 mg/l with a median value of 12.08 mg/l.
- During mid-deployment, a period of warm air temperatures and precipitation resulted in a depression of diurnal DO cycles.





**Dissolved Oxygen Concentration and Saturation** 

• From November 18<sup>th</sup> to December 16<sup>th</sup>, 2010 very little was recorded in terms of turbidity. A single reading of 10.6 NTU over 28 days indicates that conditions at Rattling Brook Big Pond were very calm. The single reading of 10.6 NTU occurred on November 27<sup>th</sup> at 6:30am. While some precipitation was recorded on this day, all records before and after indicate zero turbidity. It is possible that even this reading is a spurious value caused by a temporary obstruction of the sensor.





Water Turbidity and Stage

Rattling Brook below Bridge

- While the profile in water temperature is similar to that of Rattling Brook Big Pond, the peaks and valleys are more emphasized.
- Values fell between 0.42 to 6.68°C with a median temperature of 3.33°C. A trend up- or downwards is not apparent given the bimodal nature of the graph below.





Water Temperature and Stage Level

- A difference of 0.71 pH units was calculated between the maximum and minimum values for this deployment period (max: 6.81, min: 6.10). The median was found to be 6.38.
- As is the norm for this river system, these values are below the CCME Guideline for the Protection of Aquatic Life. Site Specific Guidelines are in development.





Water pH and Stage Level

- Specific conductivity ranged from 35.0 to 68.1 µS/cm for this deployment period with a median value of 38.9 µS/cm.
- At the beginning of deployment, it appears that conductivity values are trending upwards; however, towards the end of the 28 day period it appears that conductivity may be leveling off or falling.
- A large peak of 68.1 μS/cm is apparent and seems to be related to about 20 mm of precipitation on December 3<sup>rd</sup>, 2010.

# Figure 8: Specific Conductivity at Rattling Brook below Bridge from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010



Specific Conductivity of Water and Stage Level

- Dissolved Oxygen saturation fell between 94.5 to 100.6% for this 28 day period.
- The concentration of DO fell between 11.76 to 14.00 mg/l with a median value of 12.89 mg/l. All values are above the minimum DO levels established by the CCME Guidelines for the protection of aquatic life.



Figure 9: Dissolved Oxygen at Rattling Brook below Bridge from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010

**Dissolved Oxygen Concentration and Saturation** 

- Recorded turbidity events at Rattling Brook below Bridge station fall between November 25<sup>th</sup> and December 11<sup>th</sup>, in relation to frequent precipitation through the middle of the deployment period.
- Values fall between 0.0 and 120.6 NTU with 50% of values being recorded as less than or equal to 0.2 NTU.
- An extended period of low turbidity was identified between December 6<sup>th</sup> and 9<sup>th</sup>. Despite consistent rainfall during this time span, it is unusual for turbidity events to last for more than a few hours following the onset of rain.





Water Turbidity and Stage

Rattling Brook below Plant Discharge

Water temperature at this station ranged from 0.07 to 7.35°C for this 28 day period. Water temperature appears to be warming somewhat during the scale of this report. This may be the result of a warm period in the center of the deployment period, however. It is likely that water temperature will continue to decline as time progresses.

#### Figure 11: Water Temperature at Rattling Brook below Plant Discharge from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010



Water Temperature and Stage Level

PH at Rattling Brook below Plant Discharge remained level for this deployment period within the range of 6.31 to 6.76 units. The median value was found to be 6.48 units, just below the CCME Guideline for the Protection of Aquatic Life. Values below this guideline are typical for this region of the province.



Water pH and Stage Level

Figure 12: pH at Rattling Brook below Plant Discharge from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010

- The range of conductivity values for conductivity ranged from 39.5 to 77.5 µS/cm with a median value of 3.85 µS/cm.
- A large peak in conductivity values is present in conjunction with a rapid rise in stage level. On this same day, ~20 mm of precipitation fell on December 3<sup>rd</sup>.

# Figure 13: Specific Conductivity at Rattling Brook below Plant Discharge from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010



Specific Conductivity of Water and Stage Level

- The saturation of Dissolved Oxygen ranged from 91.0 to 100.2% during this deployment period. This is within the expected range for this station.
- Concentration of DO ranged from 11.17 to 13.84 mg/l with a median value of 12.46 mg/l. All values were recorded as above the CCME Guideline minimums for the protection of aquatic life.
- As expected from the temperature graph in the appendix, DO fell slightly during the warm period mid deployment.

# Figure 14: Dissolved Oxygen at Rattling Brook below Plant Discharge from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010



**Dissolved Oxygen Concentration and Saturation** 

- Turbidity at Rattling Brook below Plant Discharge was found to be less than values recorded upstream at below Bridge station. Here, turbidity was found to range from 0.0 to 92.6 NTU with a median value of 0.0 NTU.
- From December 6<sup>th</sup> to 9<sup>th</sup>, an extended period of low turbidity averaged 2.9 NTU but peaked at a value of 33.0 NTU. Although this was during a period of consistent rainfall, it is unusual for turbidity to remain elevated for such a period of time. Since this pattern is also identified upstream at Bridge station, it should be noted that this is not an irregularity in instrumentation.





Water Turbidity and Stage

# Conclusions

- All instruments performed well during this deployment from November 18<sup>th</sup> to December 16<sup>th</sup>, 2010.
- All parameters are within the expected ranges given the volume of precipitation and flux in air temperature.
- As mentioned in many past monthly reports, CCME Guidelines are derived on a national basis using water bodies across Canada. While these guidelines are representative for the majority of cases, in Newfoundland and Labrador, geochemical effects from exposed bedrock and low alkalinity soil leads to acidic natural waters. The result is that most water bodies on the island of Newfoundland fail to meet CCME Guidelines for the Protection of Aquatic Life in terms of pH. Work is under way to create a Site Specific Guideline for pH for the Rattling Brook system. This should be available in future reports.

# **Appendix**



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