

# Real-Time Water Quality Deployment Report Rattling Brook Network

March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010



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### General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- This monthly deployment report interprets the data from Rattling Brook Big Pond, Rattling Brook below Bridge and Rattling Brook below Plant Discharge stations for the period of March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010; a period of 34 days.
- Vale Inco will be informed of any significant water quality events in the form of a monthly deployment report and automated alerts as they occur.

## **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	рН	Conductivity	Dissolved Oxygen	Turbidity
Big Pond	March 31, 2010	Deployment	Excellent	Good	Good	Excellent	Excellent
	May 4, 2010	Removal	Excellent	Excellent	Excellent	Excellent	Excellent
Below Bridge	March 31, 2010	Deployment	Good	Excellent	Good	Good	Excellent
	May 4, 2010	Removal	Excellent	Excellent	Good	Good	Excellent
Below Plant Discharge	March 31, 2010	Deployment	Excellent	Good	Good	Excellent	Excellent
	May 4, 2010	Removal	Excellent	Good	Excellent	Good	Good

Table 1: QA/QC Data Comparison Rankings upon Deployment on March 31<sup>st</sup> to May 4<sup>th</sup>, 2010.

• All parameter rankings ranged from "Excellent" to "Good" for this deployment period.

# **Data Interpretation**

• The following sections describe trends and events present at the three real-time stations on Rattling Brook in Long Harbour, Newfoundland and Labrador.

Rattling Brook Big Pond

- Following two months of thick ice cover that precluded the deployment of a water quality instrument, Big Pond station was reactivated on March 31<sup>st</sup>, 2010.
- Total Error calculated for water temperature did not exceed the data correction criterion for this deployment and was not corrected. Temperature, depicted in Figure 1, ranged from 1.80°C to 7.35°C with a very obvious increasing trend as day length and air temperature increase.



Figure 1: Water Temperature at Rattling Brook Big Pond from March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010.

During this deployment, the Total Error for pH did not exceed the data correction criterion and was not corrected; raw data is presented in Figure 2. pH at Rattling Brook Big Pond ranged from 5.63 to 6.35 and presented a marginally positive trend. pH reached the maximum on April 26<sup>th</sup>. Most values were below the CCME Guideline for the Protection of Aquatic Life of 6.5; however, this is the norm for the region.



Figure 2: pH at Rattling Brook Big Pond from March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010.

• Total Error for Specific Conductivity exceeded the data correction criterion and a correction of 2.30  $\mu$ S/cm was applied to the record from March 31<sup>st</sup> to May 4<sup>th</sup>. Corrected Specific Conductivity ranged from 31.5 to 39.4  $\mu$ S/cm. Two periods of heavy precipitation are of interest in Figure 3. These events, occurring between April 15<sup>th</sup> to 17<sup>th</sup> and April 19<sup>th</sup> to 22<sup>nd</sup> dropped 16.8 mm and 21 mm of precipitation, respectively. The two events caused temporary fluctuations to specific conductivity.





Corrected and Uncorrected Specific Conductivity

• A minor correction of 1.9% was added to the %-Sat record for this deployment. From March 31<sup>st</sup> to May 4<sup>th</sup>, 2010, %-Sat ranged from 87.7 to 101.2%. Heavy precipitation on May 3<sup>rd</sup> is likely associated with increased turbulence in Rattling Brook that resulted in a peak saturation of 101.2%. The concentration of dissolved oxygen ranged from 12.56 to 11.30 mg/l and showed an increasing trend toward mid-deployment when air temperature was lowest for the month and a declining trend towards the end of deployment when air temperature was at its maximum. All values were above the CCME Guidelines for the Protection of Aquatic Life.



#### Figure 4: Dissolved Oxygen at Rattling Brook Big Pond from March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010.

A correction of -2.60 NTU was added to the turbidity record for this deployment, corrected turbidity ranged from 0.0 to 8.7 NTU. Where 8.7 NTU is a relatively high value and occurs for a very short duration, it is probable that this reading is inflated and caused by errant debris passing and obscuring the sensor. The weather conditions at this time were 3°C and dry and no spike in turbidity would be expected. Additionally, the measurement immediately before and after were 1.2 NTU and 0.9 NTU, respectively. A spike in turbidity is seen mid-deployment during a period of frequent precipitation occurring from April 13<sup>th</sup> to April 23<sup>rd</sup>.



Figure 5: Turbidity at Rattling Brook Big Pond from March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010.

**Corrected and Uncorrected Turbidity** 

Rattling Brook below Bridge

 No correction was applied to Water Temperature because the data correction criterion was not exceeded. Temperature ranged from 1.92 to 11.04°C during this time period and showed a distinct warming trend expected with the season. The warming trend was curtailed in mid-April due to cool air temperatures and precipitation.



Figure 6: Water Temperature at Rattling Brook below Bridge from March 31<sup>st</sup> to May 4<sup>th</sup>, 2010.

Uncorrected Temperature

PH at Rattling Brook below Bridge ranged from 6.45 to 5.22 and showed a marked decline in mid-April during a period of sustained precipitation. Initially it was thought that this drop was due to a malfunction of the sensor or calibration drift, but at removal, the Total Error was found to be only 0.09 and no correction was needed. All values were found to be below the CCME Guideline for the Protection of Aquatic Life; however, this is normal for the region.





A Total Error of 4.5 µS/cm exceeded the data correction criterion for this parameter. Raw and corrected data is presented in Figure 8. Specific conductivity ranged from 33.8 to 45.5 µS/cm during this deployment period.



#### Figure 8: Specific Conductivity at Rattling Brook below Bridge from March 31<sup>st</sup> to May 4<sup>th</sup>, 2010.



A correction of 4.1% was applied to %-Saturation causing values to range from 94.5 to 103.7%. The concentration of dissolved oxygen ranged from 10.62 to 13.24 mg/l. During the period of mid-April precipitation, an attenuation of the diurnal DO cycle was seen. Although a downward trend in DO concentration is seen due to warming temperatures, all values are above the CCME Guideline for the Protection of Aquatic Life.





 A correction of 0.90 NTU was applied to the turbidity record for the period of March 31<sup>st</sup> to May 4<sup>th</sup>, 2010. Corrected turbidity ranged from 2.9 to 100.0 NTU (median = 7.3 NTU). A period of higher-than-normal turbidity occurred through the period of April 13<sup>th</sup> to April 22<sup>nd</sup> during a period of precipitation.



Corrected and Uncorrected Turbidity

Figure 10: Turbidity at Rattling Brook below Bridge from March 31<sup>st</sup> to May 4<sup>th</sup>, 2010.

Rattling Brook below Plant Discharge

No correction was necessary for temperature in this deployment and raw data is presented. A steady seasonal upward trend is seen in temperature at Rattling Brook below Plant Discharge for this deployment period. Temperature reached a maximum of 12.22°C and was as low as 1.51°C on April 16<sup>th</sup> at 3:30am during precipitation and cold air temperatures.



Figure 11: Water Temperature at Rattling Brook below Plant Discharge from March 31<sup>st</sup>, to May 4<sup>th</sup>, 2010.

A correction of -0.32 was applied to the record for pH during this deployment due to Total Error exceeding the data correction criterion. Though most pH values fell below the CCME Guidelines for the Protection of Aquatic Life, pH remained fairly stable from March 31<sup>st</sup> to May 4<sup>th</sup>; corrected values ranged from 6.07 to 6.69.



Figure 12: pH at Rattling Brook below Plant Discharge from March 31<sup>st</sup>, to May 4<sup>th</sup>, 2010.



No correction was required for Specific Conductivity for this deployment period. As such, the raw values ranged from 37.5 to 63.2 μS/cm and showed a positive trend for the month.



Corrected and Uncorrected Specific Conductivity

Figure 13: Specific Conductivity at Rattling Brook below Plant Discharge from March 31<sup>st</sup>, to May 4<sup>th</sup>, 2010.

A correction of 5.70% was applied to the %-Sat record for this deployment. Corrected values for %-Sat ranged from 90.7 to 103.2%. Values less than 100% may be related to the catabolic metabolism of aquatic life which reduces available oxygen from the water column. The concentration is also seen to drop in relation to the seasonally rising water temperature. The concentration of oxygen at Rattling Brook below Plant Discharge ranged from 9.69 to 12.85 mg/l.



# Figure 14: Dissolved Oxygen at Rattling Brook below Plant Discharge from March 31<sup>st</sup>, to May 4<sup>th</sup>, 2010.

A correction of -7.5 NTU was added to the turbidity record for this deployment period. Corrected turbidity ranged from 0 to 132.0 NTU for this deployment period with a median value of 6.3 NTU. At the start of this deployment, turbidity was highly variable until approximately April 7<sup>th</sup> when values began to stabilize. During the rainy period in mid-April, turbidity values rose again and reached a maximum on April 21<sup>st</sup> during the stage plateau. Following this period, turbidity values declined to a point where incidences of zero turbidity were found. Frequent spikes of >25 NTU in less than 12 hours are seen, however.



Figure 15: Turbidity at Rattling Brook below Plant Discharge from March 31<sup>st</sup>, to May 4<sup>th</sup>, 2010.

# Conclusions

- Rattling Brook Big Pond station was redeployed following two consecutive months of ice cover.
- Stations at Rattling Brook performed as expected and reported temperature, pH, specific conductivity and dissolved oxygen levels appropriate for this time of the year. No significant events of concern were recorded for the deployment period of March 31<sup>st</sup>, 2010 to May 4<sup>th</sup>, 2010, other than those that appear to be associated with increased precipitation.

# Appendix



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Long Harbour, Newfoundland and Labrador