Real-Time Water Quality Deployment Report
NF02ZK0023 – Rattling Brook below Bridge
April 24, 2009 to May 20, 2009

General

- The Water Resources Management Division staff monitors the real-time web page on a daily basis.
- Vale Inco will be informed of any significant water quality events in the form of a monthly deployment report.
- This monthly deployment report interprets the data from the Rattling Brook River real-time water quality station for the period of April 24, 2009 to May 20, 2009.
- Most maintenance outings require two day trips to Long Harbour to remove, clean and calibrate an instrument for redeployment the next day. Unfortunately, due to staff availability, two consecutive days could not be scheduled for field work during the last maintenance period. A decision was made to remove Hydrolab s/n 44604 and replace it, temporarily, with Hydrolab s/n 44975. To ensure the long-term consistency instrument deployment at Rattling Brook, a subsequent single-day maintenance outing on May 20th replaced s/n 44975 with s/n 44604.
- Over the course of the deployment period some communication drops have resulted in small 'gaps' in the dataset. These gaps, however, did not impede the interpretation of data and have not been deemed critical.

Maintenance and Calibration of Instrumentation

- As part of the removal and reinstallation process, parameters are recorded from both the field sonde (in situ) and a similar, newly-calibrated QA sonde (placed side by side). The parameters from both instruments are compared and their variability is ranked as part of the QA/QC protocol (see Table 1).
- Upon installation of Hydrolab s/n 44975, all parameters ranked as "Excellent". During the removal of s/n 44975, all parameters once again ranked as "Excellent."

Table 1: QA/QC Data Comparison Rankings upon installation on April 24, 2009 and removal on May 20, 2009

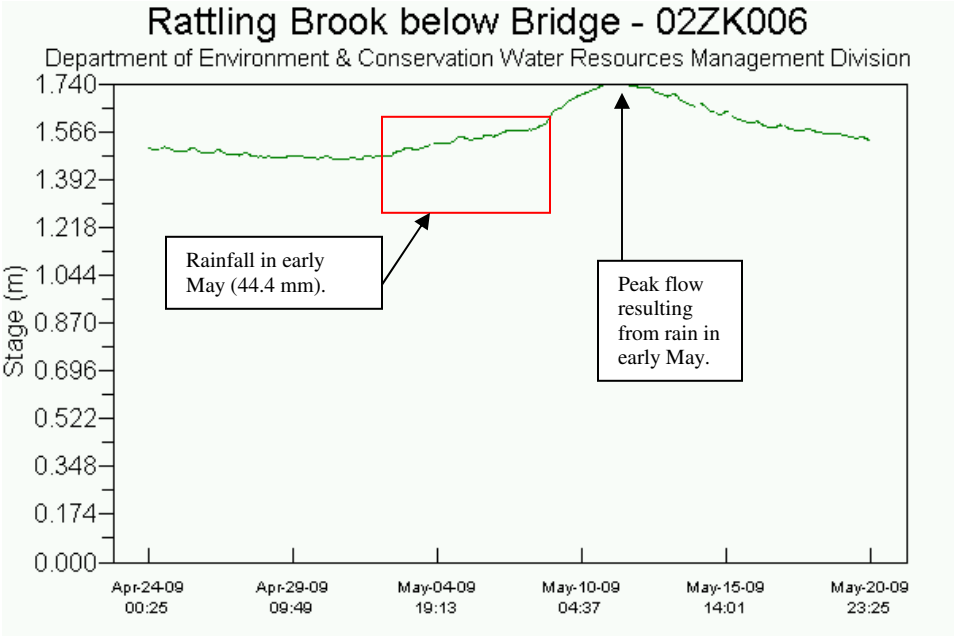
Station	Date	Action	Instrument Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook (Long Harbour)	April 24, 2009	Installation	Excellent	Excellent	Excellent	Excellent	Excellent
	May 20, 2009	Removal	Excellent	Excellent	Excellent	Excellent	Excellent

Data Interpretation

- Initial inspection of the data retrieved from the Rattling Brook below Bridge station implies that no significant water quality events have taken place from April 24th to May 20th. One major rain event occurs midway through the deployment period. All parameters reflect the anticipated seasonal trends: increasing water temperature and decreasing dissolved oxygen concentration.
- Figure 1 depicts the Stage Level of Rattling Brook. The first half of the figure shows a falling limb reclining to baseline flow following previous rainfall events on April 4th and 8th. The rising leg occurs in early May

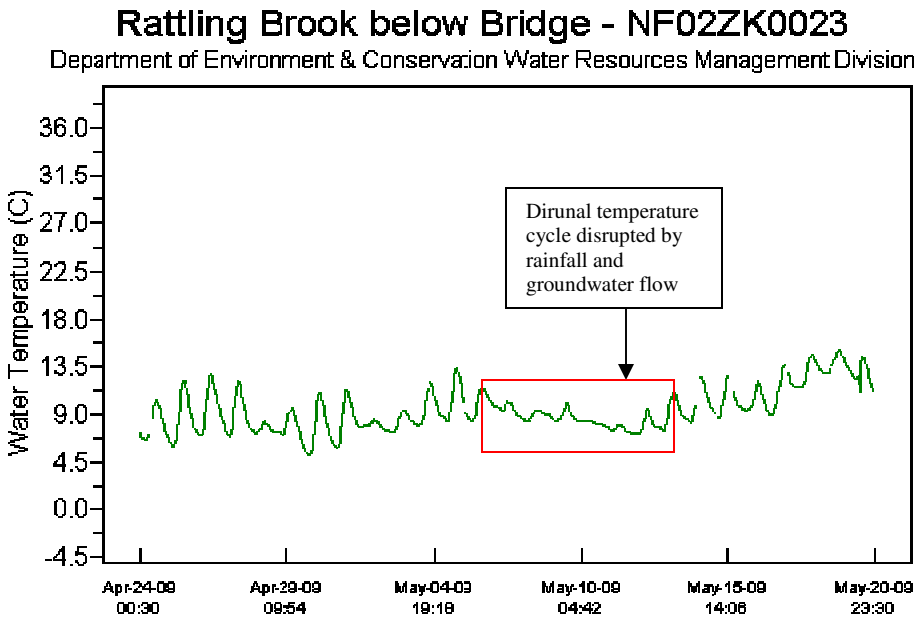
during moderate precipitation for the period of May 1st to May 4th (24.2 mm). A more intense period of rainfall (44.4 mm) occurred from May 6th to 8th resulting in peak flow on May 11. Significant lag time between peak rainfall and peak flow occurs because groundwater flow is relatively slow compared to the main river channel.

Figure 1: Stage level at Rattling Brook from April 24 to May 20, 2009



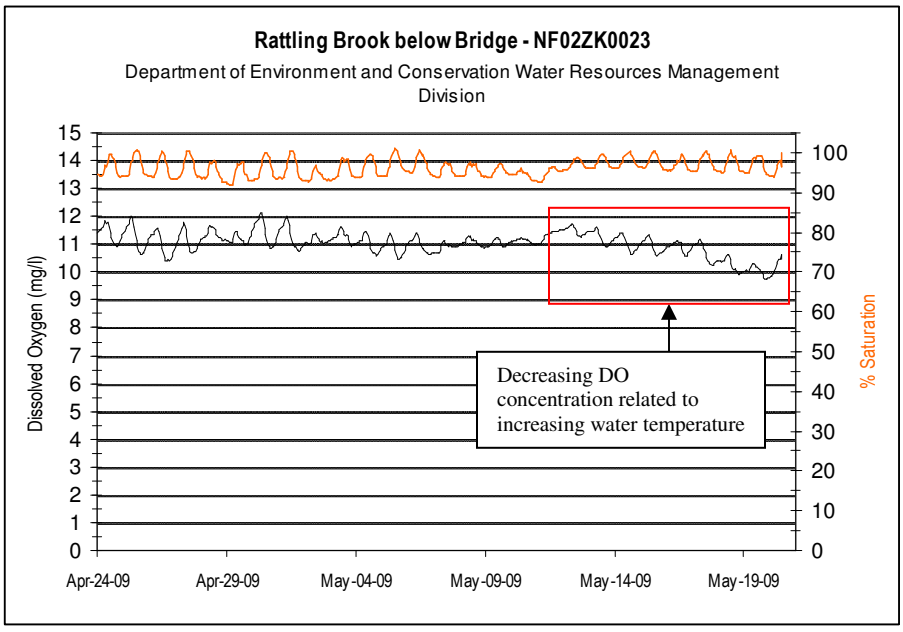
- Water temperature (Figure 2) shows a slight upward trend over the deployment period – as expected during the spring season. Diurnal patterns in water temperature are seen as sunlight warms the water and the river cools again at night. During peak flow, the diurnal pattern is depressed significantly due to rainfall and groundwater having a moderating effect on temperature.

Figure 2: Water temperature at Rattling Brook from April 24 to May 20, 2009



- Photosynthesis and respiration impose a diurnal cycle in the dissolved oxygen concentration at Rattling Brook. During the day, photosynthesis releases more oxygen into the water than respiration can withdraw. As the sun goes down, photosynthesis slows, but respiration continues. Such a change in the balance of production and consumption leads to a decrease in DO values. No concern has been warranted due to DO values. A decline in the concentration of dissolved oxygen towards the end of the deployment is related to higher water temperatures.

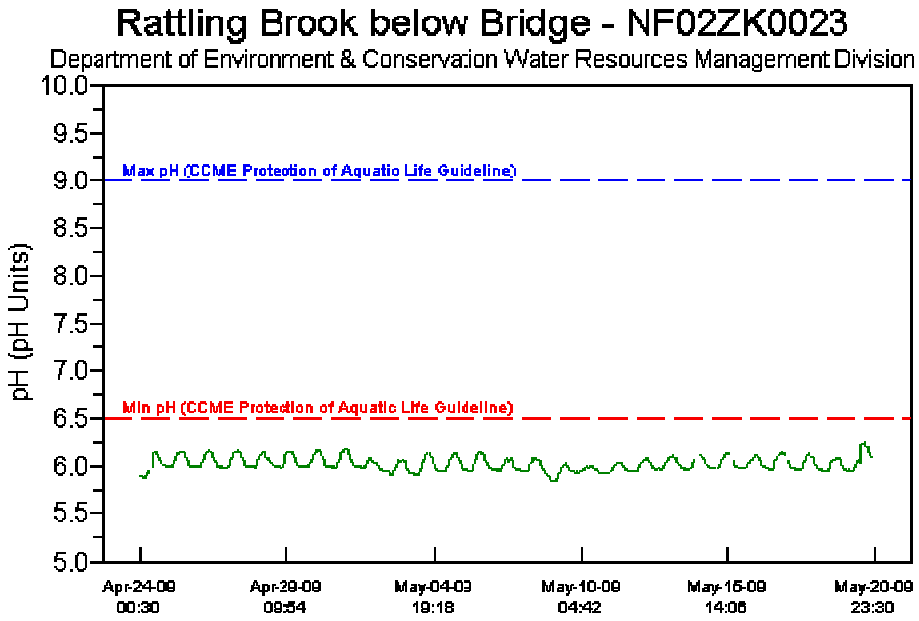
Figure 3: Dissolved oxygen at Rattling Brook from April 24 to May 20, 2009



- A diurnal pattern of pH, reminiscent of the cycle seen in Figure 2, is present at Rattling Brook. pH is generally lowest in the evenings as aquatic life respires during the evening, releasing $CO_{2(g)}$. The dissolution

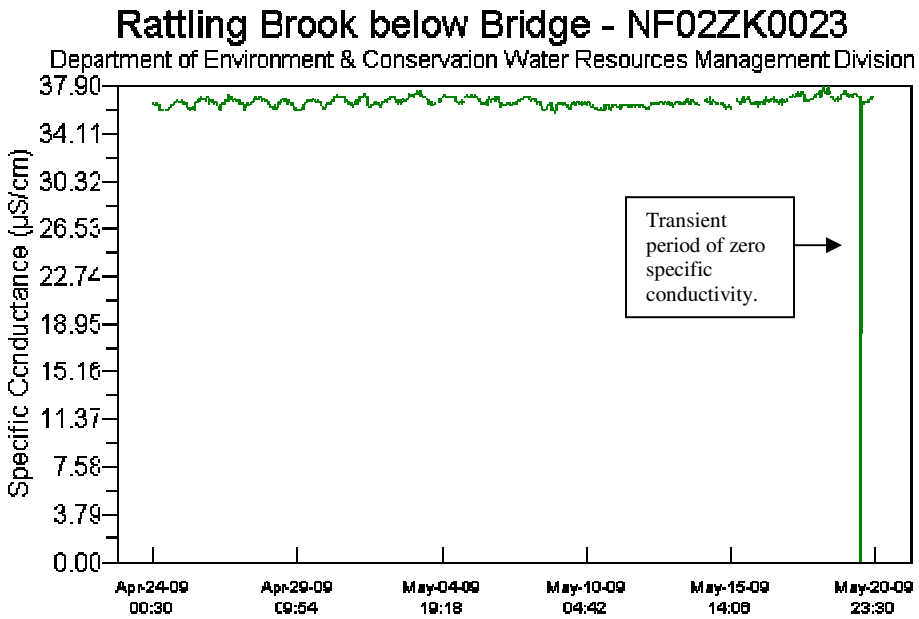
of carbon dioxide in water forms carbonic acid depressing pH. Guidelines for the protection of aquatic life, established by the Canadian Council of Ministers of the Environment, were not met throughout the course of this deployment. This was to be expected, however, as natural waters in this area of the province are consistently acidic in nature.

Figure 4: pH at Rattling Brook from April 24 to May 20, 2009



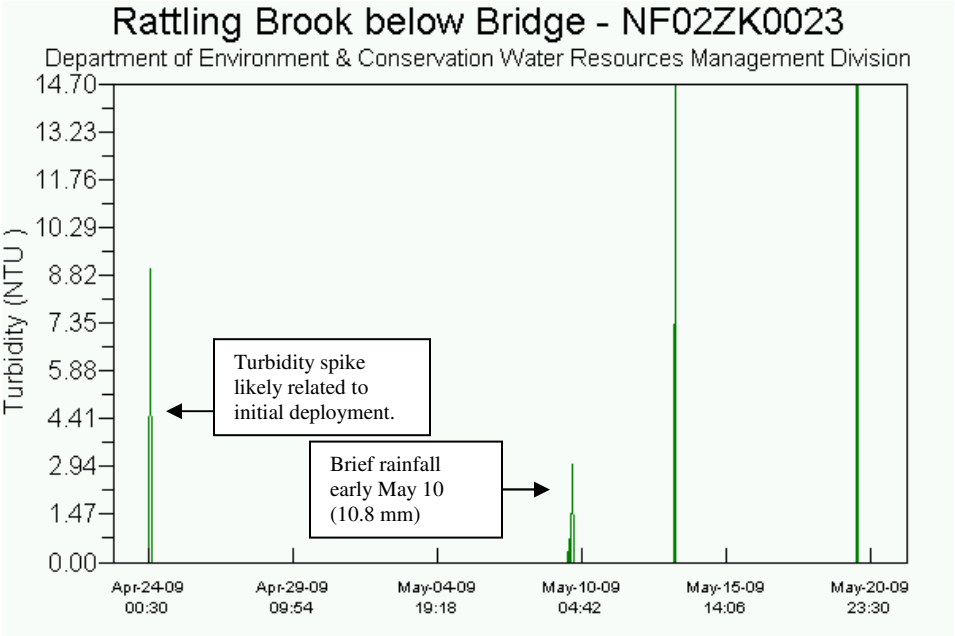
- Specific conductivity ranged from 35.7µS/cm to 37.9µS/cm from April 24th to May 20th, 2009. With a standard deviation of only 0.331, specific conductivity is very stable at Rattling Brook. A single period of very low conductivity is likely due to a communication dropout resulting in a value of '0'.

Figure 5: Specific conductivity at Rattling Brook from April 24 to May 20, 2009



- The deployment average (April 24 – May 20) was 0.043 ntu. The turbidity ranged from 0.0 ntu to a high of14.7 ntu on May 13 at 15:30. Debris or bubbles were likely responsible for obstructing the turbidity probe and influencing the highest reading of 14.7 ntu. Actual water turbidity was probably 0.0 ntu as the five reporting periods before and after the high value were 0.0 ntu.

Figure 6: Turbidity at Rattling Brook from April 24 to May 20, 2009



Appendix

Daily Data Report for April 2009

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	2.4	-1.4	0.5	17.5	0.0	M	M	0.0		35	39
02†	1.8	-0.5	0.7	17.3	0.0	M	M	0.0		23	43
03†	1.8	-0.7	0.6	17.4	0.0	M	M	0.0		21	37
04†	11.1	0.7	5.9	12.1	0.0	M	M	20.1		16	69
05†	10.8	1.8	6.3	11.7	0.0	M	M	2.5		19	61
06†	4.5	0.6	2.6	15.4	0.0	M	M	1.3			<31
07†	5.9	0.1	3.0	15.0	0.0	M	M	1.1		14	67
08†	15.5	2.0	8.8	9.2	0.0	M	M	15.4		19	89
09†	7.3	-0.3	3.5	14.5	0.0	M	M	0.0		22	33
10†	6.6	-0.7	3.0	15.0	0.0	M	M	0.0		21	35
11†	4.2	0.7	2.5	15.5	0.0	M	M	0.0		26	39
12†	16.2	1.6	8.9	9.1	0.0	M	M	4.4		18	74
13†	11.5	1.7	6.6	11.4	0.0	M	M	0.6		18	65
14†	5.1	0.2	2.7	15.3	0.0	M	M	2.0		27	56
15†	2.1	-1.7	0.2	17.8	0.0	M	M	0.0		25	56
16†	1.2	-4.0	-1.4	19.4	0.0	M	M	0.0		33	44
17†	0.5	-5.1	-2.3	20.3	0.0	M	M	0.0		27	44
18†	1.1	-3.8	-1.4	19.4	0.0	M	M	0.0		27	32
19†	3.5	-3.3	0.1	17.9	0.0	M	M	0.0		22	32
20†	4.8	-0.5	2.2	15.8	0.0	M	M	0.0		22	32
21†	5.5	0.3	2.9	15.1	0.0	M	M	0.0		20	37
22†	11.4	0.0	5.7	12.3	0.0	M	M	0.0		17	43
23†	15.8	5.3	10.6	7.4	0.0	M	M	3.1		19	91
24†	10.1	1.8	6.0	12.0	0.0	M	M	0.0		19	46
25†	8.1	1.1	4.6	13.4	0.0	M	M	0.0			<31
26†	7.3	1.5	4.4	13.6	0.0	M	M	0.7		5	56
27†	6.2	-0.1	3.1	14.9	0.0	M	M	0.0		4	43
28†	4.5	2.0	3.3	14.7	0.0	M	M	2.3		20	57
29†	7.5	0.0	3.8	14.2	0.0	M	M	5.5		33	54
30†	5.0	0.2	2.6	15.4	0.0	M	M	0.0		29	44
Sum				**440.0**	**0.0**	**M**	**M**	**59.0**			
Avg	**6.6**	**0**	**3.31**								
Xtrm	**16.2**	**-5.1**								**19**	**91**

Daily Data Report for May 2009											
Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	8.3	1.4	4.9	13.1	0.0	M	M	7.6		20	89
02†	6.6	3.6	5.1	12.9	0.0	M	M	9.7		20	74
03†	6.6	3.0	4.8	13.2	0.0	M	M	4.3			<31
04†	8.8	3.9	6.4	11.6	0.0	M	M	2.6		20	39
05†	8.2	2.1	5.2	12.8	0.0	M	M	0.0		20	33
06†	9.9	2.7	6.3	11.7	0.0	M	M	11.9		14	56
07†	7.0	3.3	5.2	12.8	0.0	M	M	3.4		21	50
08†	10.0	4.0	7.0	11.0	0.0	M	M	29.1		19	50
09†	6.4	2.5	4.5	13.5	0.0	M	M	0.0		22	44
10†	7.6	2.4	5.0	13.0	0.0	M	M	9.8		12	57
11†	5.6	1.4	3.5	14.5	0.0	M	M	0.7		34	65
12†	5.5	1.0	3.3	14.7	0.0	M	M	0.0		20	37
13†	7.7	-0.8	3.5	14.5	0.0	M	M	0.0		21	39
14†	14.3	3.9	9.1	8.9	0.0	M	M	0.0		20	37
15†	13.7	4.6	9.2	8.8	0.0	M	M	0.0		21E	46E
16†	7.8	3.3	5.6	12.4	0.0	M	M	0.0		20	41
17†	12.5	3.9	8.2	9.8	0.0	M	M	0.0			<31
18†	15.1	7.7	11.4	6.6	0.0	M	M	2.9			<31
19†	14.5	6.7	10.6	7.4	0.0	M	M	7.1		20	44
20†	7.6	4.2	5.9	12.1	0.0	M	M	0.8		22	50
21†	9.0	3.8	6.4	11.6	0.0	M	M	0.0		20	52
22†	10.2	4.8	7.5	10.5	0.0	M	M	0.0		20	52
23†	10.7	3.2	7.0	11.0	0.0	M	M	0.0		25	46
24†	9.5	2.4	6.0	12.0	0.0	M	M	3.7		15	44
25†	10.2E	5.9E	8.1E	9.9E	0.0E	M	M	4.5E		M	M
Sum				290.3*	0.0*	M	M	98.1*			
Avg	9.3*	3.4*	6.4*								
Xtrm	15.1*	-0.8*								20*	89*

Prepared by:

Ryan Pugh

Regional Water Quality Officer

Department of Environment and Conservation

Water Resources Management Division

Phone: 709.729.1681

Fax: 709.729.3020