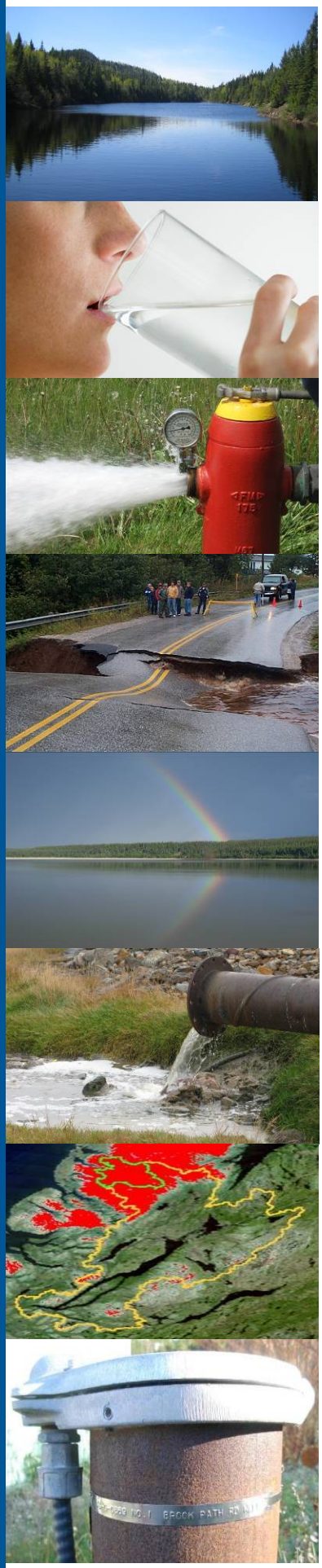


Waterford River @ Kilbride

NF02ZM0009

September - October 2011

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

Real Time Water Quality Monthly Report
Waterford River - St. John's NL
September–October 2011

General

- Data from the Waterford River real-time station is regularly monitored by the Water Resources Management Division staff.
- The instrument used for the deployment period from August 26th until November 9th was a YSI 6600 series multi-probe, which continuously measured water temperature; pH; specific conductivity; dissolved oxygen and turbidity. The duration of the deployment was 75 days.
- There are no data available from November 2 to November 9 due to transmission failure.

Maintenance and Calibration of Instrumentation

- **Table 1** displays the dates when routine cleaning, maintenance and calibration was performed on the water quality probe during this deployment.

Table 1: Table of Water Quality Probe Installation and Removal

Date Installed	Date Removed
August 26th , 2011	November 9th , 2011

- Water quality readings were taken with a second freshly cleaned and calibrated water quality instrument at the time of installation and removal for QAQC comparison.

Quality Assurance and Quality Control

- Deployment and removal comparison rankings between the field instrument and the QAQC instrument are summarized in **Table 2**.

Table 2: Comparison rankings for Waterford @ Kilbride station, August 26th to November 9, 2011

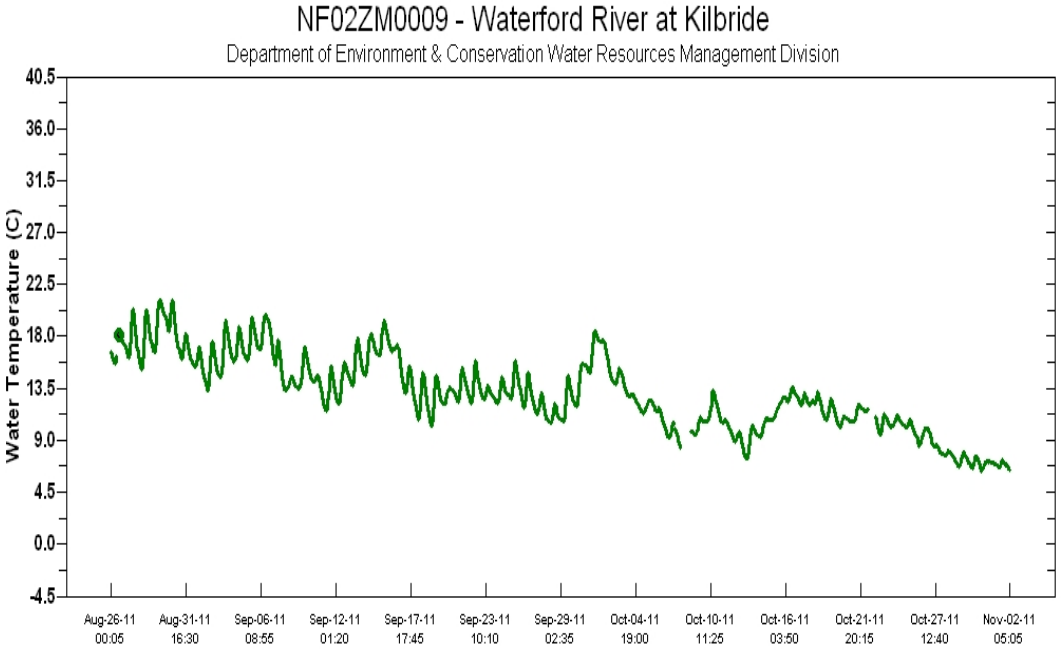
Date	Action	Comparison Ranking				
		Temp	pH	SpC	DO	Turb
August 26, 2011	Deployment Ranking	Excellent	Excellent	Marginal	Excellent	Excellent
November 9, 2011	Removal Ranking	Excellent	Good	Poor	Fair	Excellent

- **Deployment rankings** of "excellent" for water temperature, pH, dissolved oxygen and turbidity indicate successful cleaning and calibration, which should enable these sensors to produce reliable data during the subsequent deployment period. A deployment ranking of "marginal" for specific conductivity may result in measured sensor values drifting beyond reliable limits over the duration of the deployment.
- **Removal rankings** of "excellent", "good" and "fair" for water temperature, pH, dissolved oxygen and turbidity increase confidence that the data collected for these parameters over the duration of this deployment are reliable. A removal ranking of "poor," obtained by comparing specific conductivity values measured by the field sonde and a QAQC sonde at the end of the deployment period, indicates that the data for this parameter are less reliable.

Data Interpretation

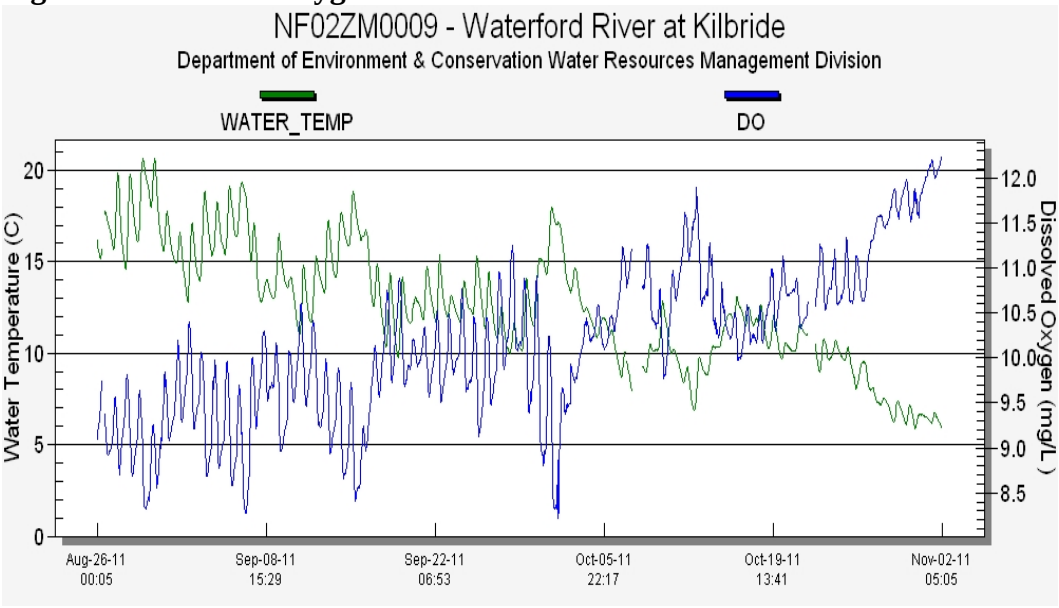
- **Water temperatures** showed an expected seasonal decreasing trend over the duration of this deployment, ranging from 20.66 down to 5.86 ^{o}C. Water temperature data are shown in **Figure 1** below.

Figure 1: Water Temperature



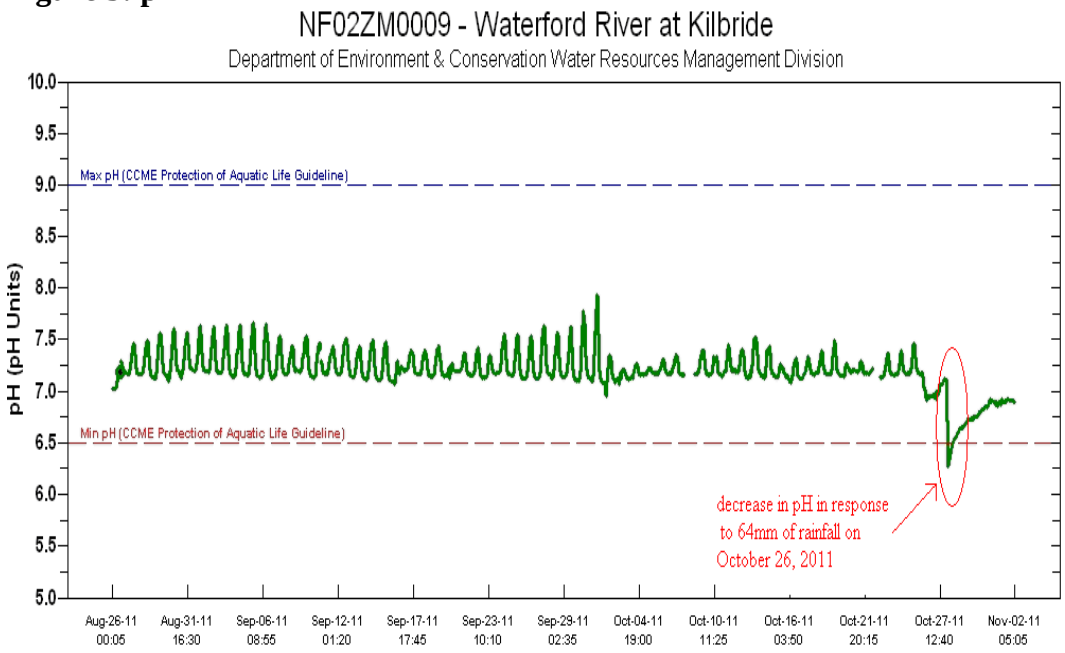
- **Dissolved oxygen (DO)** has an inverse relationship with water temperature whereby DO levels generally increase as water temperatures decrease. Dissolved oxygen values are shown in green and water temperatures are shown in blue in **Figure 2**, below. The graph indicates that dissolved oxygen levels peaked at 12.23mg/L on November 2nd, the same day that water temperature reached one of its lowest levels of 5.92^{o}C. DO concentration dropped to its lowest level of 8.22 mg/L on October 2nd, corresponding to a high water temperature of 18.17 ^{o}C.

Figure 2: Dissolved Oxygen



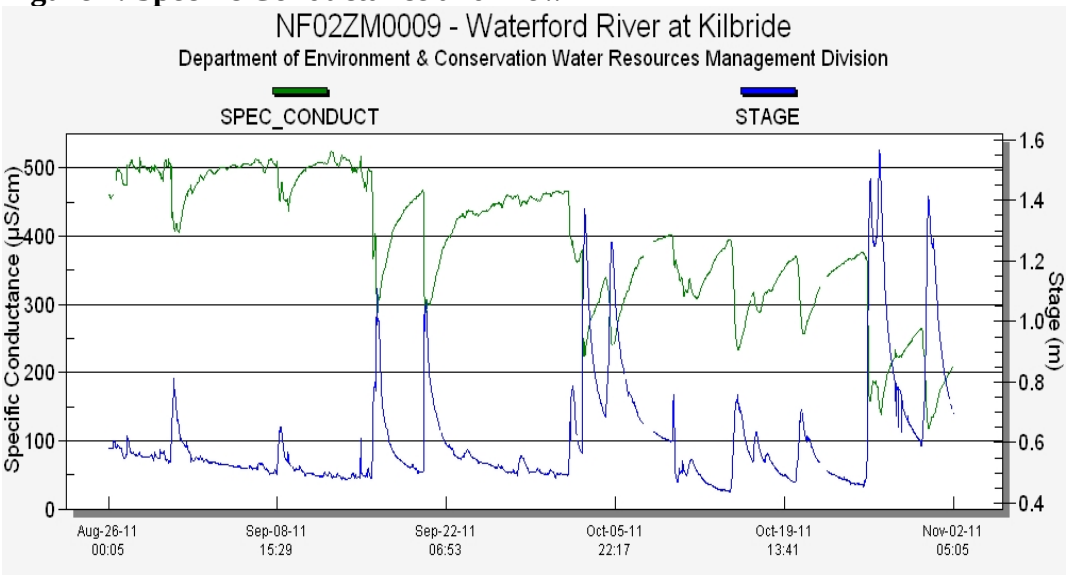
- **pH** levels were fairly constant and, for most of the deployment period, fell within the CCME recommended minimum and maximum guidelines for the Protection of Aquatic Life, of 6.5 and 9.0 pH units, respectively. pH levels decreased sharply on October 28, in response to the 64mm of rain that fell on October 26th, and the increased flows from tributaries and surface run-off. pH data is graphed in **Figure 3** below. The increased acidity (decreased pH) is most likely the result of the effects of acid rain in combination with surface run-off within the watershed.

Figure 3: pH



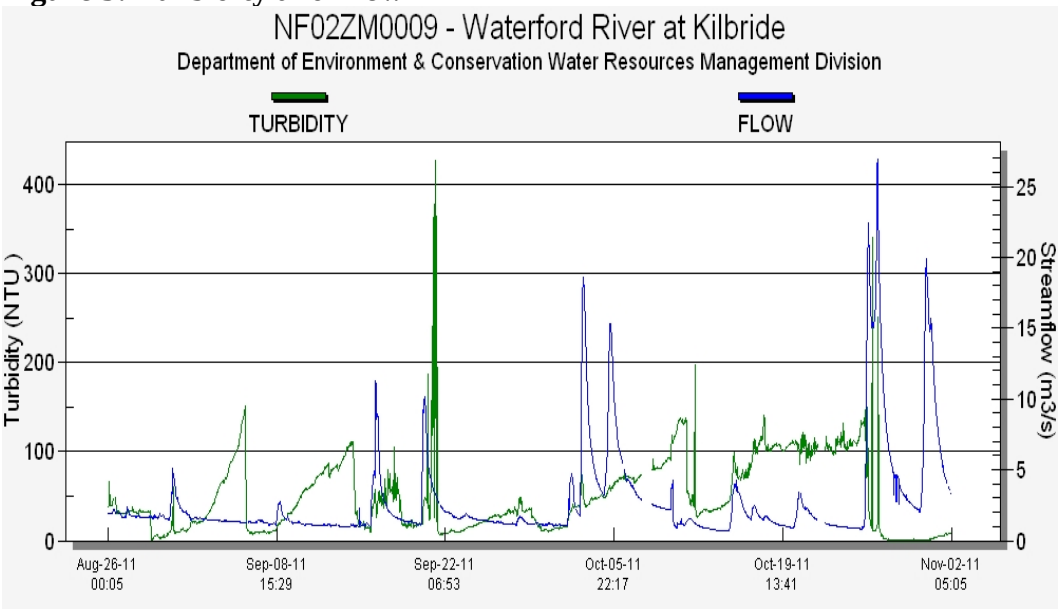
- **Specific conductivity** levels were within the expected range for Waterford River during this deployment period, ranging between 119 and 525µS/cm. Precipitation during the warmer months (when road salt is not being used for ice control) generally has a dilution effect, resulting in decreased specific conductivity. This relationship between specific conductivity and precipitation is seen in **Figure 4**, which graphs specific conductivity values for this deployment period in green, and flow values in blue. The Environment Canada Daily Climate Data for September 2011 for the St. John's region are shown below in **Appendix 1,** below**.** The Environment Canada Daily Climate Data for October 2011 are shown below in **Appendix 2.**

Figure 4: Specific Conductance and Flow



- **Turbidity** levels fluctuated between 0.0 and 427.1 NTU during this deployment, as shown below in **Figure 5**. Turbidity spikes often occurred immediately after significant precipitation, resulting in increased surface run-off and suspended particles. Turbidity returned to background levels after higher flows subsided. Turbidity values are graphed in green and flow is graphed in blue, in Figure 5. Environment Canada Daily Climate Data is presented in Appendices 1 and 2, following this report.

Figure 5: Turbidity and Flow



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APPENDIX 1 Environment Canada Daily Climate Data for St. John's, NL:
September 2011

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	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†	15.6	8.8	12.2	5.8	0.0	0.4	0.0	0.4			<31
02†	21.1	9.6	15.4	2.6	0.0	0.0	0.0	0.0		24	35
03†	21.9	11.5	16.7	1.3	0.0	0.0	0.0	0.0		19	33
04†	22.9	13.6	18.3	0.0	0.3	0.0	0.0	0.0		28E	35E
05†	24.4	13.3	18.9	0.0	0.9	0.0	0.0	0.0		24	52
06†	25.0	14.3	19.7	0.0	1.7	1.2	0.0	1.2		26	54
07†	14.5	7.2	10.9	7.1	0.0	2.4	0.0	2.4		33	87
08†	15.1	11.4	13.3	4.7	0.0	6.4	0.0	6.4		25E	50E
09†	19.7	11.6	15.7	2.3	0.0	0.0	0.0	0.0		26	54
10†	12.7	4.8	8.8	9.2	0.0	T	0.0	T		35	59
11†	14.3	5.1	9.7	8.3	0.0	0.0	0.0	0.0		25E	57E
12†	18.0	11.1	14.6	3.4	0.0	0.0	0.0	0.0		34	65
13†	20.8	11.2	16.0	2.0	0.0	T	0.0	T		26	35
14†	22.5	13.0	17.8	0.2	0.0	T	0.0	T		25	57
15†	23.2	15.9	19.6	0.0	1.6	T	0.0	T		18	43
16†	19.0	9.6	14.3	3.7	0.0	18.0	0.0	18.0		25	80
17†	14.6	6.1	10.4	7.6	0.0	T	0.0	T		26	87
18†	15.5	6.1	10.8	7.2	0.0	0.0	0.0	0.0			<31
19†	17.8	6.8	12.3	5.7	0.0	0.0	0.0	0.0			<31
20†	14.0	9.5	11.8	6.2	0.0	17.0	0.0	17.0		30E	56E
21†	18.0	9.1	13.6	4.4	0.0	0.2	0.0	0.2		29	46
22†	18.3	9.6	14.0	4.0	0.0	0.0	0.0	0.0		27	39
23†	14.9	7.9	11.4	6.6	0.0	2.0	0.0	2.0			<31
24†	13.4	7.3	10.4	7.6	0.0	0.0	0.0	0.0		27	39
25†	16.9	10.6	13.8	4.2	0.0	0.0	0.0	0.0		27	74
26†	15.8	5.7	10.8	7.2	0.0	T	0.0	T		31	48
27†	9.9	5.7	7.8	10.2	0.0	4.0	0.0	4.0		36	43
28†	11.7	5.7	8.7	9.3	0.0	3.4	0.0	3.4		26E	54E
29†	17.0	9.9	13.5	4.5	0.0	0.0	0.0	0.0		26	63
30†	20.9	11.2	16.1	1.9	0.0	0.4	0.0	0.4		22	59

APPENDIX 2 Environment Canada Daily Climate Data for St. John's, NL:
October 2011:

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	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†	23.5	15.4	19.5	0.0	1.5	T	0.0	T		24	56
02†	21.2	8.6	14.9	3.1	0.0	9.4	0.0	9.4		26	44
03†	16.8	8.4	12.6	5.4	0.0	27.0	0.0	**27.0**		32	78
04†	10.0	7.7	8.9	9.1	0.0	0.8	0.0	0.8		10	54
05†	15.3	7.2	11.3	6.7	0.0	13.6	0.0	13.6		11	67
06†	11.1	3.7	7.4	10.6	0.0	2.0	0.0	2.0		22	95
07†	6.8	0.9	3.9	14.1	0.0	1.4	0.4	1.8	T	29E	57E
08†	9.0	1.3	5.2	12.8	0.0	0.2	0.0	0.2		25	46

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	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
09†	11.2	4.9	8.1	9.9	0.0	0.0	0.0	0.0		26	48
10†	17.0	6.3	11.7	6.3	0.0	4.0	0.0	4.0		25	46
11†	7.4	4.1	5.8	12.2	0.0	9.6	0.0	9.6		32	69
12†	6.7	0.4	3.6	14.4	0.0	0.2	0.0	0.2		35	50
13†	11.0	3.9	7.5	10.5	0.0	0.0	0.0	0.0		26E	59E
14†	11.7	7.2	9.5	8.5	0.0	0.2	0.0	0.2		16E	39E
15†	17.5	9.5	13.5	4.5	0.0	28.0	0.0	**28.0**		18	59
16†	19.5	11.4	15.5	2.5	0.0	7.8	0.0	7.8		27	39
17†	15.0	10.0	12.5	5.5	0.0	3.2	0.0	3.2		19	67
18†	15.2	8.9	12.1	5.9	0.0	0.4	0.0	0.4		24	50
19†	15.7	7.4	11.6	6.4	0.0	0.0	0.0	0.0		24	43
20†	10.0	7.3	8.7	9.3	0.0	16.0	0.0	16.0		9	41
21†	16.6	7.5	12.1	5.9	0.0	2.0	0.0	2.0		26	43
22†	14.7	5.5	10.1	7.9	0.0	T	0.0	T		24	41
23†	13.7	5.7	9.7	8.3	0.0	0.0	0.0	0.0			<31
24†	10.0	6.0	8.0	10.0	0.0	T	0.0	T			<31
25†	7.8	5.1	6.5	11.5	0.0	1.4	0.0	1.4		9	78
26†	9.6	5.7	7.7	10.3	0.0	64.4	0.0	**64.4**		8	82
27†	6.4	2.2	4.3	13.7	0.0	2.4	0.2	2.6	T	29	96
28†	3.4	1.0	2.2	15.8	0.0	0.8	2.4	3.2	T	28	59
29†	6.8	-0.2	3.3	14.7	0.0	0.6	0.0	0.6		28	67
30†	5.2	-0.9	2.2	15.8	0.0	33.0	0.0	33.0		9	72
31†	6.0	2.0	4.0	14.0	0.0	22.0	T	22.0		33	82