Waterford River
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NF02ZM0009

October 2013

Government of Newfoundland & Labrador

Department of Environment and Conservation

Real Time Water Quality Monthly Report
Waterford River - St. John's, NL
September 30 to October 30, 2013

General

- Data from the Waterford River real-time station is regularly monitored by the Water Resources Management Division (WRMD).
- The instrument used for the deployment period from September 30 to October 30, 2013 was a YSI 6600 series multi-probe, which continuously measured water temperature, dissolved oxygen, pH, specific conductivity and turbidity. The duration of the deployment was 30 days.

Maintenance and Calibration of Instruments

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

Table 1: **Table of Water Quality Probe Installation and Removal**

Date Deployed	Date Removed
September 30, 2013	October 30, 2013

- Water quality readings were taken with a second freshly cleaned and calibrated water quality instrument at the time of deployment and removal, in compliance with WRMD quality assurance and quality control protocol.

Deployment

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

Table 2: Field sonde to QAQC sonde comparison rankings for deployment of the RTWQ instrument on September 30, 2013

Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	15.08	15.21	0.13	Excellent
pH			0.40	N/A
Specific Conductivity (µS/cm)	379.0	372.1	1.8	Excellent
Total Dissolved Solids (g/l)	0.2460	0.2382	0.0078	
Dissolved Oxygen (%-Sat)	100.7	99.5	1.2	
Dissolved Oxygen (mg/l)	10.13	9.81	0.32	Good
Turbidity (NTU)	1.6	0.8	0.8	Excellent

- **Deployment rankings** of "excellent" and "good" for water temperature, specific conductivity, dissolved oxygen and turbidity indicate successful cleaning and calibration, which enable these sensors to produce reliable data during the deployment period. The pH sensor is damaged, thus pH data is not available for this deployment.

Removal

- Removal comparison rankings between the field instrument and the QAQC instrument are summarized in **Table 3**.

Table 3: Field sonde to QAQC sonde comparison rankings for removal of the RTWQ instrument on October 30, 2013

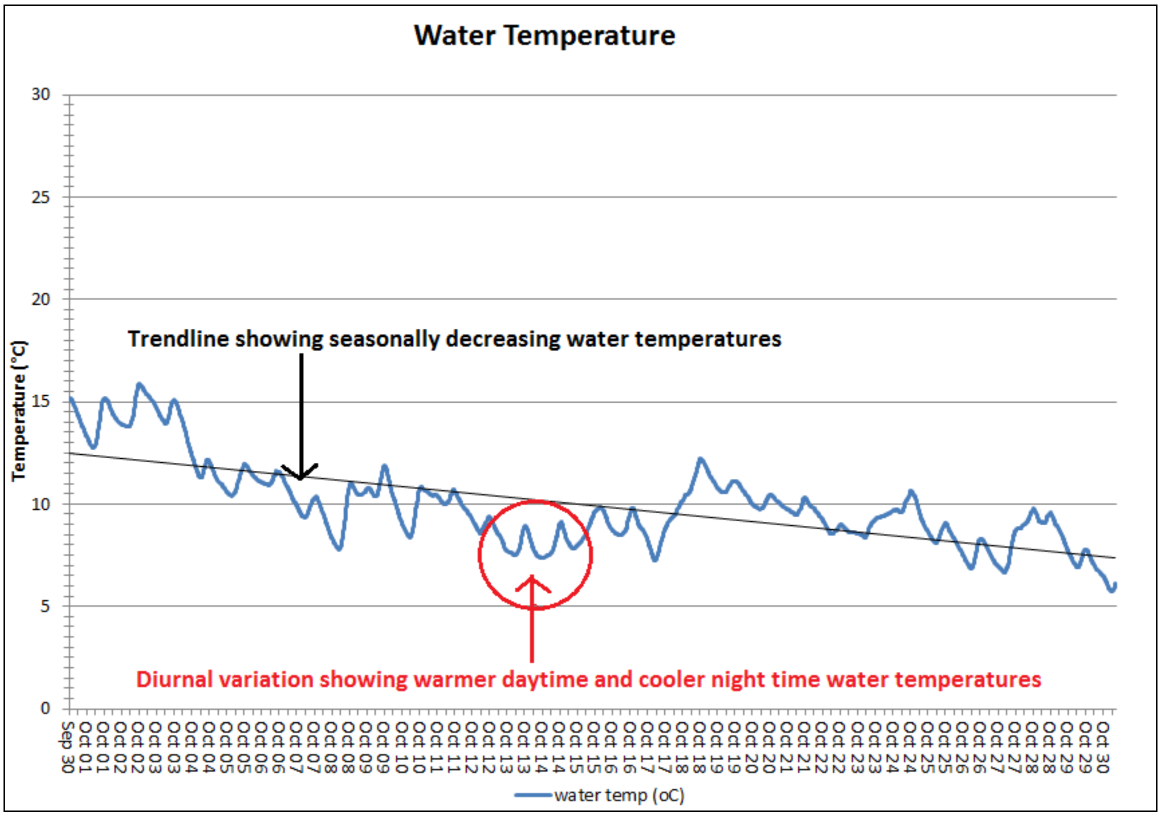
Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	6.11	6.20	0.09	Excellent
pH				N/A
Specific Conductivity (µS/cm)	379.0	379.4	0.1	Excellent
Total Dissolved Solids (g/l)	0.2470	0.2470	0.0000	
Dissolved Oxygen (%-Sat)	101.7	102.3	0.6	
Dissolved Oxygen (mg/l)	12.62	12.66	0.04	Excellent
Turbidity (NTU)	6.1	4.4	1.7	Excellent

Removal rankings of “excellent” for water temperature, specific conductivity, dissolved oxygen and turbidity increase confidence that the data collected for these parameters over the duration of this deployment are reliable. As indicated above, the pH sensor is damaged and pH data is not available for this deployment period.

Data Interpretation

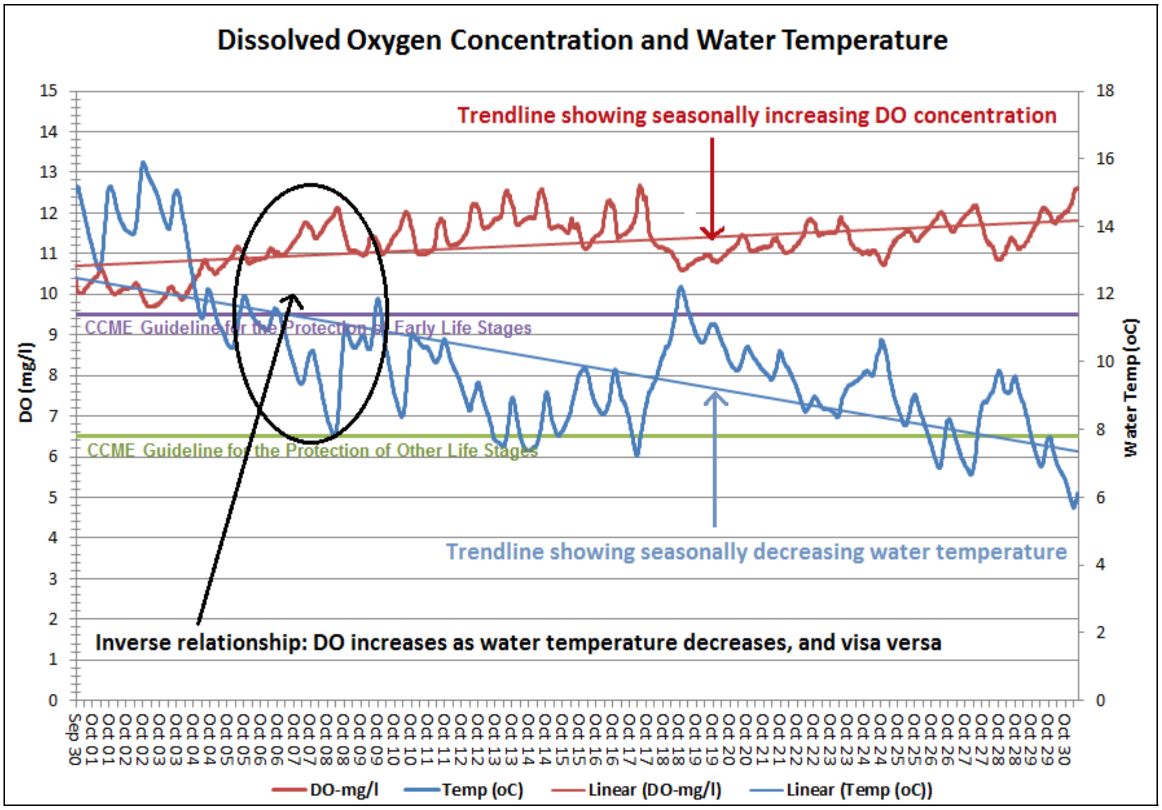
▪ A graph of **water temperature,** which fluctuated between 5.7 and 15.89°C during this deployment period, is shown in blue in **Figure 1**, below. Diurnal variation in water temperature is clearly seen with colder temperatures occurring at night and warmer temperatures occurring during the day, corresponding with cooler nightly air and warmer daily air temperatures. Water temperature during this deployment is showing an overall decreasing trend in response to seasonally decreasing air temperature. Daily air temperatures for October 2013 are shown in Environment Canada's Daily Climate Data, in **Appendix 1** at the end of this report.

Figure 1: Water Temperature



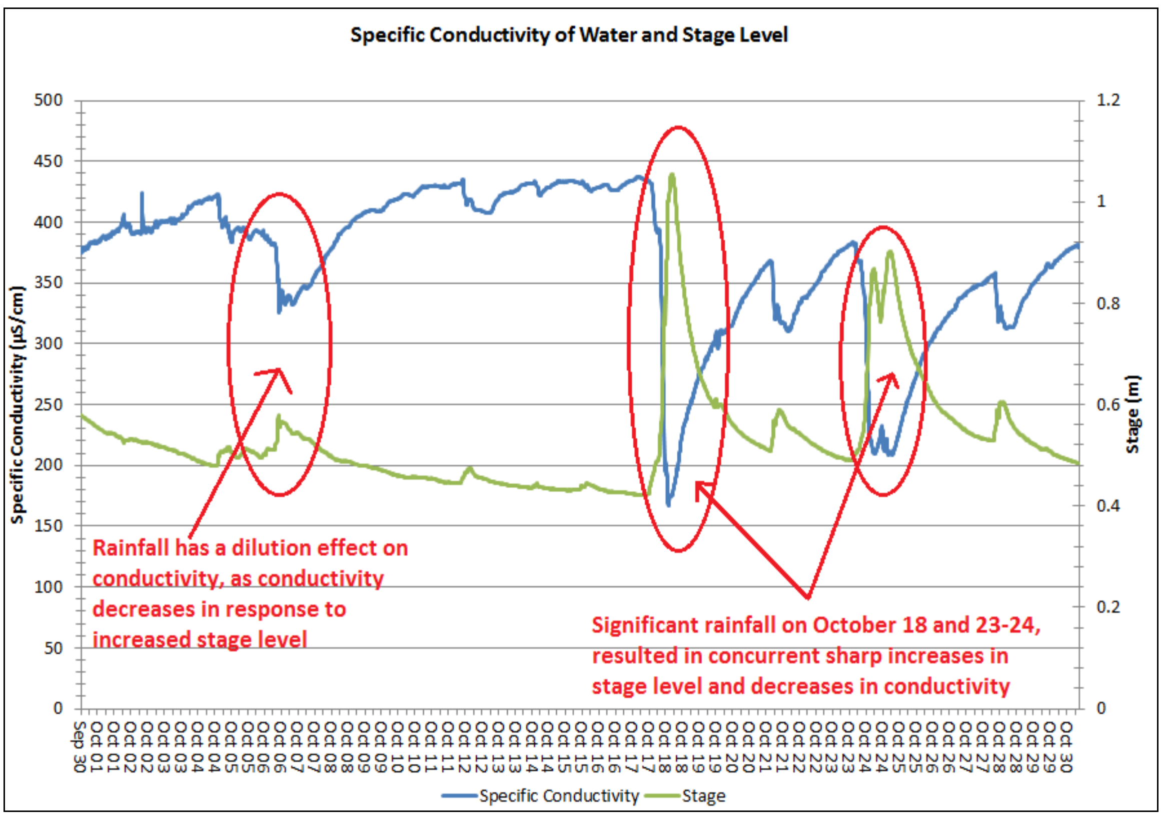
▪ **Dissolved Oxygen** (DO) measurements during this deployment ranged between 9.68 and 12.67 mg/l. DO concentrations are shown in red in the graph in **Figure 2**, along with water temperatures which are shown in blue. Dissolved oxygen is showing a seasonally increasing trend over the course of the deployment, while water temperature is showing a seasonally decreasing trend. The inverse relationship between dissolved oxygen concentration and water temperature is apparent in the graph, as DO levels decrease in response to increasing water temperatures, and DO levels increase in response to decreasing water temperatures. This relationship is based on the fact that the solubility of oxygen is greater in colder water than in warmer water. All DO measurements were above the minimum guidelines recommended by the CCME for the protection of freshwater aquatic life, of 9.5 mg/L for early life stages and 6.5 mg/L for other life stages in cold water systems

Figure 2: Dissolved Oxygen



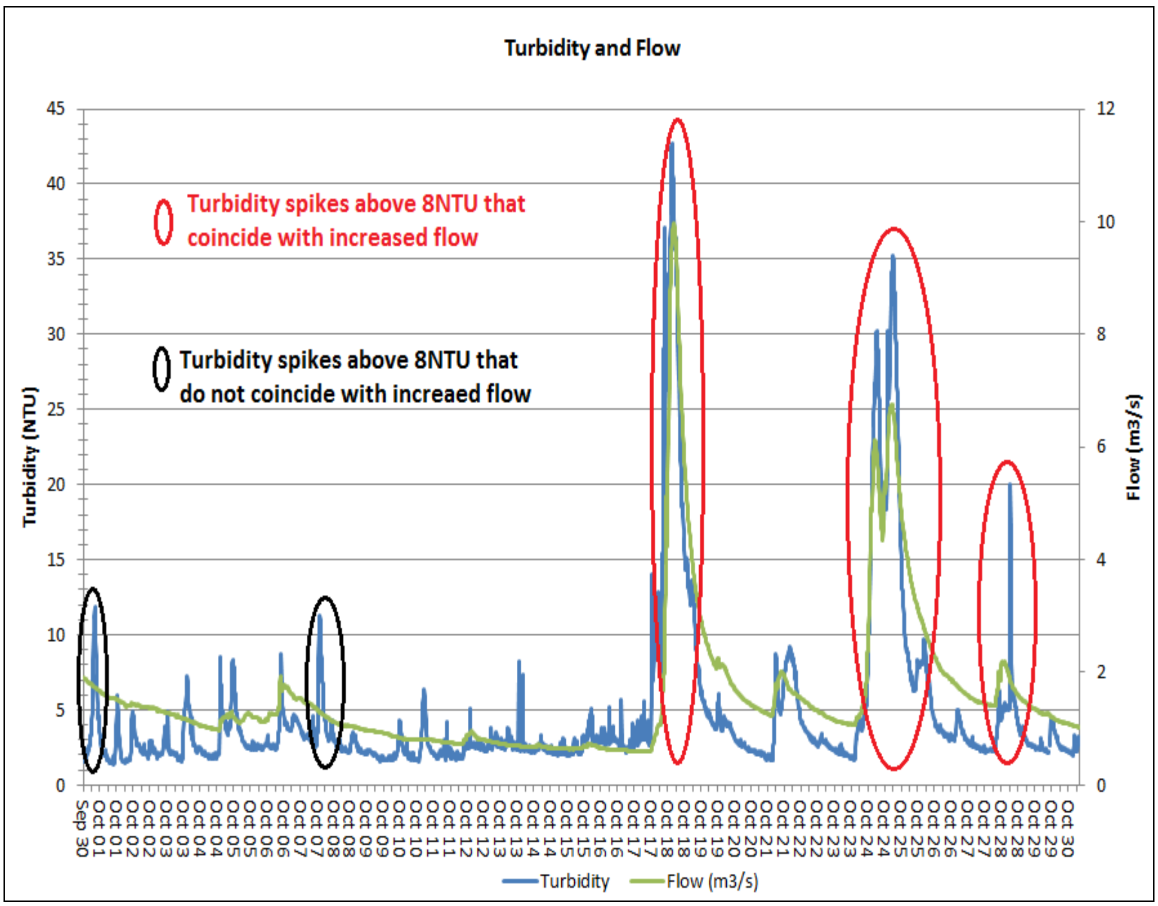
- **Specific conductivity (SpC)** measures the ability of water to pass an electrical current. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through granite bedrock tend to have lower conductivity than those that flow through limestone and clay soils. High specific conductance readings are often influenced by urban run-off. The effects of urban run-off are dependent upon the season. During warmer temperatures, when road salt is not being used for ice control, rainfall and urban run-off can have a dilution effect, causing specific conductivity levels to decrease as stage height increases. However, during the winter months when road salting operations are in effect, urban run-off can result in spikes in specific conductivity. In **Figure 4,** below, specific conductivity (shown in blue) tends to increase during dry spells marked by decreases in stage level (shown in green); and conversely, specific conductivity decreases as stage level increases. This observation is supported by Environment Canada Daily Climate Data, presented in **Appendix 1,** at the end of this report. The climate data indicate there was moderate rainfall from October 4-6, which resulted in a concurrent moderate increase in stage level and decrease in conductivity, as shown in **Figure 4**. Although there is no climate data for October 18, it appears as though there was significant rainfall on this date, as indicated in **Figure 4** by a quick spike in stage level coinciding with a sharp decrease in conductivity. According to the climate data in **Appendix 1**, there was significant rainfall on October 23-24, which is apparent in **Figure 4** as a concurrent spike in stage level and decrease in conductivity occurred during those dates. Specific conductance values in Waterford River during this deployment period were within the expected range for the river at this time of year, ranging between 167 and 437µS/cm.

Figure 4: Specific Conductance and Stage Level



- **Turbidity** is a measure of water clarity, and the degree to which material suspended in water decreases the passage of light through the water. Suspended materials include soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances. Many turbidity measurements during this deployment were at background levels of less than 8NTU. Three turbidity spikes above 8NTU occurred on October 18, 24-25 and 27, and coincided with spikes in flow. Environment Canada's Daily Climate Data for October 2013, found in **Appendix 1**, indicates that no precipitation data was available for October 18 and 27, however, 38mm of rain fell between October 23 and 24. Other turbidity spikes above 8NTU occurred on September 30 and October 7, which did not coincide with increased flow. The spike on September 30 was probably related to disruption of the river bed during sonde deployment. The spike on October 7 was only marginally above background levels, peaking at 11.3NTU, and is probably the result of run-off caused by light rainfall during the preceding 3 days, as indicated in **Appendix 1**.

Figure 5: Turbidity



Appendix 1:

Environment Canada Daily Climate Data (October, 2013)
St. John's International Airport

October	Max Temp	Min Temp	Mean Temp	Total Rain	Max Wind Gust
2013	°C	°C	°C	mm	km/h
DAY					
01	23.1	12.9	18	1	<31
02	23.1	12.4	17.8	0.6	48
03	17.7	9.7	13.7	T	72
04	11.9	6.6	9.3	**6.6**	82
05	9.5	6.7	8.1	**4.6**	57
06	8.2	3.8	6	**12.6**	50
07	7.7	0.4	4.1	**2.4**	48
08	15.3	1.3	8.3	0.6	43
09	12.1	2.1	7.1	T	52
10	13.9	2	8	0	54
11	7.4	2.4	4.9	4.2	<31
12	6.1	-1.7	2.2	1	44
13	7.4	1	4.2	0.8	63
14	7.7	2.4	5.1	1.4	43
15	10.1	3.7	6.9	4.2	50
16	10	1.5	5.8	0	50
17	10.8	0.8	5.8	37	61
18					
19	11	6.5	8.8	2.8	41
20	8.8	5.9	7.4	T	32
21	11.5	5	8.3	**11.4**	65
22	7.2	3.7	5.5	1	65
23	9.6	2.2	5.9	**11.8**	70
24	11.2	3.7	7.5	**26.6**	67
25	9	2	5.5	0.8	72
26	9	0.4	4.7	0	37
27					
28	10.8	3.1	7	0.8	61
29	7.6	1.2	4.4	0	59
30	4.6	-2.6	1	0	35
31	5.3	0.2	2.8	T	54

*Blank cells = no data available
** T = trace

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