Waterford River
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NF02ZM0009

June 2013

Government of Newfoundland & Labrador

Department of Environment and Conservation

Real Time Water Quality Monthly Report
Waterford River - St. John's NL
May 24- June 25, 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 May 24 to June 25, 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 31 days.

Maintenance and Calibration of Instrumentation

- **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
May 24, 2013	June 25, 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 May 24, 2013

Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	16.47	16.20	0.27	Good
pH	7.75	7.63	0.12	Excellent
Specific Conductivity (µS/cm)	623.0	621.0	0.3	Excellent
Total Dissolved Solids (g/l)	0.0405	0.4040	0.3635	
Dissolved Oxygen (%-Sat)	112.0	111.4	0.6	
Dissolved Oxygen (mg/l)	10.92	10.94	0.02	Excellent
Turbidity (NTU)	0.0	0.0	0.0	Excellent

- **Deployment rankings** of "good" and "excellent" for water temperature, pH, specific conductivity, dissolved oxygen and turbidity indicate successful cleaning and calibration, which enable these sensors to produce reliable data during the deployment period.

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 June 25, 2013

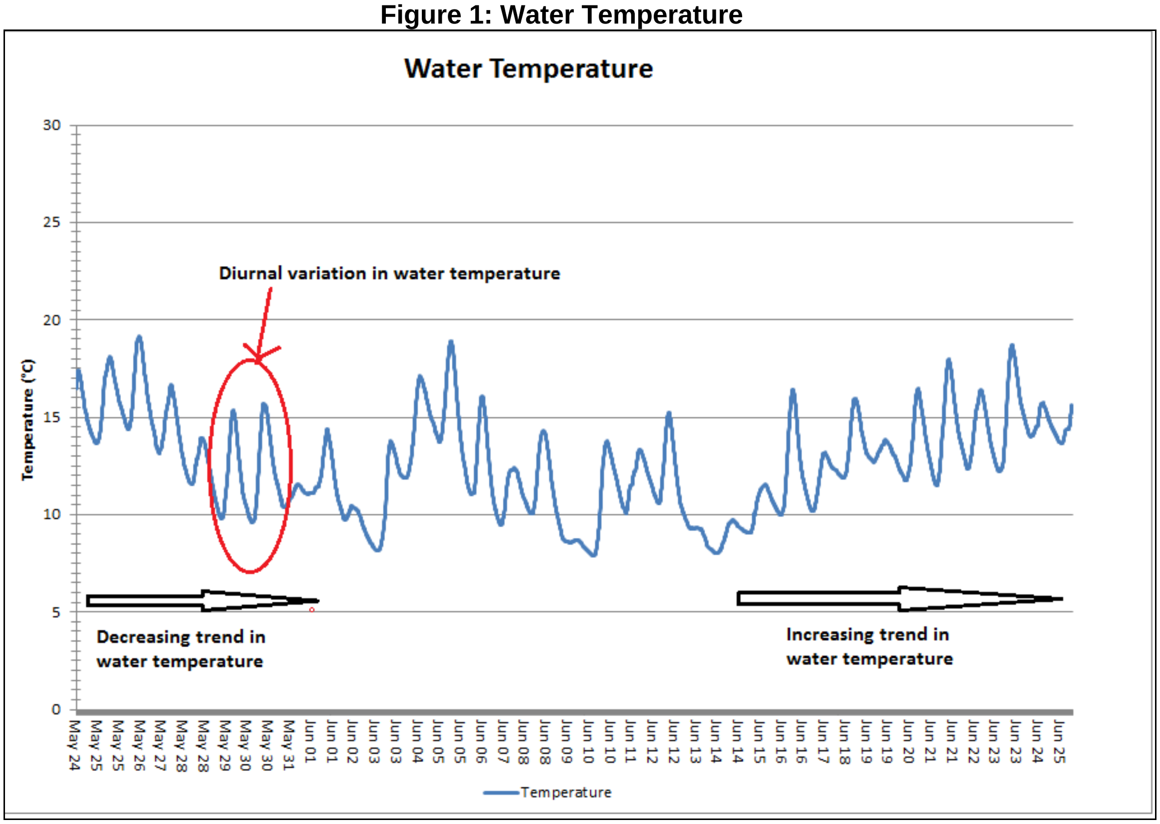
Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	15.61	15.46	0.15	Excellent
pH	7.08	7.60	0.52	Fair
Specific Conductivity (µS/cm)	593.0	608.0	2.5	Excellent
Total Dissolved Solids (g/l)	0.3850	0.3950	0.0100	
Dissolved Oxygen (%-Sat)	105.4	108.1	2.7	
Dissolved Oxygen (mg/l)	10.47	10.77	0.30	Excellent
Turbidity (NTU)	0.0	1.5	1.5	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. A ranking of “fair” for pH indicates that all pH data are acceptable and meet QAQC standards; however, the sensor is aging, and replacement may need to be considered.

Data Interpretation

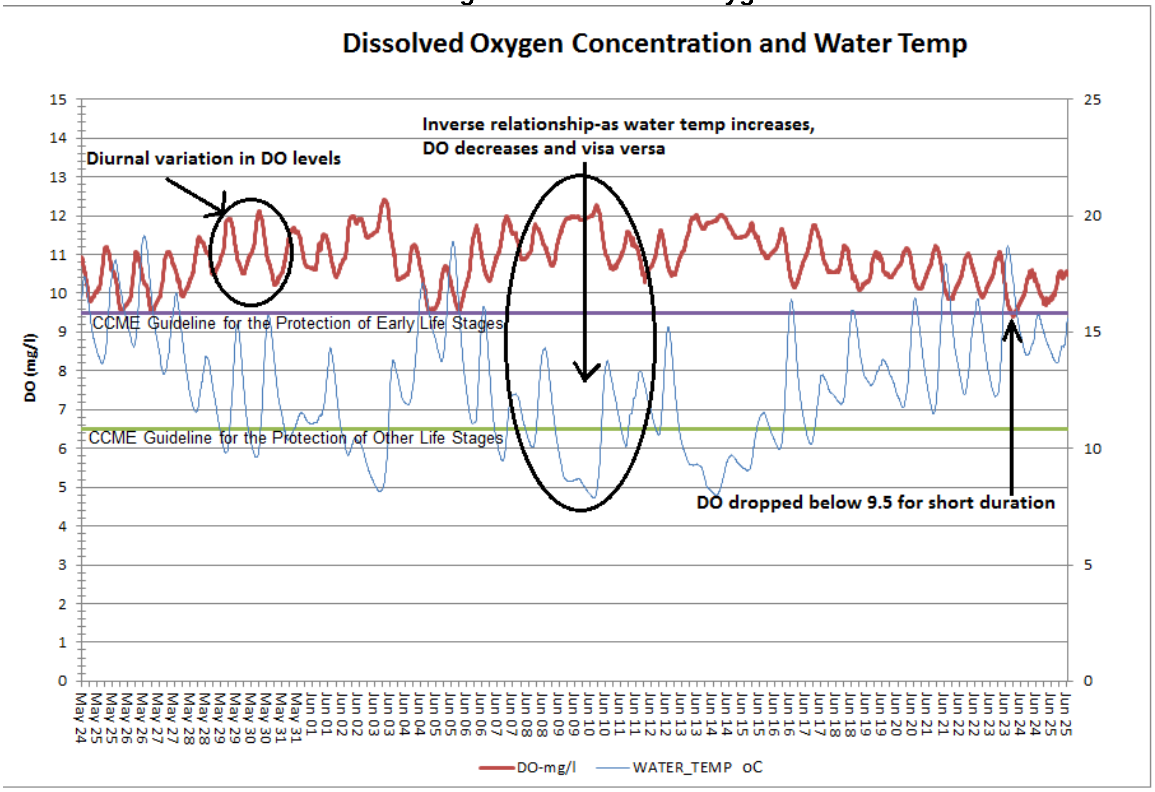
- A graph of **water temperature,** which fluctuated between 7.87 and 19.14^{o}C during this deployment period, is shown in blue ink in Figure 1, below. Diurnal variation in water temperature is clearly seen with colder temperatures occurring at night and warmer temperatures occurring during the day, corresponding with cooler nightly air and warmer daily air temperatures. A decreasing trend in water temperature during the first few days of the deployment, and an increasing trend during the last few days, corresponds with trends in air temperature, as shown in Environment Canada’s Daily Climate Data in **Appendix 1,** at the end of this report.

Figure 1: Water Temperature



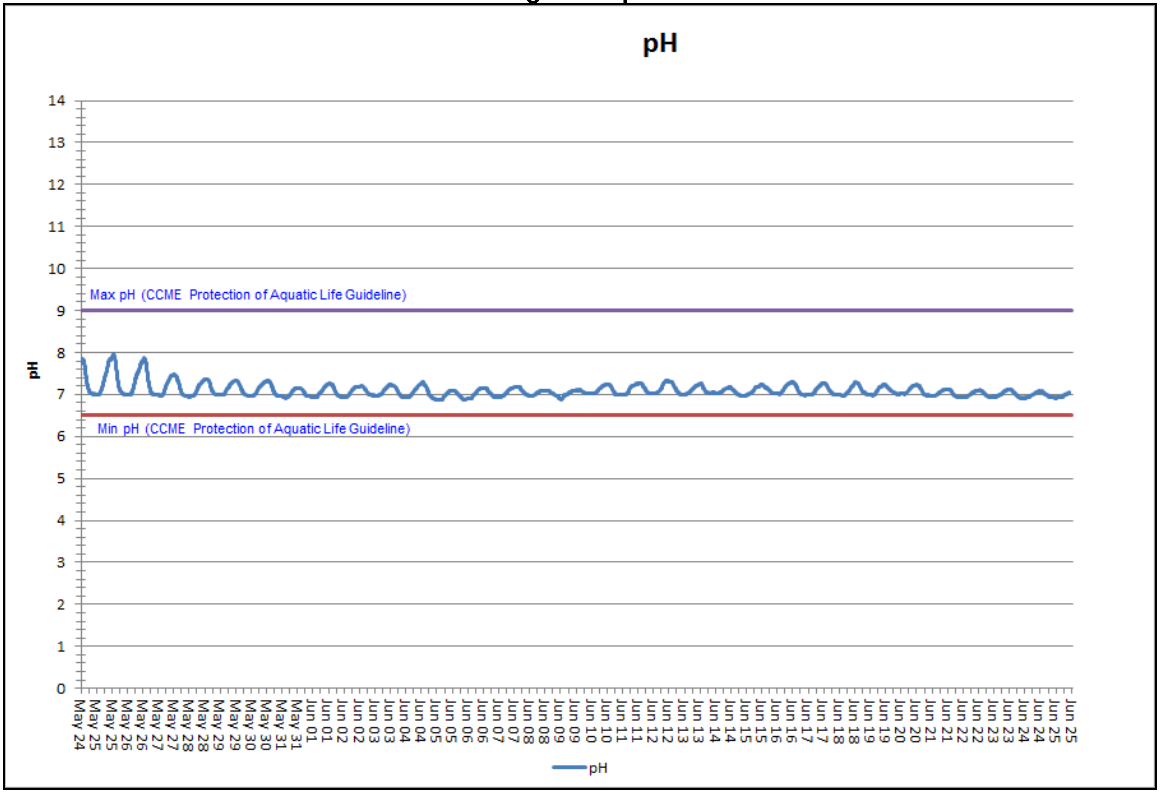
▪ **Dissolved Oxygen** (DO) measurements during this deployment ranged between 9.39 and 12.42 mg/l. Most DO measurements were above the minimum guidelines recommended by the CCME for the protection of freshwater aquatic life, of 9.5 mg/L for early life stages and 6.5 mg/L for other life stages in cold water systems. DO values dropped very slightly below 9.5 mg/L for approximately 3.5 hours on June 23. Diurnal variation in DO is clearly seen in **Figure 2**, where DO is shown in red ink and water temperature in blue. DO levels were lower during the warmer daylight hours and higher at night, corresponding to warmer water temperatures during the daytime and cooler water temperatures at night. This inverse relationship is based on the fact that the solubility of oxygen is greater in colder water than in warmer water, thus as water temperatures decrease DO levels increase.

Figure 2: Dissolved Oxygen



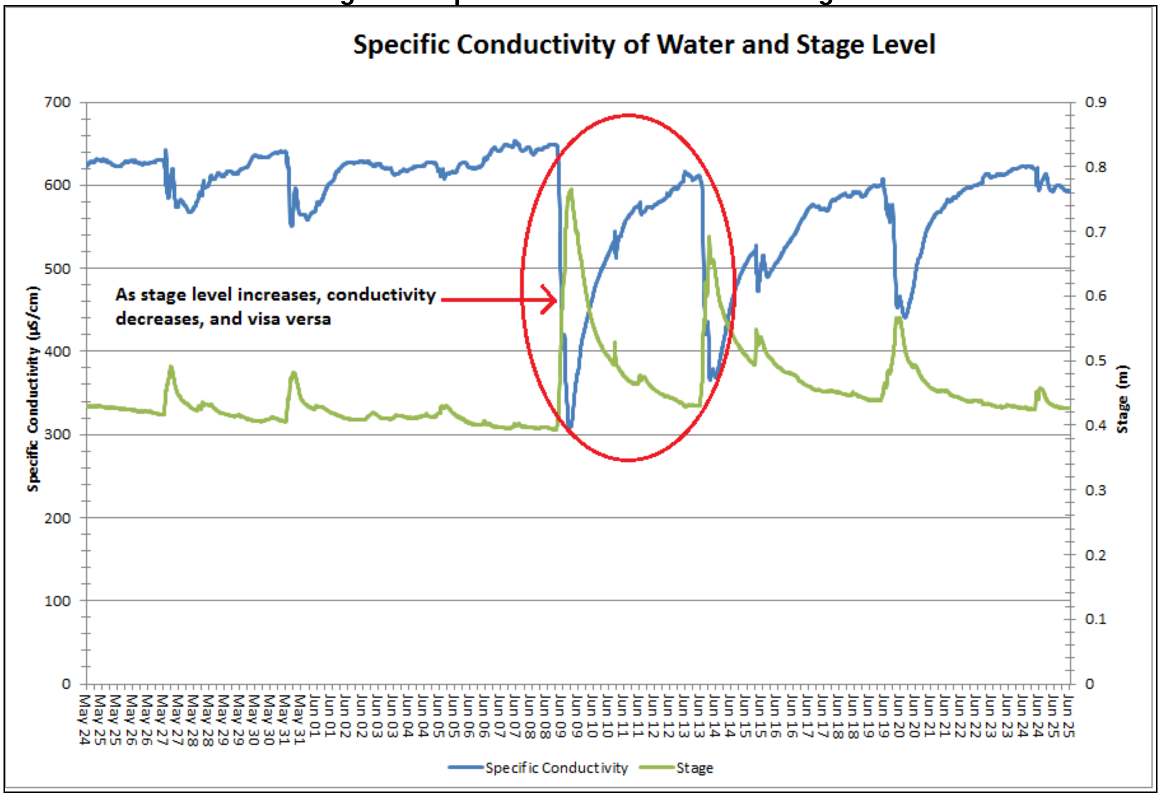
▪ **pH** values during this deployment period were quite stable, ranging from 6.86 to 7.97 pH units. All pH measurements were within the CCME recommended guideline range for the protection of aquatic life, of 6.5 - 9.0 pH units. pH values for this deployment are shown below in **Figure 3.**

Figure 3: pH



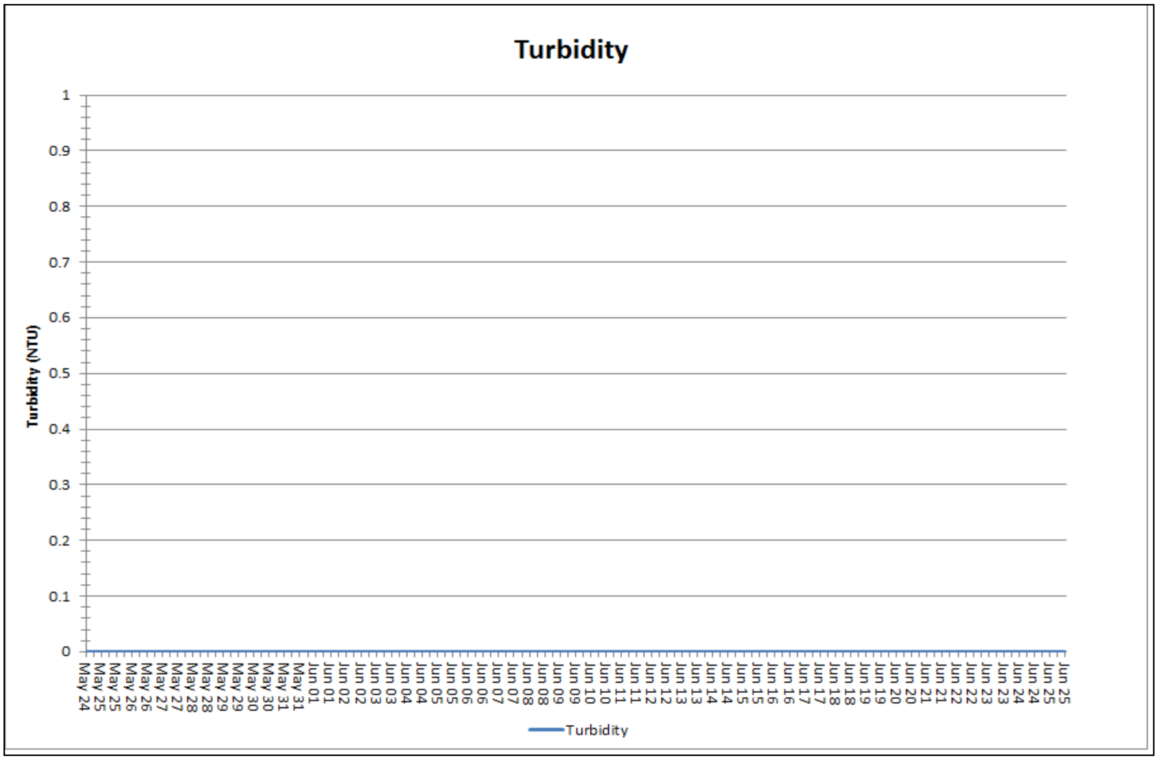
- **Specific conductivity (SpC)** measures the ability of water to pass an electrical current. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through granite bedrock tend to have lower conductivity than those that flow through 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 level 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, increased stage height appears to have a dilution effect on conductivity, as spikes in stage, shown in green, correspond with drops in conductivity, shown in blue. This observation is supported by Environment Canada Daily Climate Data, presented in **Appendix 1,** at the end of this report. The climate data indicate significant rainfall occurred on June 9, 13 and 19 which coincide with concurrent spikes in stage height and dips in conductivity. Specific conductance values in Waterford River during this deployment period were within the expected range for this river at this time of year, ranging between 308 and 653µS/cm.

Figure 4: Specific Conductance and Stage



- **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. Turbidity values remained constant at 0.0NTU during this deployment, as shown in **Figure 5**, indicating a malfunction of the sensor. Turbidity data are not valid during this deployment.

Figure 5: Turbidity



Appendix 1: Environment Canada Daily Climate Data (June 2013), St. John's International Airport

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Total Rain mm	Total Snow mm	Total Precip mm	MaxWind Gust km/h
1	12.8	1.5	7.2	LegendTT	0	LegendTT	76
2							
3							
4	21.7	11.7	16.7	1	0	1	70
5	16.7	3.5	10.1	1.4	0	1.4	59
6	15	3.3	9.2	0	0	0	80
7	14.8	4.6	9.7	0	0	0	70
8	12.6	3.7	8.2	13	0	13	37
9	5	2.6	3.8	20.4	0	20.4	56
10	17	2.2	9.6	2.2	0	2.2	50
11	16	5.4	10.7	4	0	4	41
12	11.3	1.6	6.5	0.2	0	0.2	33
13	4.8	2.6	3.7	24.1	0	24.1	52
14	7	4.7	5.9	2.4	0	2.4	35
15							
16	19.7	7.5	13.6	0	0	0	82
17	19.2	7.4	13.3	1.4	0	1.4	56
18	19.2	9.3	14.3	LegendTT	0	LegendTT	46
19	15.2	9.5	12.4	9.8	0	9.8	46

20	17.5	9.4	13.5	0	0	0	39
21	21.9	10	16	0	0	0	48
22	19.8	9.3	14.6	0	0	0	48
23	25	9.6	17.3	0	0	0	52
24	18.6	12.1	15.4	2.2	0	2.2	67
25	15.5	6.7	11.1	LegendTT	0	LegendTT	50

LegendTT = Trace Precipitation

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