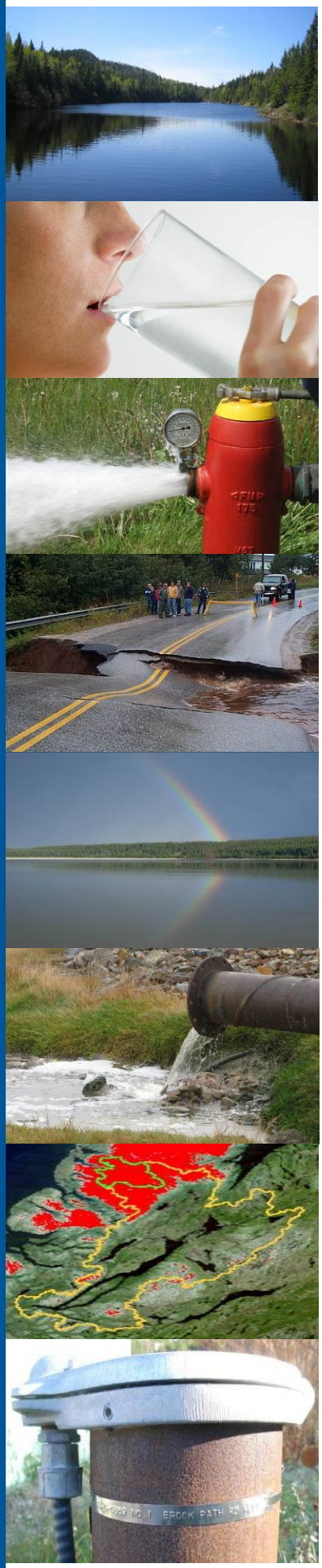


Waterford River @ Kilbride

NF02ZM0009

June-July 2012

Newfoundland Labrador

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
June 7 – July 24, 2012

General

- Data from the Waterford River real-time station is regularly monitored by the Water Resources Management Division (WRMD) staff.
- The instrument used for the deployment period from June 7 until July 24 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 47 days.

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
June 7, 2012	July 24, 2012

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

Quality Assurance and Quality Control (QAQC)

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

Table 2: Comparison rankings for deployment of RTWQ instrument on June 7, 2012

Deployment

Field Sonde to QAQC Sonde Comparisons

Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	10.14	10.09	0.05	Excellent
pH	7.07	7.35	0.28	Good
Specific Conductivity (µS/cm)	410.0	406.0	1.0	Excellent
Total Dissolved Solids (g/l)	0.2660	0.2640	0.0020	
Dissolved Oxygen (%-Sat)	100.1	101.2	1.1	
Dissolved Oxygen (mg/l)	11.24	11.38	0.14	Excellent
Turbidity (NTU)	3.6	3.8	0.2	Excellent

- **Deployment rankings** of "excellent" and "good" 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 subsequent deployment period.

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

Table 3: Comparison rankings for removal of RTWQ instrument on July 24, 2012

Removal

Field Sonde to QAQC Sonde Comparisons

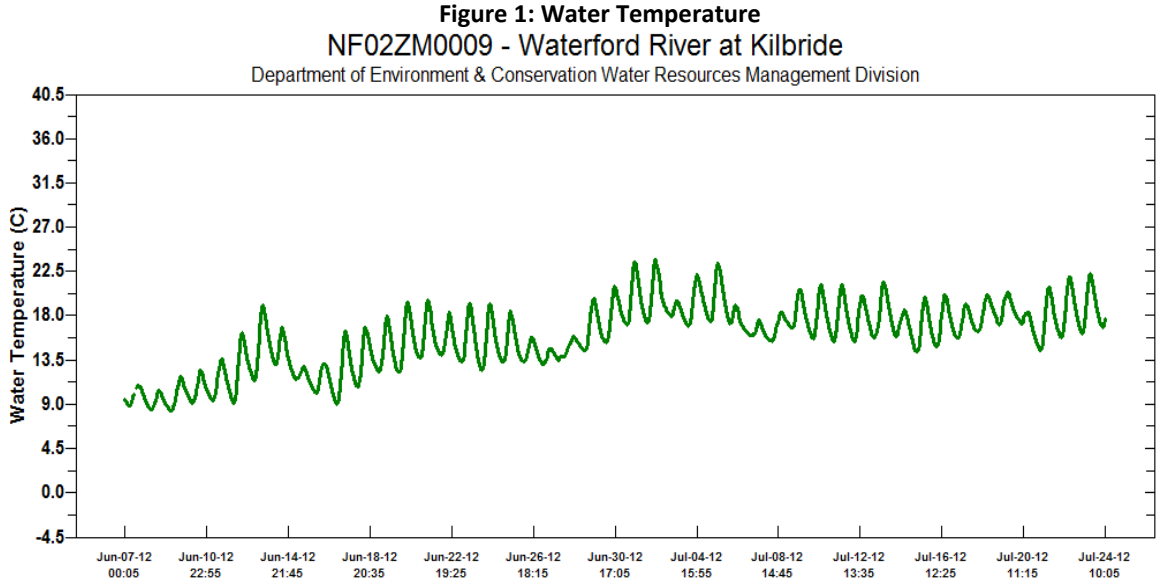
Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	17.39	17.65	0.26	Good
pH	7.14	6.95	0.19	Excellent
Specific Conductivity (µS/cm)	584.0	593.0	1.5	Excellent
Total Dissolved Solids (g/l)	0.3790	0.3850	0.0060	
Dissolved Oxygen (%-Sat)	100.1	100.6	0.5	
Dissolved Oxygen (mg/l)	9.58	9.57	0.01	Excellent
Turbidity (NTU)	2.9	0.7	2.2	Good

- **Removal rankings** of "excellent" and "good" for water temperature, pH, specific conductivity, dissolved oxygen and turbidity increase confidence that the data collected for these parameters over the duration of this deployment are reliable.

Data Interpretation

- **Water temperatures** fluctuated between 7.85 and 23.19^{o}C during this deployment period, showing diurnal variation and a seasonally increasing trend. Water temperature data are shown in green ink in **Figure 1** below. The overall increasing trend in water temperature corresponds to the seasonal increase in air temperature, as shown in the daily climate data for this period in Appendix 1 at the end of this report.

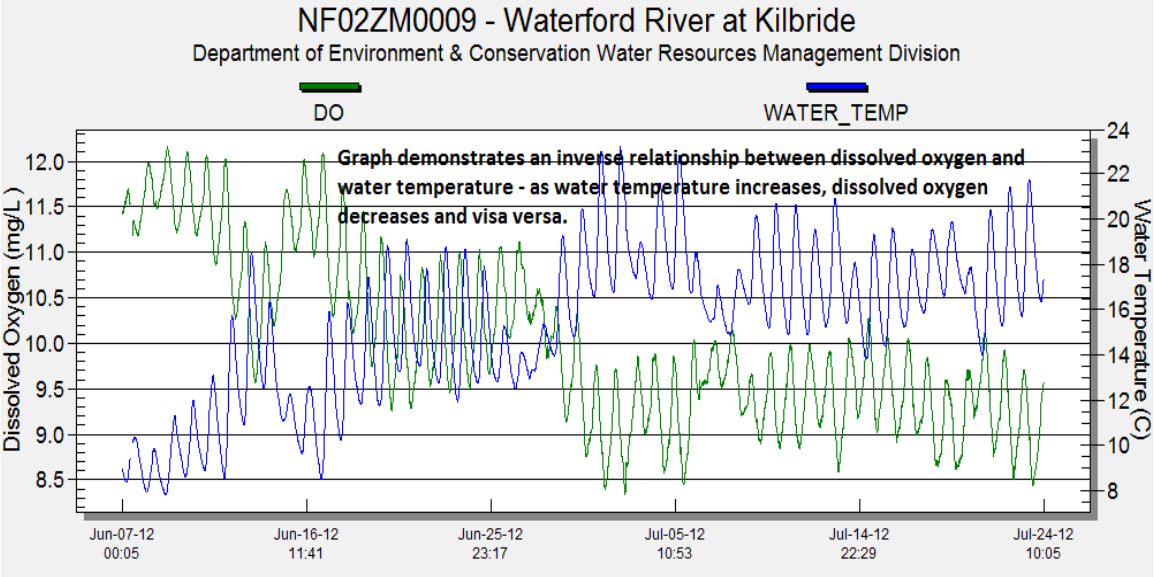
Figure 1: Water Temperature



- **Dissolved Oxygen (DO)** values were within the range of 12.16 and 8.34mg/L during this deployment period. DO displayed an overall decreasing trend during this deployment, in response to the increasing trend in water temperature. DO has an inverse relationship with water temperature in that as water temperature increases, DO decreases and visa versa. This inverse relationship exists because the solubility of oxygen is greater in colder water than in warmer water. DO levels are shown in green ink in **Figure 2** below, and water temperature is shown in blue ink. DO levels during this period were generally above the minimum guidelines recommended by the CCME for the protection

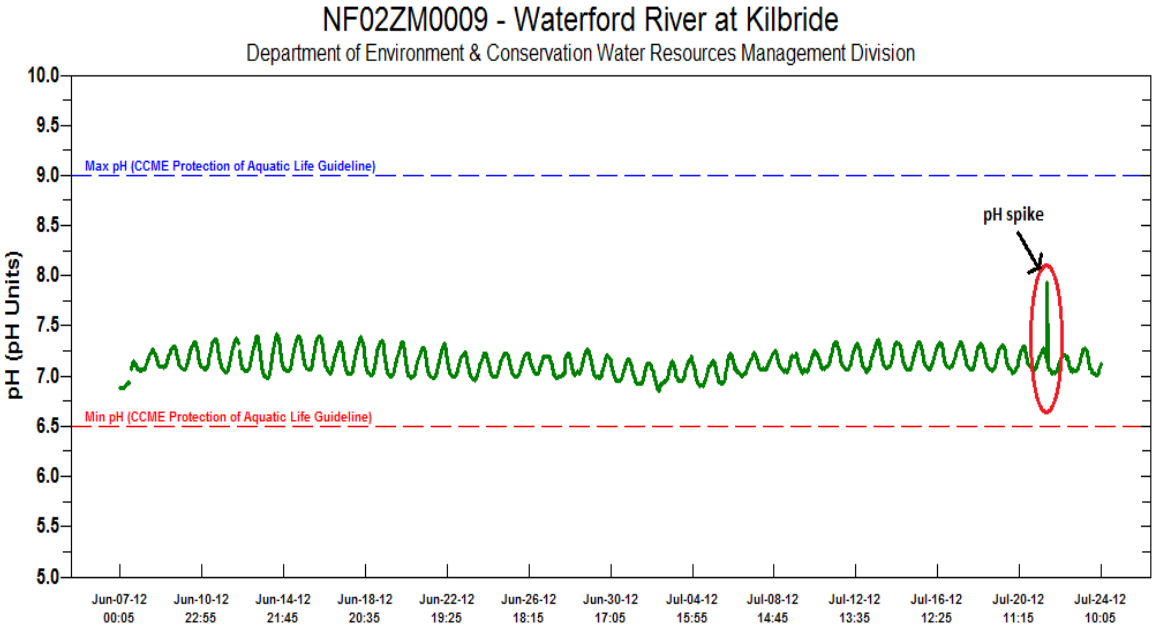
of freshwater aquatic life, of 6.5 mg/L for early life stages and 9.5 mg/L for other life stages in cold water systems.

Figure 2: Dissolved Oxygen



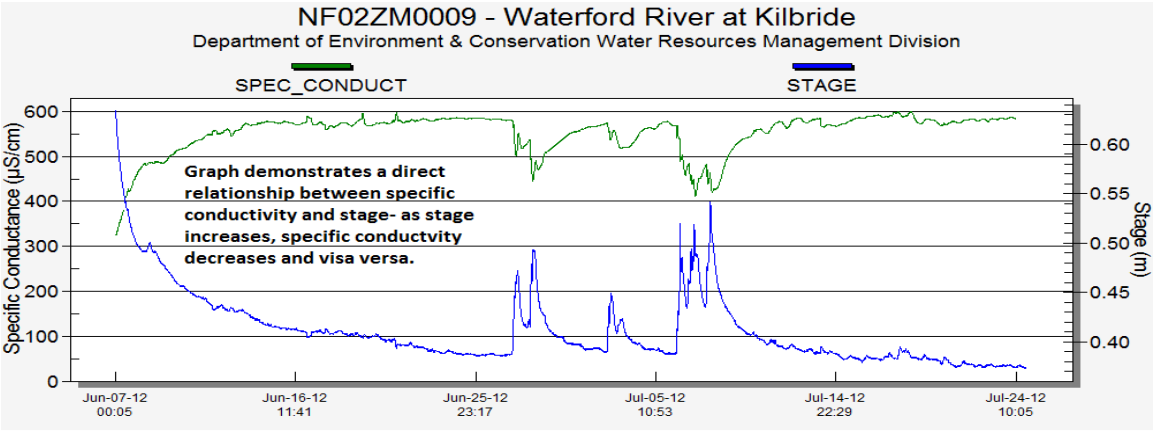
▪ **pH** levels were generally constant and within the expected background range for Waterford River throughout the deployment period, ranging from 6.85 to 7.94 pH units. pH displayed diurnal variations in response to photosynthetic activity, which occurs during the daylight hours. Carbon dioxide, which readily forms carbonic acid in water, is removed from water during the photosynthetic process, thus increasing pH. pH remained within the CCME recommended guideline range for the protection of aquatic life, of 6.5 to 9.0 units, for the duration of this deployment. There was one spike in pH on July 21, but this was instantaneous, and therefore more likely to have been the result of sensor interference than a water quality event. pH levels are shown in green ink in **Figure 3**, below.

Figure 3: pH



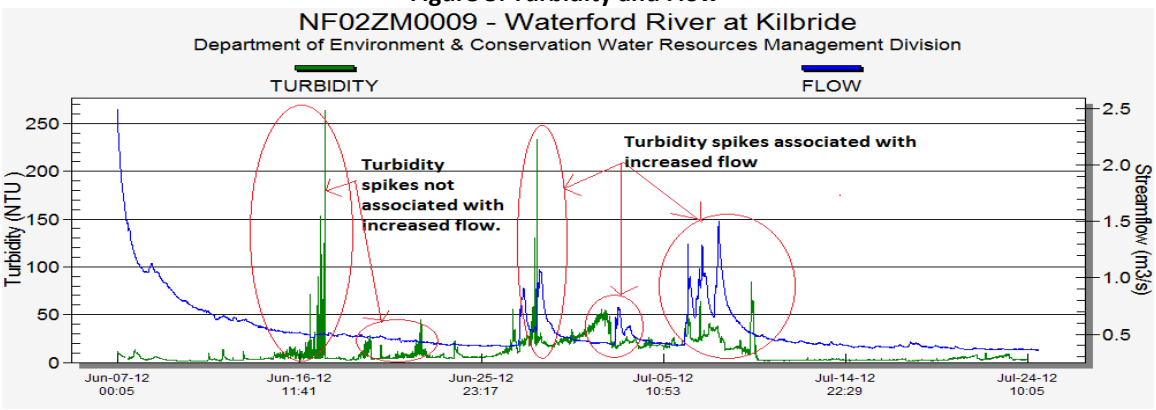
- **Specific conductivity (SpC)** levels were within the expected range for an urban river throughout this deployment, with values falling between 410 and 600µS/cm. Precipitation can have a dilution effect on specific conductivity during the summer months, whereby increased rainfall causes increased stage height (water level) and results in decreased conductivity. This relationship is demonstrated in **Figure 4** below, where specific conductivity is shown in green ink and stage height is shown in blue ink. This relationship may not be true during the winter season when road salt is used, because increased precipitation results in increased road salt deposition in surface water bodies, causing specific conductivity to increase.

Figure 4: Specific Conductance and Stage



- **Turbidity** fluctuated near background concentrations throughout most of the deployment period, with the exception of a couple of notable spikes. Unsettled and increased turbidity levels that occurred near June 28, July 2 and July 8 coincide with rainfall events and increased flows. Turbidity levels are shown in green ink in **Figure 5** below, and flow levels are shown in blue ink. Precipitation data for this deployment period are shown below in **Appendix 1**, as recorded by the Provincial Department of Environment and Conservation weather station at Pippy Park in St. John's. Turbidity spikes that occurred near June 17, and from June 20-22, are not associated with rainfall or increased flow, and may be the result of land based activity upstream in the watershed.

Figure 5: Turbidity and Flow



Appendix1: Provincial Environment and Conservation Climate Data ,St. John's, June 7-July 24, 2012

YMD	AIR_TEMP_AVG	AIR_TEMP_MIN	AIR_TEMP_MAX	PRECIP_TOT
2012/06/07	7.17	3.77	10.48	2.79
2012/06/08	4.98	3.53	7.27	1.52
2012/06/09	7.3	3.99	12.19	0
2012/06/10	6.05	3.32	10.46	0.25
2012/06/11	7.74	2.9	12.39	0
2012/06/12	11.96	2.66	17.91	0
2012/06/13	17.03	10.21	24.18	0
2012/06/14	9.51	6.69	13.25	0
2012/06/15	7.75	6.1	10.24	0
2012/06/16	7.32	1.45	11.36	0
2012/06/17	8.69	0.76	14.22	0
2012/06/18	13.52	6.19	21.3	0
2012/06/19	14.11	8.41	21.7	0
2012/06/20	14.67	7.19	22.63	0
2012/06/21	11.43	8.34	16.25	0
2012/06/22	11.74	8.59	15.61	0
2012/06/23	11.12	5.93	17.31	0
2012/06/24	11.32	4.85	17.14	0
2012/06/25	10.16	6.72	15.57	0
2012/06/26	11.76	8.71	15.44	0
2012/06/27	12.2	9.91	15.13	4.31
2012/06/28	16.45	13.92	19.92	6.59
2012/06/29	18.2	14.02	23.35	0.25
2012/06/30	19.6	13.98	25.52	0
2012/07/01	21.12	16.1	28.8	0
2012/07/02	21.8	16.15	28.75	3.74
2012/07/03	19.3	17.43	22.56	1.52
2012/07/04	20.53	16.43	25.83	0
2012/07/05	19.62	13.64	26.96	0
2012/07/06	15.58	12.49	20.96	10.65
2012/07/07	15.89	14.55	20.86	5.58
2012/07/08	17.91	14.22	22.38	7.87
2012/07/09	18.67	14.46	23.27	0
2012/07/10	18.78	12.66	24.08	0
2012/07/11	19.61	12.8	25.22	0
2012/07/12	19.53	12.14	25.69	0
2012/07/13	18.96	12.97	24.82	0
2012/07/14	15.54	9.39	21.87	0
2012/07/15	13.79	9.43	20.16	0
2012/07/16	17.07	10.81	24.92	0
2012/07/17	16.58	13.83	21.39	0
2012/07/18	18.97	13.6	24.85	0
2012/07/19	19.05	15.1	23.41	0
2012/07/20	14.2	10.77	17.63	2.03
2012/07/21	17.07	11.02	23.19	0
2012/07/22	19.4	13.51	25.88	0
2012/07/23	18.83	12.72	24.8	0
2012/07/24	20.35	13.53	27.23	0

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