

Waterford River @ Kilbride

NF02ZM0009

December 2007 to January
2008



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
December 2007 – January 2008**

General

- Data from the Waterford River real-time station is monitored by the Water Resources Management Division staff regularly.

Maintenance and Calibration of Instrumentation

- The following table displays the dates when the Waterford River water quality probe was installed and removed during this deployment period for routine cleaning, maintenance and calibration.

Table 1: Table of Water Quality Probe Installation and Removal

Date Installed	Date Removed
December 7 th , 2007	January 10 th , 2008

- 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. The QAQC instrument was calibrated prior to each use.

Quality Assurance and Quality Control

- Deployment and removal comparison rankings for the Waterford River deployment from December 7th, 2007 to January 10th, 2008 are summarized in **Table 2**.
- The absence of turbidity ranking can be attributed to the QA/QC probe lacking a turbidity sensor.

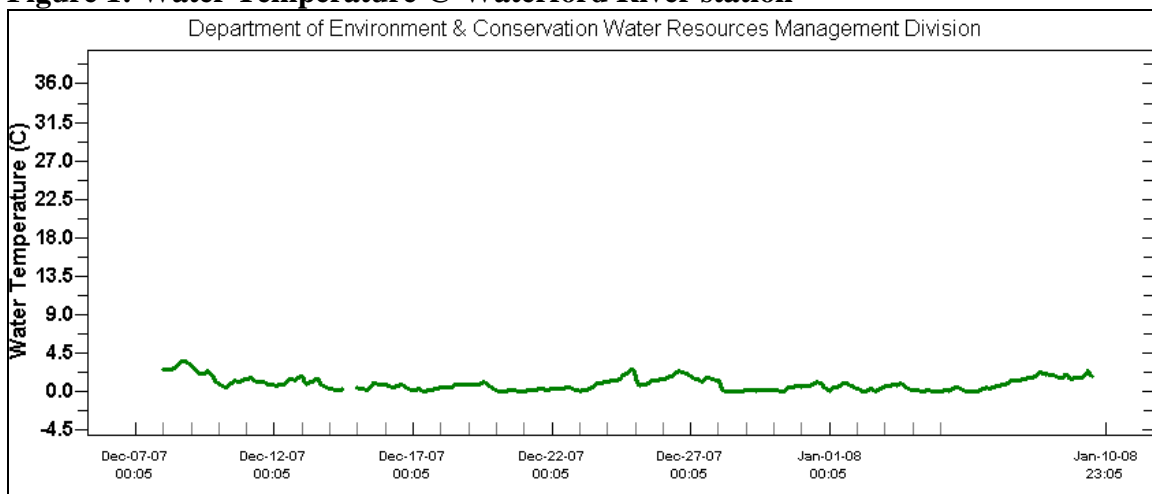
Table 2: Comparison rankings for Waterford @ Kilbride station, December 7th, 2007 – January 10th, 2008

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Waterford @ Kilbride	December 7 th , 2007	Deployment	Excellent	Good	Poor	Poor	N/A
	January 10 th , 2008	Removal	Good	Marginal	Poor	Poor	N/A

Data Interpretation

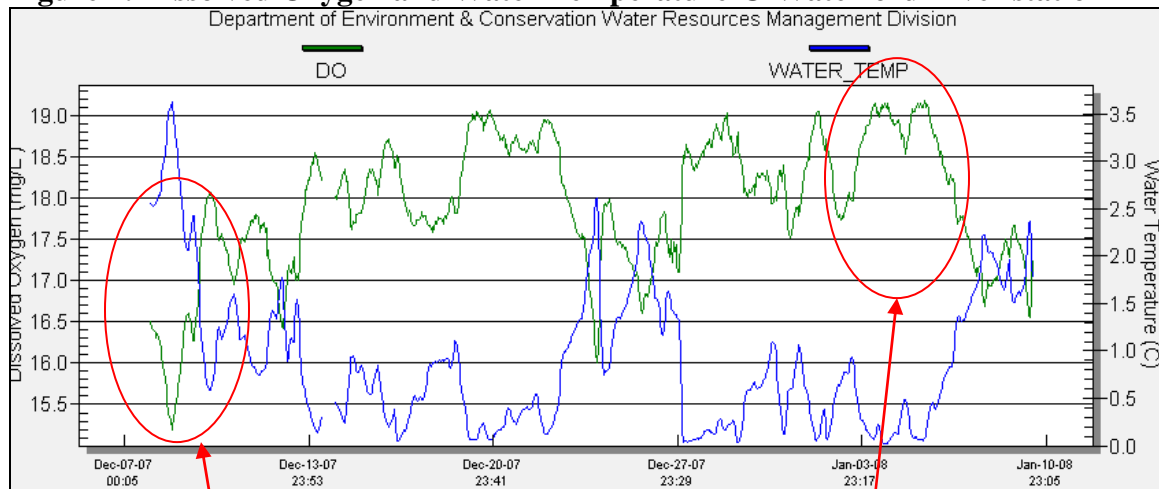
- **Water temperatures** were fairly constant and fluctuated at the freezing mark during this deployment. Water temperatures ranged between 0 and 3.63°C, which is within the expected temperature range for this time of year. Water temperature data is shown in **Figure 1** below.

Figure 1: Water Temperature @ Waterford River station



- Dissolved oxygen (DO)** has an inverse relationship with water temperature whereby DO levels increase as water temperature decrease. Dissolved oxygen is shown in green and water temperature is shown in blue in **Figure 2**, below. The graph indicates that dissolved oxygen levels peaked at 19.70 mg/L on January 6th, the same day the water temperature reached one of its lowest values, at 0.08 °C. DO plummeted to its lowest level of 15.20 mg/L on December 8th, corresponding to the day the highest water temperatures during the deployment period were reached at roughly 3.63 °C.. It should be noted that this deployment saw DO values that were quite high. This could be contributed to the DO sensor having a calibration ranking of “poor” as seen in **Table 2**. Based on this, DO values may be suspect for this deployment.

Figure 2: Dissolved Oxygen and Water Temperature @ Waterford River station

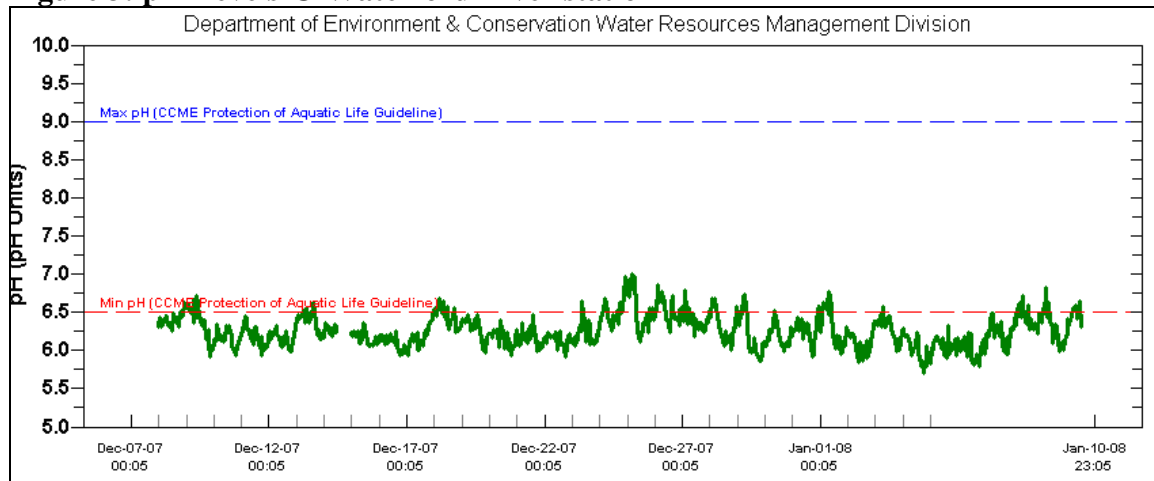


Decline in DO due to increase in Temperature

Rise in DO due to decline in Temperature

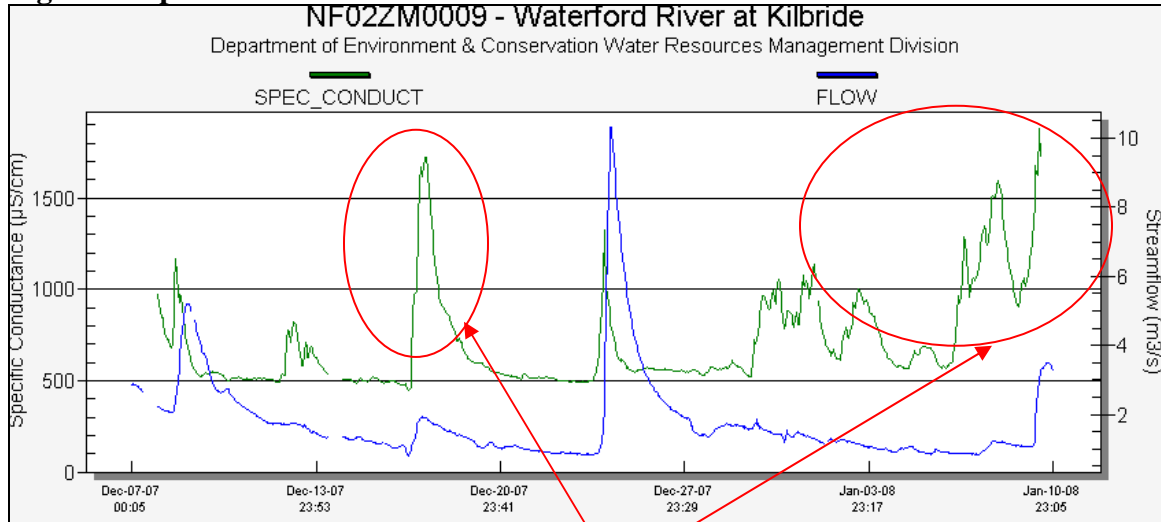
- pH** levels were fairly constant and were within the expected range for this station, with pH values ranging from of 5.71 – 7.01. It should be noted that the pH fell below the minimum CCME Protection of Aquatic Life Guideline, of 6.5 pH units for most of the deployment. Daylight hours are shortest at this time of year, resulting in less photosynthetic activity, and lower pH values.

Figure 3: pH Levels @ Waterford River station



- **Specific conductivity** levels were within the expected range for Waterford River during this deployment. Specific conductivity levels ranged between 450.0 - 1879.0 $\mu\text{S}/\text{cm}$ and showed sudden increases, generally in response to the aftermath of significant precipitation events. The specific conductivity data for this deployment period is shown in **Figure 4** below. The Environment Canada Daily Climate Data for December, for the St. John's region, shown below in **Appendix 1**, indicates that there were significant precipitation events during the month of December, which resulted in excess rainfall. Significantly large amounts of precipitation, has a dilution effect on specific conductance as can be seen in the spikes after December 27th. During the winter months, increased flow tends to cause an increase in specific conductance, due to road salting operations. This is in direct contrast to the dilution effect that increased flow and precipitation has on specific conductance during late spring/summer and early fall.

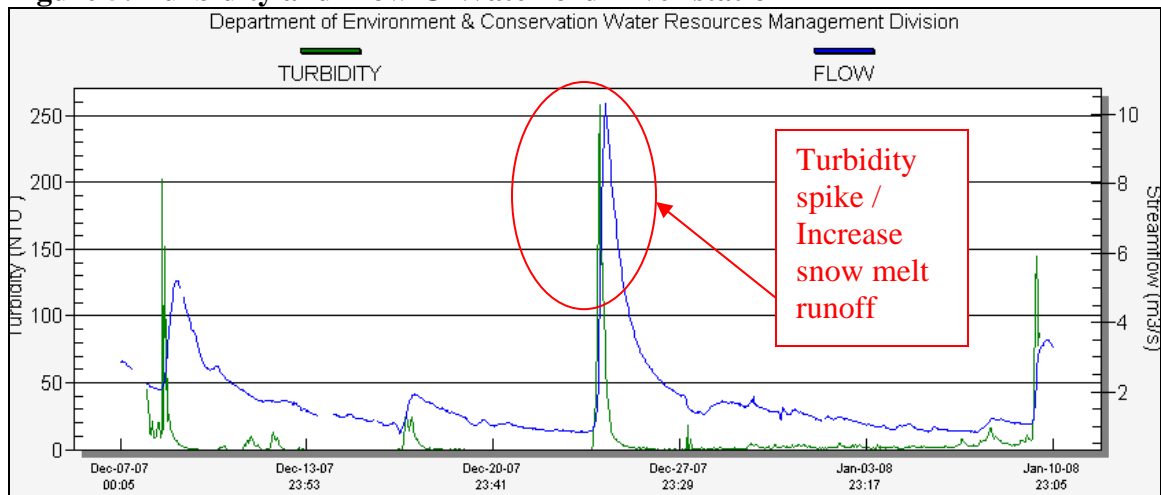
Figure 4: Specific Conductance and Flow @ Waterford River station



Sudden rise due to an increase in salt content from snow melt and runoff

- **Turbidity** levels were within the expected range for Waterford River during this deployment. Turbidity levels ranged between 0 – 258.1 NTU and showed sudden increases, generally in response to the aftermath of significant precipitation events. The Turbidity data for this deployment period is shown in green in **Figure 5** below. The Environment Canada Daily Climate Data for December, for the St. John’s region, shown below in **Appendix 1**, indicates that there was significant precipitation events during the month of December, more specifically on December 24th, which resulted in rainfall in excess of 10mm. This rainfall caused increased flow, snow melt, and run-off, which in turn caused the turbidity to spike.

Figure 5: Turbidity and Flow @ Waterford River station



Turbidity spike / Increase snow melt runoff

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APPENDIX 1: Weather information for St. John's, NL provided by Environment Canada for December 2007:

Day	<u>Max Temp</u> °C	<u>Min Temp</u> °C	<u>Mean Temp</u> °C	<u>Heat Deg Days</u> °C	<u>Cool Deg Days</u> °C	<u>Total Rain</u> mm	<u>Total Snow</u> cm	<u>Total Precip</u> mm	<u>Snow on Grnd</u> cm	<u>Dir of Max Gust</u> 10's deg	<u>Spd of Max Gust</u> km/h
Sum				675.2	0.0	18.6	134.6	140.2			
Avg	-1.0	-6.6	-3.8								
Xtrm	8.4	-14.6								14*	89*
01	2.5	-3.0	-0.3	18.3	0.0	1.6	T	1.6	T	27E	54E
02	1.1	0.0	0.6	17.4	0.0	T	21.2	21.2	T	M	M
03	1.4	-1.2	0.1	17.9	0.0	0.0	2.2	2.2	12	M	M
04	1.8	-1.6	0.1	17.9	0.0	0.0	8.8	8.8	10	M	M
05	2.4	0.2	1.3	16.7	0.0	1.6	T	1.6	14	23E	48E
06	0.8	-0.7	0.1	17.9	0.0	0.2	7.0	7.2	12	26E	41E
07	0.1	-5.7	-2.8	20.8	0.0	0.0	T	T	17	30E	39E
08	4.4	-5.0	-0.3	18.3	0.0	2.0	1.8	3.8	17	27E	72E
09	0.4	-10.1	-4.9	22.9	0.0	0.0	0.0	0.0	15	31E	61E
10	-5.4	-10.0	-7.7	25.7	0.0	0.0	T	T	8	30E	61E
11	-5.7	-9.0	-7.4	25.4	0.0	0.0	T	T	5	31E	54E
12	-1.2	-8.1	-4.7	22.7	0.0	0.0	16.8	13.0	5	14E	32E
13	-1.6	-11.2	-6.4	24.4	0.0	0.0	7.2	4.0	26	30E	63E
14	-9.9	-13.4	-11.7	29.7	0.0	0.0	0.0	0.0	25		<31
15	-6.7	-14.0	-10.4	28.4	0.0	0.0	T	T	24		<31
16	-7.9	-14.6	-11.3	29.3	0.0	0.0	T	T	22	29E	32E
17	4.3	-9.0	-2.4	20.4	0.0	3.6	13.8	17.4	26	14E	89E
18	-0.9	-3.6	-2.3	20.3	0.0	0.0	0.6	0.2	20	26E	70E
19	-3.1	-10.9	-7.0	25.0	0.0	0.0	T	T	20	29E	52E
20	-7.0	-13.4	-10.2	28.2	0.0	0.0	0.0	0.0	20		<31
21	-2.7	-7.4	-5.1	23.1	0.0	0.0	T	T	19	4E	61E
22	-4.7	-10.6	-7.7	25.7	0.0	0.0	T	T	18		<31
23	1.1	-6.2	-2.6	20.6	0.0	0.0	0.0	0.0	18	29E	57E
24	8.4	-0.2	4.1	13.9	0.0	9.2	0.0	9.2	17	21E	83E
25	3.4	-1.2	1.1	16.9	0.0	0.0	1.0	1.0	9	28E	72E
26	-0.4	-2.6	-1.5	19.5	0.0	T	T	T	9	29E	59E
27	-1.9	-6.0	-4.0	22.0	0.0	0.0	2.0	2.0	9	11E	44E

<u>D</u> <u>a</u> <u>y</u>	<u>Max</u> <u>Temp</u> °C	<u>Min</u> <u>Temp</u> °C	<u>Mean</u> <u>Temp</u> °C	<u>Heat</u> <u>Deg</u> <u>Days</u> °C	<u>Cool</u> <u>Deg</u> <u>Days</u> °C	<u>Total</u> <u>Rain</u> mm	<u>Total</u> <u>Snow</u> cm	<u>Total</u> <u>Precip</u> mm	<u>Snow</u> <u>on</u> <u>Grnd</u> cm	<u>Dir of</u> <u>Max</u> <u>Gust</u> 10's deg	<u>Spd of</u> <u>Max</u> <u>Gust</u> km/h
28	-1.6	-4.7	-3.2	21.2	0.0	0.0	32.0	26.4	25	2E	82E
29	-4.3	-10.1	-7.2	25.2	0.0	0.0	T	T	32	34E	56E
30	1.4	-5.4	-2.0	20.0	0.0	0.4	12.2	12.6	41	M	M
31	1.6	-4.6	-1.5	19.5	0.0	T	8.0	8.0	37	M	M

APPENDIX 2: Weather information for St. John's, NL provided by Environment Canada for January 2008:

<u>D</u> <u>a</u> <u>y</u>	<u>Max</u> <u>Temp</u> °C	<u>Min</u> <u>Temp</u> °C	<u>Mean</u> <u>Temp</u> °C	<u>Heat</u> <u>Deg</u> <u>Days</u> °C	<u>Cool</u> <u>Deg</u> <u>Days</u> °C	<u>Total</u> <u>Rain</u> mm	<u>Total</u> <u>Snow</u> cm	<u>Total</u> <u>Precip</u> mm	<u>Snow</u> <u>on</u> <u>Grnd</u> cm	<u>Dir of</u> <u>Max</u> <u>Gust</u> 10's deg	<u>Spd of</u> <u>Max</u> <u>Gust</u> km/h
Sum				667.4	0.0	75.7	89.8	144.5			
Avg	0.1	-7.2	-3.5								
Xtrm											
01	1.6	-6.6	-2.5	20.5	0.0	0.2	1.8	2.0	42	M	M
02	2.0	-8.1	-3.1	21.1	0.0	T	5.0	4.5	42	M	M
03	-0.4	-11.0	-5.7	23.7	0.0	0.2	T	0.2	38	32E	65E
04	-5.9	-12.6	-9.3	27.3	0.0	0.0	T	T	36	24E	37E
05	-2.4	-9.6	-6.0	24.0	0.0	0.0	2.6	1.6	34	28E	50E
06	-2.5	-10.5	-6.5	24.5	0.0	0.0	6.4	2.2	34		<31
07	2.5	-4.2	-0.9	18.9	0.0	T	T	T	40	24E	54E
08	3.8	-1.2	1.3	16.7	0.0	0.6	0.0	0.6	32	27E	61E
09	0.5	-2.5	-1.0	19.0	0.0	0.8	1.8	1.8	26		<31
10	9.5	0.0	4.8	13.2	0.0	8.2	0.0	8.2	23	28E	74E
11	0.5	-3.0	-1.3	19.3	0.0	0.0	0.0	0.0	19	29E	82E
12	7.0	-2.7	2.2	15.8	0.0	11.0	T	11.0	19	19E	57E
13	5.0	-4.3	0.4	17.6	0.0	0.4	0.0	0.4	13	29E	74E
14	-2.6	-5.3	-4.0	22.0	0.0	0.0	1.0	1.0	12	30E	67E
15	0.9	-2.7	-0.9	18.9	0.0	4.5	8.6	11.6	16	11E	56E
16	0.1	-2.0	-1.0	19.0	0.0	T	0.8	0.2	18	4E	61E
17	-1.6	-4.8	-3.2	21.2	0.0	0.0	T	T	18	1E	67E
18	-1.9	-8.4	-5.2	23.2	0.0	0.0	0.0	0.0	18	18E	59E
19	2.0	-5.8	-1.9	19.9	0.0	T	2.0	2.0	19	19E	78E
20	-3.8	-7.4	-5.6	23.6	0.0	0.0	24.6	20.8	18	12E	33E
21	-4.1	-15.6	-9.9	27.9	0.0	0.0	2.6	2.4	43	29E	59E
22	-9.8	-15.1	-12.5	30.5	0.0	0.0	T	T	43	29E	69E
23	4.0	-10.0	-3.0	21.0	0.0	6.4	10.4	15.4	46	17E	82E
24	-3.8	-8.0	-5.9	23.9	0.0	0.0	T	T	48	20E	37E
25	-3.5	-10.8	-7.2	25.2	0.0	0.0	22.2	15.2	48	2E	63E

<u>D</u> <u>a</u> <u>y</u>	<u>Max</u> <u>Temp</u> °C 	<u>Min</u> <u>Temp</u> °C 	<u>Mean</u> <u>Temp</u> °C 	<u>Heat</u> <u>Deg</u> <u>Days</u> °C 	<u>Cool</u> <u>Deg</u> <u>Days</u> °C 	<u>Total</u> <u>Rain</u> mm 	<u>Total</u> <u>Snow</u> cm 	<u>Total</u> <u>Precip</u> mm 	<u>Snow</u> <u>on</u> <u>Grnd</u> cm 	<u>Dir of</u> <u>Max</u> <u>Gust</u> 10's deg 	<u>Spd of</u> <u>Max</u> <u>Gust</u> km/h 
26	-10.8	-15.9	-13.4	31.4	0.0	0.0	T	T	63	31E	46E
27	-9.9	-17.3	-13.6	31.6	0.0	0.0	T	T	62	29E	35E
28	2.6	-14.9	-6.2	24.2	0.0	1.8	T	1.8	62	16E	59E
29	7.9	1.6	4.8	13.2	0.0	39.4	0.0	39.4	47	14	65
30	9.1	0.2	4.7	13.3	0.0	2.2	0.0	2.2	30	27E	33E
31	8.0	-3.7	2.2	15.8	0.0	T	0.0	T	22	24E	57E