

Real Time Water Quality Report Humber River at Humber Village

Deployment Period 2015-12-10 to 2016-04-13



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

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General

- This station is operated as part of the Provincial Real Time Water Quality (RTWQ) network.
- This station is operated year round.
- Staff of the Water Resources Management Division (WRMD) monitors the real-time web page on a regular basis. Any unusual observations are investigated.
- This site is easily accessed and the instrument is normally removed on a monthly to bimonthly basis for maintenance and calibration and is reinstalled within one to two days. During the winter months the deployment periods tend to be longer as the instrument is often frozen into place and difficult to remove.
- This monthly deployment report, presents water quality and water quantity data recorded at the Humber River at Humber Village station from December 10, 2015, to April 13, 2016.

Quality Assurance / Quality Control

- Water quality instrument performance is tested at the beginning and end of its deployment period. The process is outlined in Appendix A.
- Instruments are assigned a performance rating (i.e., poor, marginal, fair, good or excellent) for each water quality parameter measured.
- Table 1 shows the performance ratings of five water quality parameters (i.e., temperature, pH, specific conductivity, dissolved oxygen and turbidity) measured by instruments deployed at the water monitoring stations.
- The performances of all sensors were rated excellent at the beginning and good to excellent at the end of the deployment period (Table 1).
- With the exception of water quantity data (stage height), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.



	Humber River			
Stage of deployment	Beginning	End		
Date	2015-12-10	2016-04-13		
Temperature	Excellent	Excellent		
pH	Excellent	Excellent		
Specific Conductivity	Excellent	Good		
Dissolved Oxygen	Excellent	Excellent		
Turbidity	Excellent	Excellent		

Table 1: Water quality instrument performance at the beginning and end of the deployment

Deployment Notes

Water quality monitoring for this deployment period started on December 10, 2015 and continued without any significant operational issues until April 13, 2016, when the instrument was removed for routine calibration and maintenance. This was a relatively long deployment period of 125 days, which is typical of the winter when freezing makes it more difficult to remove the field instrument. Fortunately, with cold water conditions water quality tends to be quite stable, there is less biofouling, and the field instrument keeps good calibration for extended periods.

Data Interpretation

- Data records were interpreted for each station during the deployment period for the following six parameters:
 - (i.) Stage (m)
 - (ii.) Temperature (°C)
 - (iii.) pH

- (iv.) Specific conductivity (μ S/cm)
- (v.) Dissolved oxygen (mg/l)
- (vi.) Turbidity (NTU)



Stage

- The stage data is raw data that is transmitted via satellite and published on our web page. It has not been corrected for backwater effect. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.
- During this deployment period stage values ranged from 1.44 m to 2.67 m at Humber River, with corresponding flow ranging from 139.44 m³/sec to 336.12 m³/sec (Figure 1).
- Flows over the deployment period were typical for the winter months with no extremely high or low levels. Over the last two weeks of the deployment period stage Height and flow show a steady increase which appears to be consistent with the beginning of spring runoff.



Figure 1: Stage Height (m) at Humber River from December 10, 2015, to April 13, 2016



Temperature

- During this deployment period water temperature at Humber River ranged from 0.14°C to 5.18°C (Figure 2).
- From mid-December to mid-January temperature declines steadily and then remains cold for the remainder of the deployment period which is consistent with winter conditions.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.



Water Temperature and Stage Level

Figure 2: Temperature (°C) at Humber River from December 10, 2015, to April 13, 2016



pН

- During this deployment period pH values at Humber River ranged from 6.79 units to 7.03 units (Figure 3).
- pH was quite stable throughout the deployment period.
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.
- With a median value of 6.91, all of the pH values recorded at Humber River during this deployment period were within the guidelines for pH for the protection of aquatic life (i.e., 6.5 to 9.0 units), as defined by the Canadian Council of Ministers of the Environment (2007).



Water pH and Stage Level

Figure 3: pH values recorded at Humber River from December 10, 2015, to April 13, 2016



Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 34.0 μ S/cm to 41.0 μ S/cm (Figure 4).
- Specific conductivity appears to be relatively stable during the deployment period, however there are several small spikes which are most likely related to significant rainfall events.



Specific Conductivity of Water and Stage Level

Figure 4: Specific conductivity (µs/cm) at Humber River from Dec. 10, 2015, to April 13, 2016



Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 11.73 mg/l (89.2% saturation) to 13.35 mg/l (94.7% saturation) (Figure 5).
- Over the first few weeks DO(mg/l)shows a gentle increasing trend which is related to a cooling trend for the same period.
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- DO (mg/l) is relatively stable over the deployment period which is related to the correspondingly stable temperature trend for the same timeframe.
- All of the DO values at Humber River were above both the minimum guideline set for other life stages (6.5 mg/l), as well as above the minimum guideline (9.5 mg/l) set for the protection of early life stages, as determined by the Canadian Council of Ministers of the Environment (2007).



Dissolved Oxygen Concentration and Saturation

Figure 5: DO (mg/l & % saturation) at Humber River from December 10, 2015, to April 13, 2016



Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 1406.00 NTU (Figure 6).
- For an extended period in the early part of the deployment period (see inside red oval) turbidity readings are extremely high. These are false reading due to organic debris trapped around the sensor head. The organic material was removed around January 11 and for the remainder of the deployment period the readings are stable and relatively low. Data from these false readings will be removed from the dataset.



Water Turbidity and Stage Level

Figure 6: Turbidity (NTU) at Humber River from December 10, 2015, to April 13, 2016

Conclusion

- This monthly deployment report presents water quality and water quantity data recorded at Humber River from December 10, 2015, to April 13, 2016.
- The performances of all sensors were rated excellent at the beginning and good to excellent at the end of the deployment period.
- Variations in water quality/quantity values recorded at each station are summarized below:
 - During this deployment period stage values ranged from 1.44 m to 2.67 m at Humber River, with corresponding flow ranging from 139.44 m³/sec to 336.12



 m^3 /sec. Flows over the deployment period were typical for the winter months with an increasing trend over the last two weeks of the deployment period which was consistent with the beginning of spring runoff.

- During this deployment period water temperature at Humber River ranged from 0.14°C to 5.18°C. From mid-December to mid-January temperature declines steadily and then remains consistently cold for the remainder of the deployment period.
- During this deployment period pH values at Humber River ranged from 6.79 units to 7.03 units and were quite stable throughout the deployment period. pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations. With a median value of 6.91, all of the pH values recorded at Humber River during this deployment period were within the guidelines for pH for the protection of aquatic life (i.e., 6.5 to 9.0 units), as defined by the Canadian Council of Ministers of the Environment (2007).
- During this deployment period specific conductivity at Humber River ranged from $34.0 \,\mu$ S/cm to $41.0 \,\mu$ S/cm. Specific conductivity appears to be relatively stable during the deployment period; however there are several small spikes which are most likely related to significant rainfall events.
- During this deployment period DO values at Humber River ranged from 11.73 mg/l (89.2% saturation) to 13.35 mg/l (94.7% saturation). Over the first few weeks DO(mg/l)shows a gentle increasing trend which is related to a cooling trend for the same period and DO also shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations. All of the DO values at Humber River were above both the minimum guideline set for other life stages (6.5 mg/l), as well as above the minimum guideline (9.5 mg/l) set for the protection of early life stages, as determined by the Canadian Council of Ministers of the Environment (2007).
- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 1406.00 NTU. For an extended period in the early part of the deployment period turbidity readings are extremely high. These are false reading due to organic debris trapped around the sensor head and they will be removed from the dataset.



References

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the protection of aquatic life: Summary table. Updated December, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg. (Website: <u>http://ceqg-rcqe.ccme.ca/download/en/222/</u>)



APPENDIX A Quality Assurance / Quality Control Procedures

- As part of the Quality Assurance / Quality Control (QA/QC) protocol, the performance of a station's water quality instrument (i.e., Field Sonde) is rated at the beginning and end of its deployment period. The procedure is based on the approach used by the United States Geological Survey (Wagner *et al.* 2006)¹.
- At the beginning of the deployment period, a fully cleaned and calibrated QA/QC water quality instrument (i.e., QA/QC Sonde) is placed *in-situ* with the fully cleaned and calibrated Field Sonde. After Sonde readings have stabilized, which may take up to five minutes in some cases, water quality parameters, as measured by both Sondes, are recorded to a field sheet. Field Sonde performance for all parameters is rated based on differences recorded by the Field Sonde and QA/QC Sonde. If the readings from both Sondes are in close agreement, the QA/QC Sonde can be removed from the water. If the readings are not in close agreement, there will be attempts to reconcile the problem on site (e.g., removing air bubbles from sensors, etc.). If no fix is made, the Field Sonde may be removed for recalibration.
- At the end of the deployment period, a fully cleaned and calibrated QA/QC Sonde is once again deployed *in-situ* with the Field Sonde, which has already been deployment for 30-40 days. After Sonde readings have stabilized, water quality parameters, as measured by both Sondes, are recorded to a field sheet. Field Sonde performance for all parameters is rated based on differences recorded by the Field Sonde and QA/QC Sonde.

	Rating					
Parameter	Excellent	Good	Fair	Marginal	Poor	
Temperature (°C)	$\leq \pm 0.2$	$> \pm 0.2$ to 0.5	$>\pm 0.5$ to 0.8	>±0.8 to 1	$>\pm1$	
pH (unit)	$\leq \pm 0.2$	$> \pm 0.2$ to 0.5	$>\pm 0.5$ to 0.8	$> \pm 0.8$ to 1	$>\pm 1$	
Sp. Conductance (µS/cm)	$\leq \pm 3$	>±3 to 10	>±10 to 15	$> \pm 15$ to 20	$>\pm20$	
Sp. Conductance > 35 μ S/cm (%)	$\leq \pm 3$	$> \pm 3$ to 10	>±10 to 15	$> \pm 15$ to 20	$> \pm 20$	
Dissolved Oxygen (mg/l) (% Sat)	$\leq \pm 0.3$	$> \pm 0.3$ to 0.5	$>\pm 0.5$ to 0.8	$> \pm 0.8$ to 1	> ±1	
Turbidity <40 NTU (NTU)	$\leq \pm 2$	> ± 2 to 5	$>\pm 5$ to 8	$> \pm 8$ to 10	$>\pm10$	
Turbidity > 40 NTU (%)	$\leq \pm 5$	$> \pm 5$ to 10	>±10 to 15	$> \pm 15$ to 20	$>\pm 20$	

• Performance ratings are based on differences listed in the table below.

¹ Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous waterquality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1– D3, 51 p. + 8 attachments; accessed April 10, 2006, at *http://pubs.water.usgs.gov/tm1d3*



APPENDIX B

Environment	t Canada V	Veather I	Data – C	corner Bro	ok (Dec.10), 2015, to A
Date/Time	Max Temp	Min	Mean	Heat Deg	Cool Deg	Total
	(°C)	Temp	Temp	Days (°C)	Days (°C)	Precip
12/10/2015	3.5	(°C) -1	$(^{\circ}C)$	167	0	(mm) 0
12/11/2015	10.5	-1	4.8	13.2	0	17.7
12/12/2015	10.5	-	7.0	10.2	0	17
12/12/2015	10.5	5	7.8	10.2	0	1./
12/13/2015	3.5	-0.5	1.5	16.5	0	0.2
12/14/2015	-1	-2.5	-1.8	19.8	0	0.2
12/15/2015	0	-3.5	-1.8	19.8	0	0
12/16/2015	-2	-3	-2.5	20.5	0	0
12/17/2015	-2	-6.5	-4.3	22.3	0	0.5
12/18/2015	1	-5.5	-2.3	20.3	0	6.8
12/19/2015	2.5	-1	0.8	17.2	0	13
12/20/2015	-2	-4.5	-3.3	21.3	0	5.4
12/21/2015	-3.5	-4.5	-4	22	0	4.8
12/22/2015	-7.5	-13	-10.3	28.3	0	0
12/23/2015	-3.5	-12.5	-8	26	0	0
12/24/2015	6	-8.5	-1.3	19.3	0	2.1
12/25/2015	6.5	-0.5	3	15	0	0
12/26/2015	-1	-2	-1.5	19.5	0	0.5
12/27/2015	-5.5	-8	-6.8	24.8	0	0
12/28/2015	-9.5	-11	-10.3	28.3	0	3.7
12/29/2015	-10	-12	-11	29	0	0.2
12/30/2015	-6.5	-16.5	-11.5	29.5	0	0.6
12/31/2015	0.5	-10.5	-5	23	0	3.6
1/1/2016	-2	-4.5	-3.3	21.3	0	3.2
1/2/2016	0.5	-4	-1.8	19.8	0	5.2
1/3/2016	-5	-6.5	-5.8	23.8	0	6
1/4/2016	-6	-9.5	-7.8	25.8	0	0.8
1/5/2016	-4.5	-12	-8.3	26.3	0	2.6
1/6/2016	-2.5	-9	-5.8	23.8	0	4.8
1/7/2016	0.5	-4	-1.8	19.8	0	2.2
1/8/2016	-5.5	-8	-6.8	24.8	0	0
1/9/2016	-4.5	-10.5	-7.5	25.5	0	0
1/10/2016	0.5	-11.5	-5.5	23.5	0	0
1/11/2016	5	-10.5	-2.8	20.8	0	2.4
1/12/2016	-3.5	-5.5	-4.5	22.5	0	0.8
1/13/2016	-2	-9.5	-5.8	23.8	0	21.4
1/14/2016	-2.5	-7	-4.8	22.8	0	6.4

.10, 2015, to Apr.13,2016) **C** D 41 n



Date/Time	Max Temp (°C)	Min Temp	Mean Temp	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip
1/1/201/	2.5	(°C)	(°C)	24	0	(mm)
1/16/2016	-3.5	-8.5	-0	24	0	0
1/17/2016	-1	-11	-6	24	0	0
1/18/2016	-1	-4.5	-2.8	20.8	0	1.4
1/19/2016	-3	-5.5	-4.3	22.3	0	1.2
1/20/2016	-1	-9.5	-5.3	23.3	0	10
1/21/2016	-3.5	-7.5	-5.5	23.5	0	0
1/22/2016	-5.5	-7.5	-6.5	24.5	0	0
1/23/2016	-6	-7.5	-6.8	24.8	0	0
1/24/2016	-4.5	-15.5	-10	28	0	2
1/25/2016	-4.5	-12	-8.3	26.3	0	0
1/26/2016	4	-12	-4	22	0	11.9
1/27/2016	3	0	1.5	16.5	0	4.1
1/28/2016	-3.5	-8.5	-6	24	0	0
1/29/2016	-4	-10	-7	25	0	21.2
1/30/2016	-4.5	-8	-6.3	24.3	0	1.4
1/31/2016	2	-8	-3	21	0	0.8
2/1/2016	7	0	3.5	14.5	0	1.1
2/2/2016	-0.5	-4	-2.3	20.3	0	3.2
2/3/2016	1	-9.5	-4.3	22.3	0	5.6
2/4/2016	7	-6.5	0.3	17.7	0	2.2
2/5/2016	1.5	-2	-0.3	18.3	0	28.6
2/6/2016	-4.5	-6.5	-5.5	23.5	0	1.2
2/7/2016	1	-10.5	-4.8	22.8	0	9
2/8/2016	-5	-11	-8	26	0	3.4
2/9/2016	4	-13	-4.5	22.5	0	9.6
2/10/2016	0	-4.5	-2.3	20.3	0	1.2
2/11/2016	-2	-4.5	-3.3	21.3	0	2
2/12/2016	-3	-8.5	-5.8	23.8	0	3.2
2/13/2016	-6.5	-12	-9.3	27.3	0	2.2
2/14/2016	-9	-11.5	-10.3	28.3	0	4.6
2/15/2016	-5.5	-13.5	-9.5	27.5	0	4.4
2/16/2016	11.5	-8	1.8	16.2	0	10.2
2/17/2016	11	0	5.5	12.5	0	23.5
2/18/2016	0.5	-2	-0.8	18.8	0	0
2/19/2016	-3.5	-8.5	-6	24	0	1.2
2/20/2016	-1.5	-11	-6.3	24.3	0	0
2/21/2016	3.5	-8.5	-2.5	20.5	0	9.6
2/22/2016	3	-1.5	0.8	17.2	0	0



Date/Time	Max Temp (°C)	Min Temp	Mean Temp	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip
		(°C)	(°C)			(mm)
2/24/2016	2	-12	-5	23	0	17.1
2/25/2016	12	-3	4.5	13.5	0	20
2/26/2016	8.5	4.5	6.5	11.5	0	5.6
2/27/2016	-3	-6.5	-4.8	22.8	0	1
2/28/2016	1	-8.5	-3.8	21.8	0	2.6
2/29/2016	7	-9	-1	19	0	4.2
3/1/2016	4	-1	1.5	16.5	0	1.4
3/2/2016	10	-7	1.5	16.5	0	6.1
3/3/2016	10	-4	3	15	0	14.6
3/4/2016	-5	-11	-8	26	0	1.4
3/5/2016	-5.5	-9	-7.3	25.3	0	24.4
3/6/2016	-4.5	-8	-6.3	24.3	0	1
3/7/2016	-2	-12	-7	25	0	0.6
3/8/2016	0.5	-7	-3.3	21.3	0	0
3/9/2016	-4	-11	-7.5	25.5	0	1.8
3/10/2016	-2.5	-10	-6.3	24.3	0	0
3/11/2016	0	-13.5	-6.8	24.8	0	0.6
3/12/2016	-3.5	-7	-5.3	23.3	0	1.8
3/13/2016	1.5	-7	-2.8	20.8	0	4.8
3/14/2016	-4.5	-11	-7.8	25.8	0	0
3/15/2016	1	-16	-7.5	25.5	0	0
3/16/2016	2.5	-3.5	-0.5	18.5	0	2
3/17/2016	-3.5	-7	-5.3	23.3	0	0
3/18/2016	0	-12	-6	24	0	7.8
3/19/2016	-3.5	-7	-5.3	23.3	0	2.8
3/20/2016	-5	-7.5	-6.3	24.3	0	2.4
3/21/2016	5	-11	-3	21	0	5.4
3/22/2016	0.5	-3	-1.3	19.3	0	5
3/23/2016	-2.5	-7	-4.8	22.8	0	2.4
3/24/2016	-5	-9	-7	25	0	1.8
3/25/2016	-4	-10	-7	25	0	10.2
3/26/2016	-0.5	-8	-4.3	22.3	0	0
3/27/2016	3	-11	-4	22	0	0
3/28/2016	6	-8	-1	19	0	11.8
3/29/2016	0	-2	-1	19	0	8.6
3/30/2016	-0.5	-5	-2.8	20.8	0	1.2
3/31/2016	7	-6	0.5	17.5	0	2.8
4/1/2016	10.5	1	5.8	12.2	0	8.8



Date/Time	Max Temp	Min	Mean	Heat Deg	Cool Deg	Total
	(°C)	Temp	Temp	Days (°C)	Days (°C)	Precip
		(°C)	(°C)			(mm)
4/3/2016	5.5	0.5	3	15	0	14.8
4/4/2016	-5	-8	-6.5	24.5	0	2.6
4/5/2016	-5.5	-8	-6.8	24.8	0	0.6
4/6/2016	-4.5	-11	-7.8	25.8	0	1.4
4/7/2016	6	-8.5	-1.3	19.3	0	2
4/8/2016	10	1	5.5	12.5	0	1.4
4/9/2016	13	6	9.5	8.5	0	10.2
4/10/2016	13	-1	6	12	0	2
4/11/2016	0	-2.5	-1.3	19.3	0	0
4/12/2016	9	-4.5	2.3	15.7	0	0.6
4/13/2016	11.5	5.5	8.5	9.5	0	2.8