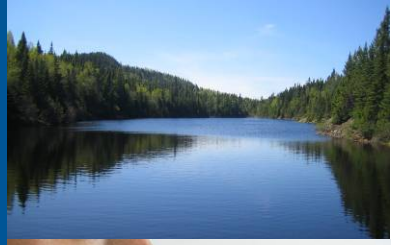




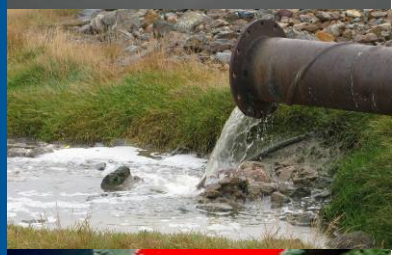


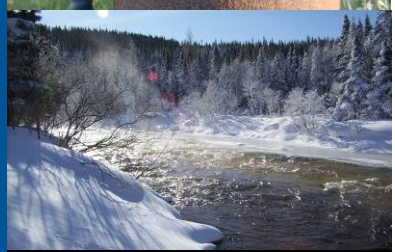

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2013-02-04 to 2013-05-10

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 daily basis. Any unusual observations are investigated.
- This site is easily accessed and the instrument is normally removed on a monthly to bi-monthly basis for maintenance and calibration and is reinstalled within one to two days.
- This monthly deployment report, presents water quality and water quantity data recorded at the Humber River at Humber Village station from February 04, 2013, to May 10, 2013.

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.

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

	Humber River	
Stage of deployment	**Beginning**	**End**
Date	2013-02-04	2013-05-10
Temperature	Excellent	Fair
pH	Good	Good
Specific Conductivity	Good	Excellent
Dissolved Oxygen	Excellent	Good
Turbidity	Excellent	Excellent

The performances of all sensors were rated good to excellent at the beginning of the deployment period, while all sensors were rated fair to excellent at the end of the deployment period (Table 1).

Deployment Notes

- Water quality monitoring for this deployment period started on February 4, 2013 at 12:15 pm and continued without any significant operational issues until May 10, 2013, at 3:15 pm when the instrument was removed for routine calibration and maintenance.

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 (µS/cm)
(v.) Dissolved oxygen (mg/l)
(vi.) Turbidity (NTU)

Stage

- Stage values ranged from 1.87 m to 4.79 m at Humber River, with corresponding flow ranging from 202.00 m^3/sec to 817.00 m^3/sec from February, 2013 to May 10, 2013 (Figure 1).

- There is a significant peak in stage height and flow during the last week of the deployment period (See inside red oval – Figure 1) which is related to a combination of heavy rain and snow melt typical of the spring runoff period.

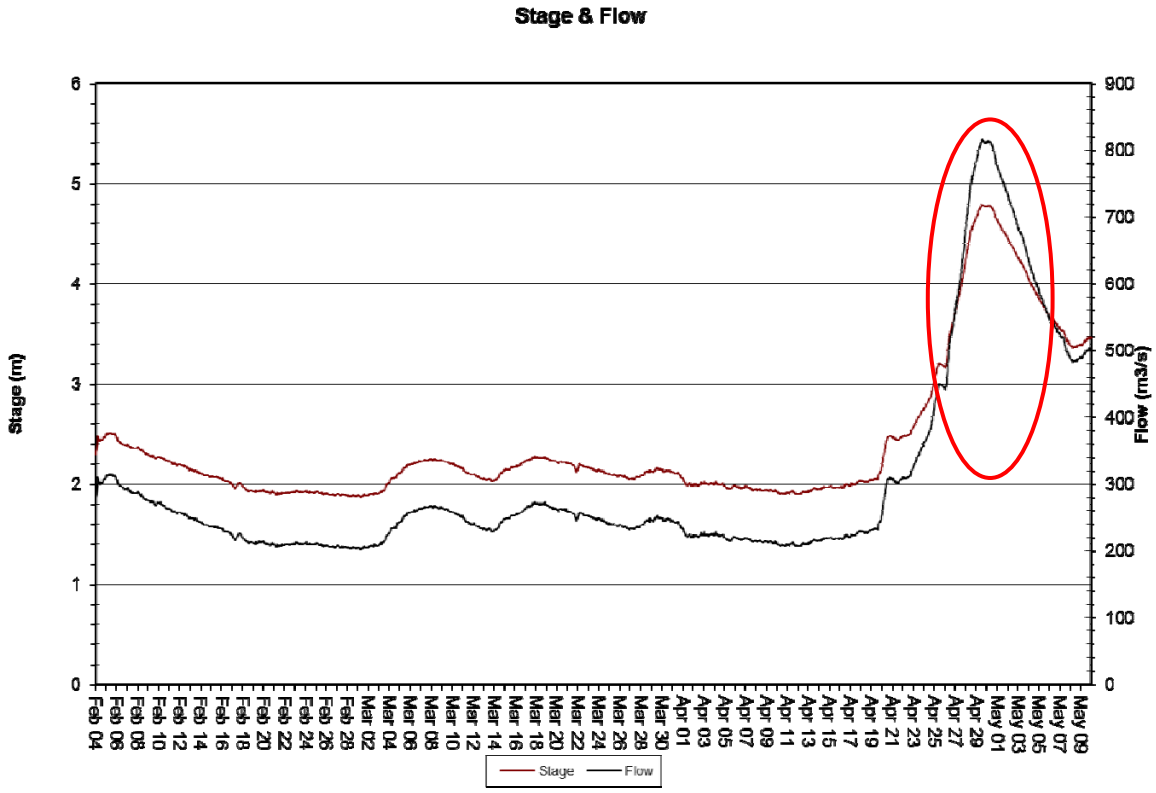

Figure 1: Stage Height (m) at Humber River from February 4, 2013 to May 10, 2013

Temperature

- Water temperature ranged from -0.08˚C to 4.52˚C at Humber River from February 4, 2013 to May 10, 2013 (Figure 2).
- Water temperature displays diurnal variations which are related to diurnal variations in ambient air temperatures.
- There is a gentle increasing temperatures trend over the deployment period which is consistent with the transition from winter to spring.

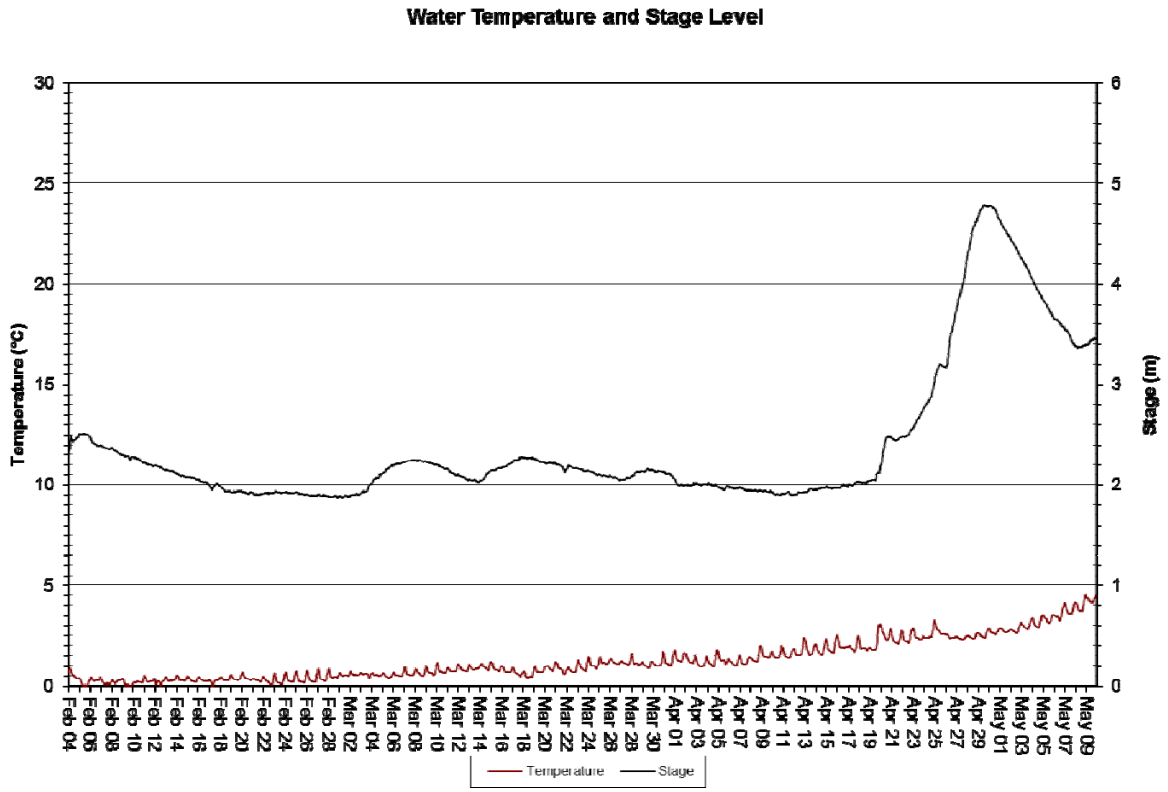

Figure 2: Temperature (^{o}C) at Humber River from February 4, 2013 to May 10, 2013

pH

- pH values ranged from 6.43 units to 7.46 units at Humber River from February 4, 2013 to May 10, 2013 (Figure 3).
- pH values show regular diurnal fluctuations which are related to the diurnal temperature fluctuations.
- pH was relatively stable throughout the deployment period.
- With a mean value of 7.01, pH values recorded at Humber River were just at or 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).

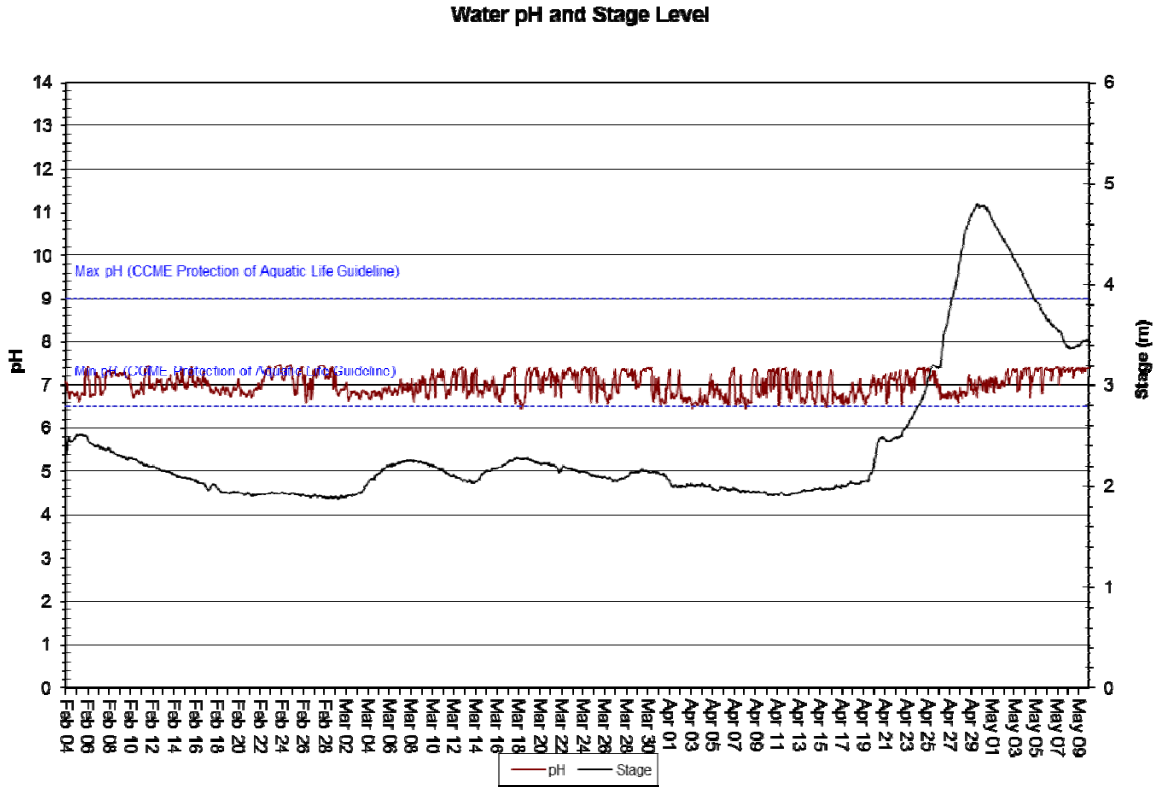

Figure 3: pH values recorded at Humber River from February 4, 2013 to May 10, 2013

Specific Conductivity

- Specific Conductivity ranged from 39.8 µS/cm to 44.3 µS/cm at Humber River from February 4, 2013 to May 10, 2013 (Figure 4).
- Specific conductivity readings were fairly stable at Humber River during the deployment period.

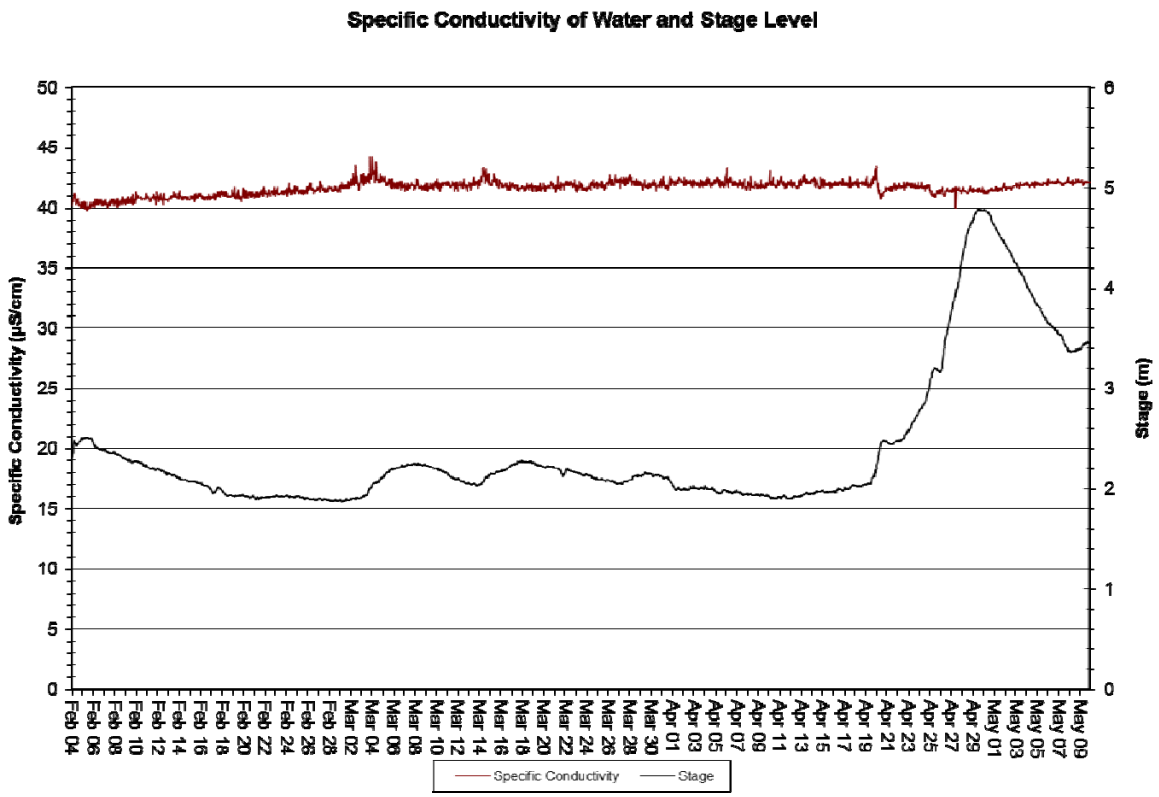

Figure 4: Specific conductivity (µs/cm) at Humber River from February 4, 2013 to May 10, 2013

Dissolved Oxygen

- Dissolved Oxygen [DO] values ranged from 12.75 mg/l (89.4% saturation) to 13.90 mg/l (99.6% saturation) at Humber River from February 4, 2013 to May 10, 2013 (Figure 5).
- DO (mg/l & % saturation) shows a diurnal fluctuation which can be attributed to the diurnal temperature fluctuations.
- The DO values at Humber River were above the cold water minimum guideline set for aquatic life during early life stages (9.5 mg/l), and above minimum guideline set for other life stages (6.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).

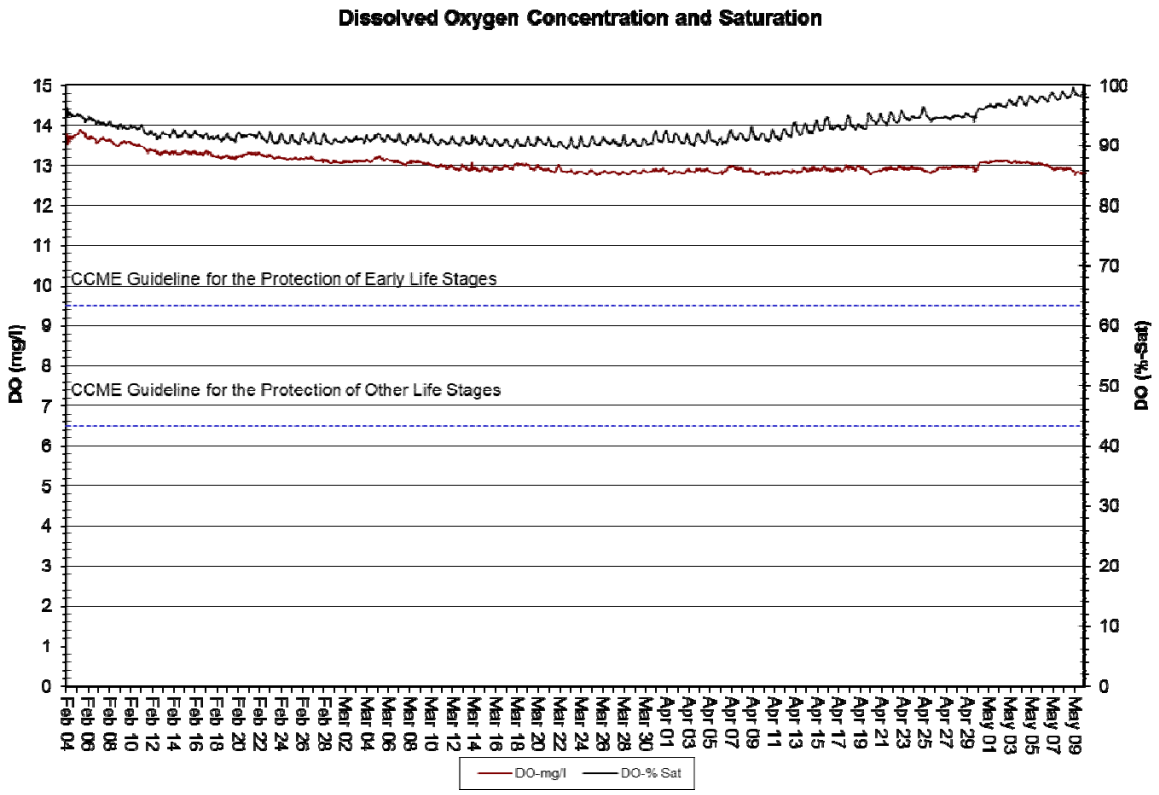

Figure 5: DO (mg/l & % saturation) at Humber River from February 4, 2013 to May 10, 2013

Turbidity

- Turbidity values ranged from 0.0 NTU to 37.9 NTU at Humber River from February 4, 2013 to May 10, 2013 (Figure 6).
- There was a significant turbidity event at Humber River (see inside red oval – Figure 6) around March 6th which is most likely explained by some organic matter or debris temporarily trapped near the turbidity sensor (i.e. it is most likely a false reading).

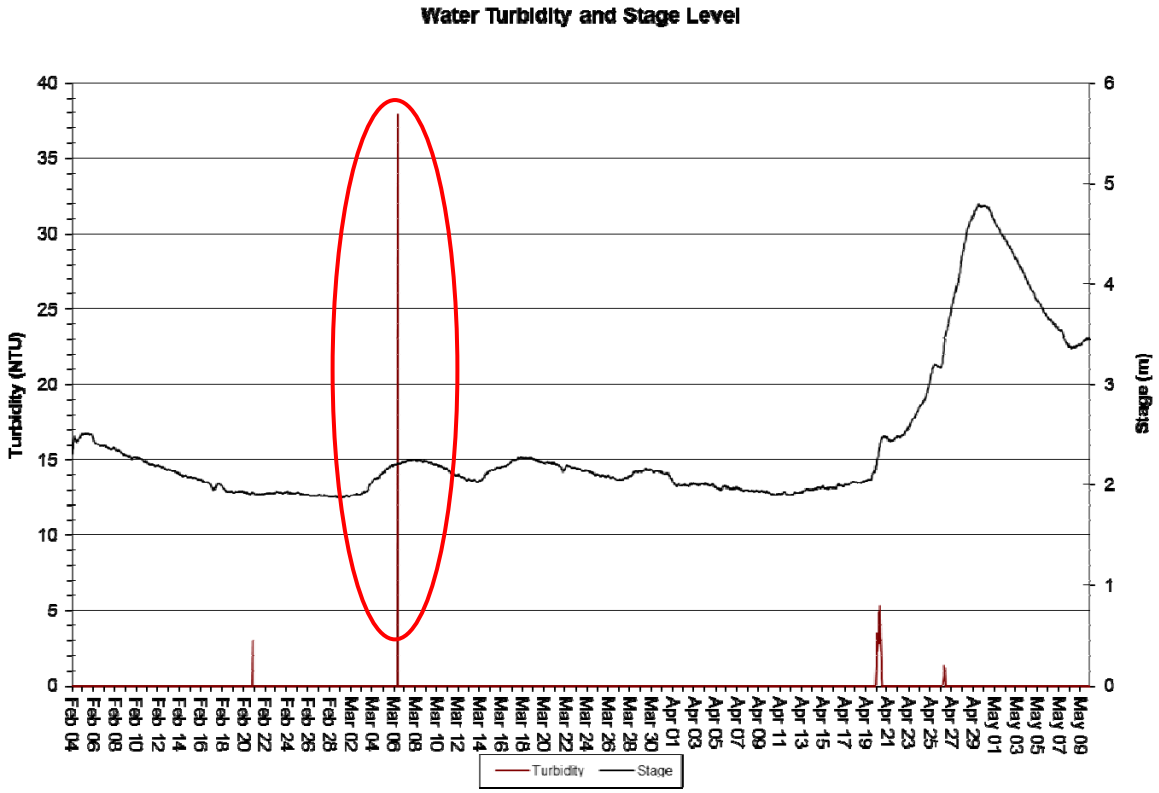

Figure 6: Turbidity (NTU) at Humber River from February 4, 2013 to May 10, 2013

Conclusion

- This monthly deployment report presents water quality and water quantity data recorded at Humber River from February 4, 2013 to May 10, 2013.
- The performances of all sensors were rated good to excellent at the beginning of the deployment period, while all sensors were rated fair to excellent at the end of the deployment period.

- Variations in water quality/quantity values recorded at each station are summarized below:
    - There is a significant peak in stage height and flow during the last week of the deployment period which is related to a combination of heavy rain and snow melt typical of the spring runoff period.
    - Water temperature displays diurnal variations which are related to diurnal variations in ambient air temperatures.
    - There is a gentle increasing temperatures trend over the deployment period which is consistent with the transition from winter to spring.
    - pH values show regular diurnal fluctuations which are related to the diurnal temperature fluctuations.
    - pH was relatively stable throughout the deployment period.
    - With a mean value of 7.01, pH values recorded at Humber River were just at or 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).
    - Specific conductivity readings were fairly stable at Humber River during the deployment period.
    - DO (mg/l & % saturation) shows a clear diurnal fluctuation which can be attributed to the diurnal temperature fluctuations.
    - The DO values at Humber River were above the cold water minimum guideline set for aquatic life during early life stages (9.5 mg/l), and above minimum guideline set for other life stages (6.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).
    - There was a significant turbidity event at Humber River around March 6th which is most likely explained by some organic matter or debris temporarily trapped near the turbidity sensor (i.e. it is most likely a false reading).

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: http://ceqg-rcqe.ccme.ca/download/en/222/)

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

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

[1] Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality 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 Canada Weather Data – Corner Brook (February 4, 2013 to May 10, 2013)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Rain Flag	Total Snow Flag	Total Precip (mm)
2/4/2013	6.6	-6.7	-0.1	18.1	0	M	M	19.2
2/5/2013	-6.6	-11.6	-9.1	27.1	0	M	M	1.4
2/6/2013	-5.7	-14.4	-10.1	28.1	0	M	M	0
2/7/2013	-5.6	-15	-10.3	28.3	0	M	M	2.1
2/8/2013	-11	-16.6	-13.8	31.8	0	M	M	0.6
2/9/2013	-9.3	-14.4	-11.9	29.9	0	M	M	4.7
2/10/2013	-4.8	-10	-7.4	25.4	0	M	M	7.6
2/11/2013	-1.8	-9.4	-5.6	23.6	0	M	M	0
2/12/2013	-1.4	-8.1	-4.8	22.8	0	M	M	8.6
2/13/2013	-0.3	-4.1	-2.2	20.2	0	M	M	3.5
2/14/2013	-0.4	-6.7	-3.6	21.6	0	M	M	0
2/15/2013	-0.5	-5.8	-3.2	21.2	0	M	M	0
2/16/2013	1.1	-6.9	-2.9	20.9	0	M	M	0
2/17/2013	1.9	-3.3	-0.7	18.7	0	M	M	11.9
2/18/2013	1.6	-1.2	0.2	17.8	0	M	M	5.5
2/19/2013	1.7	-1.5	0.1	17.9	0	M	M	0.6
2/20/2013	5.6	-2.2	1.7	16.3	0	M	M	0
2/21/2013	0.3	-2.2	-1	19	0	M	M	4.4
2/22/2013	-1.3	-9	-5.2	23.2	0	M	M	0
2/23/2013	-3.3	-15.2	-9.3	27.3	0	M	M	0
2/24/2013	-0.6	-14.5	-7.6	25.6	0	M	M	0.7
2/25/2013	-1.3	-16	-8.7	26.7	0	M	M	0
2/26/2013	-1.9	-16.5	-9.2	27.2	0	M	M	0
2/27/2013	1	-15	-7	25	0	M	M	0
2/28/2013	2.3	-13	-5.4	23.4	0	M	M	0
3/1/2013	3.1	-2.6	0.3	17.7	0	M	M	2.3
3/2/2013	3	0.5	1.8	16.2	0	M	M	7.2
3/3/2013	3.9	1.4	2.7	15.3	0	M	M	10.4
3/4/2013	3.5	0.4	2	16	0	M	M	20.7
3/5/2013	1.4	-2.3	-0.5	18.5	0	M	M	0
3/6/2013	0.4	-2.4	-1	19	0	M	M	0
3/7/2013	5	-7.5	-1.3	19.3	0	M	M	0
3/8/2013	1.3	-6.9	-2.8	20.8	0	M	M	0
3/9/2013	2.4	-4.9	-1.3	19.3	0	M	M	0
3/10/2013	3.9	-8.2	-2.2	20.2	0	M	M	0
3/11/2013	4.2	-6.3	-1.1	19.1	0	M	M	0
3/12/2013	9.4	-0.2	4.6	13.4	0	M	M	0
3/13/2013	10.2	1.3	5.8	12.2	0	M	M	0
3/14/2013	9.2	0.7	5	13	0	M	M	4.7
3/15/2013	3.1	-2.7	0.2	17.8	0	M	M	0.6
3/16/2013	0	-6.1	-3.1	21.1	0	M	M	0
3/17/2013	-2.4	-8.2	-5.3	23.3	0	M	M	1.4
3/18/2013	-7.6	-12.3	-10	28	0	M	M	1.5
3/19/2013	-4.1	-8.7	-6.4	24.4	0	M	M	0
3/20/2013	5.5	-4.9	0.3	17.7	0	M	M	4.2
3/21/2013	5.2	-2.2	1.5	16.5	0	M	M	0
3/22/2013	2.1	-3.4	-0.7	18.7	0	M	M	6.7
3/23/2013	5.2	-6.2	-0.5	18.5	0	M	M	0
3/24/2013	2.6	-9.1	-3.3	21.3	0	M	M	0.6
3/25/2013	6.4	-5.2	0.6	17.4	0	M	M	0.7
3/26/2013	3.5	-0.4	1.6	16.4	0	M	M	2.7

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Rain Flag	Total Snow Flag	Total Precip (mm)
3/27/2013	5.1	1.3	3.2	14.8	0	M	M	0
3/28/2013	4.2	-1.6	1.3	16.7	0	M	M	0
3/29/2013	-1.1	-3.8	-2.5	20.5	0	M	M	0
3/30/2013	-1.6	-4.5	-3.1	21.1	0	M	M	0
3/31/2013	2.1	-8.6	-3.3	21.3	0	M	M	0
4/1/2013	9.6	-9.8	-0.1	18.1	0	M	M	0
4/2/2013	7.2	-5.2	1	17	0	M	M	0
4/3/2013	-0.2	-7.7	-4	22	0	M	M	10.3
4/4/2013	0.6	-6.6	-3	21	0	M	M	4.2
4/5/2013	6.2	-4.5	0.9	17.1	0	M	M	18.2
4/6/2013	2.6	-3.1	-0.3	18.3	0	M	M	0.6
4/7/2013	-2.4	-5.9	-4.2	22.2	0	M	M	32.2
4/8/2013	2.1	-5	-1.5	19.5	0	M	M	0
4/9/2013	6.9	-3.3	1.8	16.2	0	M	M	0.6
4/10/2013	3.1	-1.4	0.9	17.1	0	M	M	2.3
4/11/2013	2.6	-2.3	0.2	17.8	0	M	M	2.2
4/12/2013	5.8	-1.9	2	16	0	M	M	0
4/13/2013	7.6	-4.2	1.7	16.3	0	M	M	0
4/14/2013	5.2	-4	0.6	17.4	0	M	M	0
4/15/2013	4.8	-6.5	-0.9	18.9	0	M	M	0
4/16/2013	9.6	-7.1	1.3	16.7	0	M	M	2.9
4/17/2013	5	-1.1	2	16	0	M	M	9.9
4/18/2013	1.5	-2.5	-0.5	18.5	0	M	M	0
4/19/2013	8.4	-2.7	2.9	15.1	0	M	M	11.4
4/20/2013	17.5	4.5	11	7	0	M	M	3.1
4/21/2013	4.6	-4.8	-0.1	18.1	0	M	M	0
4/22/2013	1.5	-6.2	-2.4	20.4	0	M	M	0
4/23/2013	10.2	-6.5	1.9	16.1	0	M	M	0
4/24/2013	9.5	0.9	5.2	12.8	0	M	M	0.6
4/25/2013	16.1	7.7	11.9	6.1	0	M	M	9.5
4/26/2013	8.1	0.7	4.4	13.6	0	M	M	46.7
4/27/2013	8.9	0.8	4.9	13.1	0	M	M	21.9
4/28/2013	5.8	2.1	4	14	0	M	M	15.8
4/29/2013	14.1	1.9	8	10	0	M	M	0.7
4/30/2013	16.1	4.6	10.4	7.6	0	M	M	0
5/1/2013	12.4	1.6	7	11	0	M	M	0
5/2/2013	7.1	0.2	3.7	14.3	0	M	M	0
5/3/2013	14.6	-0.8	6.9	11.1	0	M	M	0
5/4/2013	14.6	-1.2	6.7	11.3	0	M	M	0
5/5/2013	17.9	0.2	9.1	8.9	0	M	M	0
5/6/2013	17.1	2.4	9.8	8.2	0	M	M	0
5/7/2013	18.2	6.4	12.3	5.7	0	M	M	0
5/8/2013	18	3.4	10.7	7.3	0	M	M	0
5/9/2013	21.4	6.4	13.9	4.1	0	M	M	
5/10/2013	20.1	1.7	10.9	7.1	0	M	M	