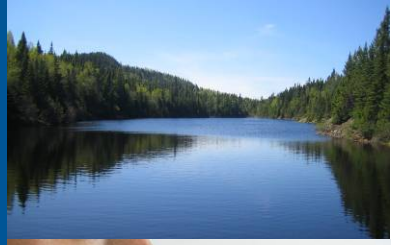




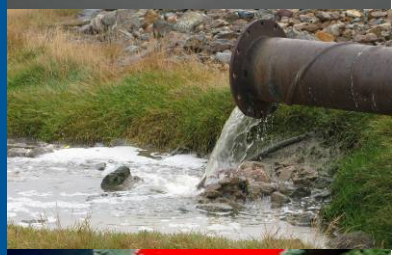


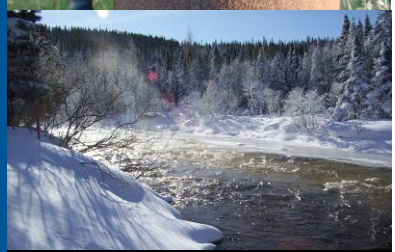

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2014-12-12 to 2015-03-30

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

Prepared by:

Ian Bell
Environmental Scientist

Department of Environment & Conservation
Water Resources Management Division
PO Box 2006, Corner Brook, NL, A2H 6J8

t. 709.637.2431
f. 709.637.2541
e. ianbell@gov.nl.ca

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 bi-monthly 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 12, 2014, to March 30, 2015.

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 the deployed instrument.
- The performances of all sensors were rated good to excellent at the beginning, and fair 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**.

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

	Humber River	
Stage of deployment	**Beginning**	**End**
Date	2014-12-12	2015-03-30
Temperature	Excellent	Good
pH	Excellent	Fair
Specific Conductivity	Good	Good
Dissolved Oxygen	Excellent	Excellent
Turbidity	Excellent	Excellent

Deployment Notes

Water quality monitoring for this deployment period started on December 12, 2014 and continued without any significant operational issues until March 30, 2015, 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 (^{o}C)
  (iii.) pH
  (iv.) Specific conductivity (µS/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 0.87 m to 2.84 m at Humber River at Humber Village, with corresponding flow ranging from 72.69 m^3/sec to 368.40 m^3/sec (Figure 1).

- On two occasions on approximately January 7th and February 10th the stage height and flow data take significant dips which are most likely related to errors in data collection due to winter when ice and extreme cold weather can affect the accuracy of data collected.

- On five occasions during this deployment stage height and flow show significant spikes (see inside green ovals) which seem to correspond with warmer temperatures and precipitation events (See climate data located in Appendix B). However, it should be noted that during winter conditions ice and extreme cold temperatures can affect the accuracy of data collected.

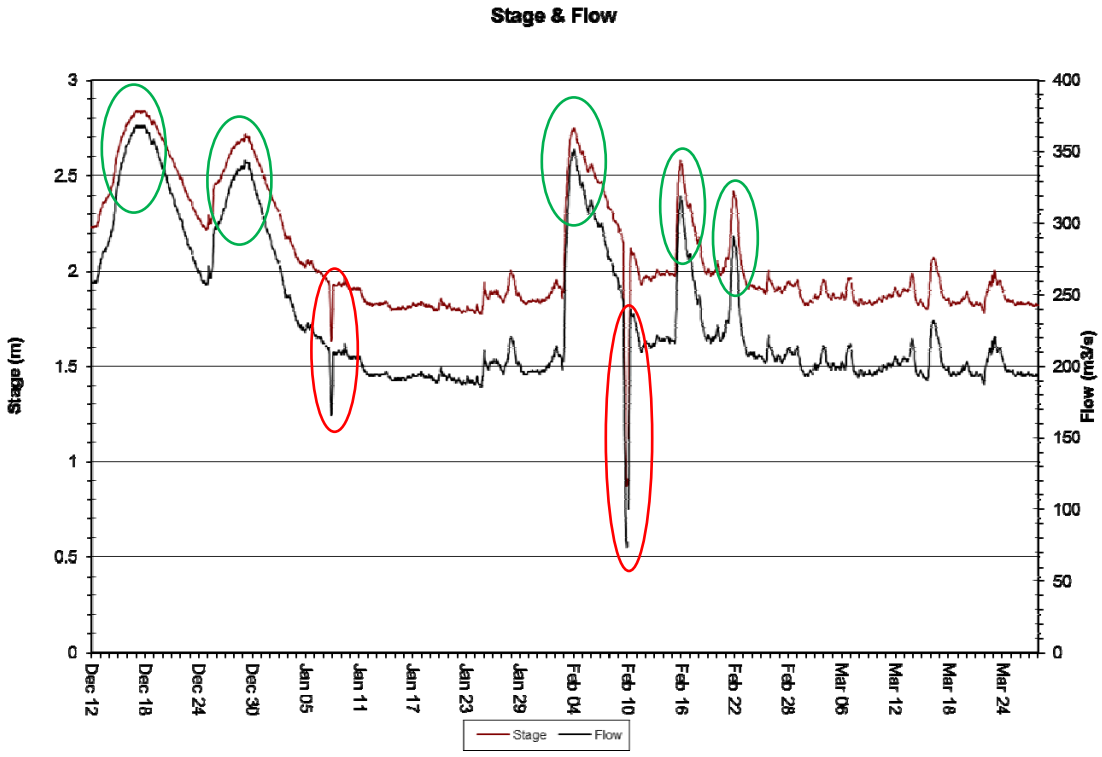

Figure 1: Stage Height (m) at Humber River from December 12, 2014, to March 30, 2015

Temperature

- During this deployment period the water temperature at Humber River ranged from 0.06˚C to 4.39˚C (Figure 2).
- Water temperature shows a decreasing trend over the initial month of the deployment period and then remains consistently cold for the remainder of the deployment which is consistent with the transition from late fall to winter.
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

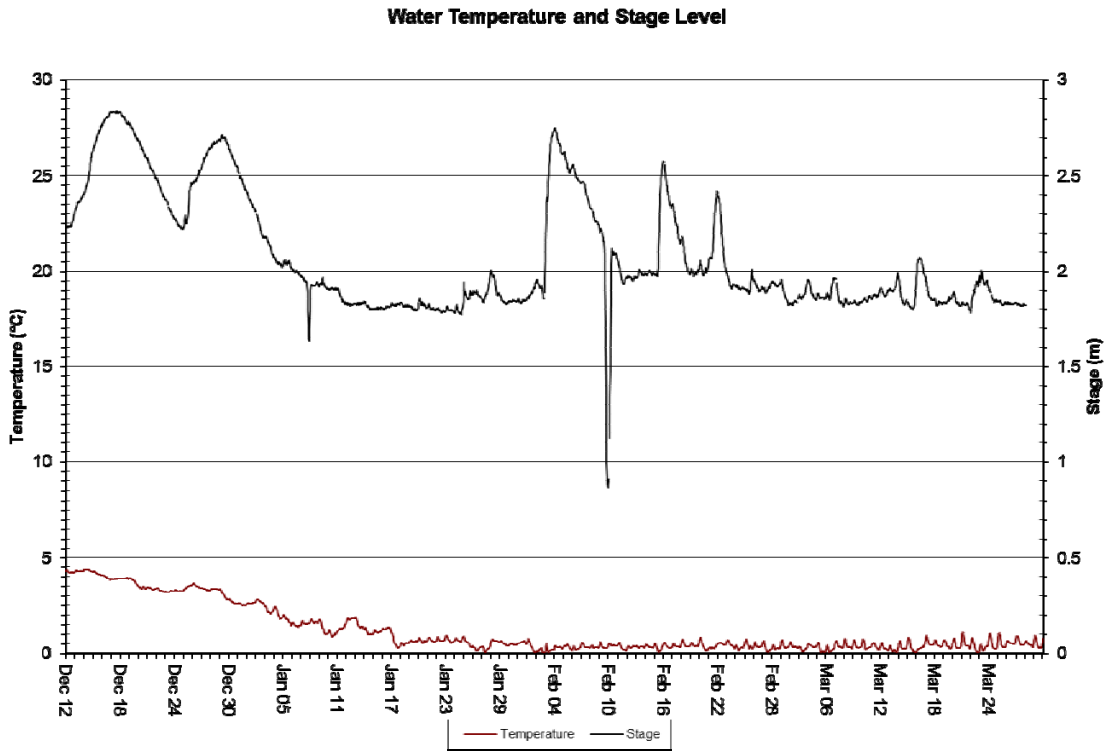

Figure 2: Temperature (^{o}C) at Humber River from December 12, 2014, to March 30, 2015

pH

- During this deployment period pH values at Humber River ranged from 6.93 units to 7.40 units (Figure 3).
- Upon the initial deployment pH was slow to stabilize, which is an indication of an aging pH probe. pH remained relatively stable throughout the remainder of the deployment period; however there is a slight dip around approximately February 3rd (see inside red oval) which is related to a rapid increase in flow for the same time period.
- pH shows diurnal fluctuations which are related to the diurnal temperature fluctuations.
- With a median value of 7.28, 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).

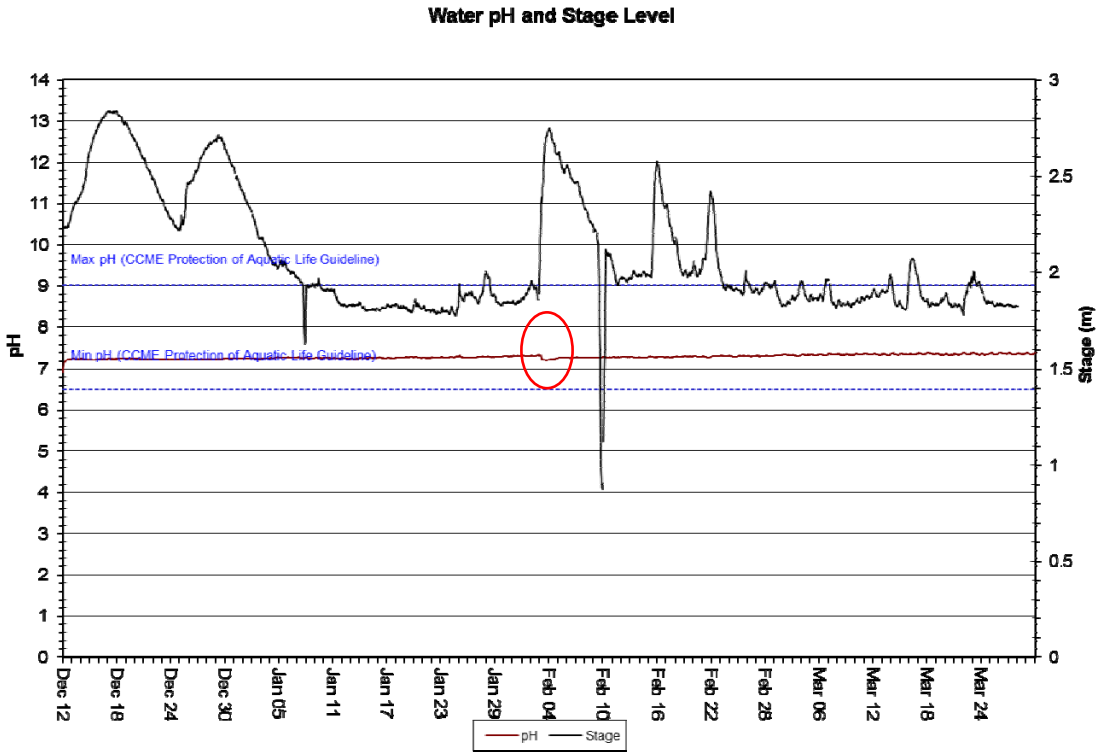

Figure 3: pH values recorded at Humber River from December 12, 2014, to March 30, 2015

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 24.0 µS/cm to 36.4 µS/cm (Figure 4).
- Specific conductivity was relatively stable during the deployment period with no noticeable trends apparent; however there was a significant dip (see inside red oval) at approximately February 3rd , which corresponds with a significant increase in flow for the same period.

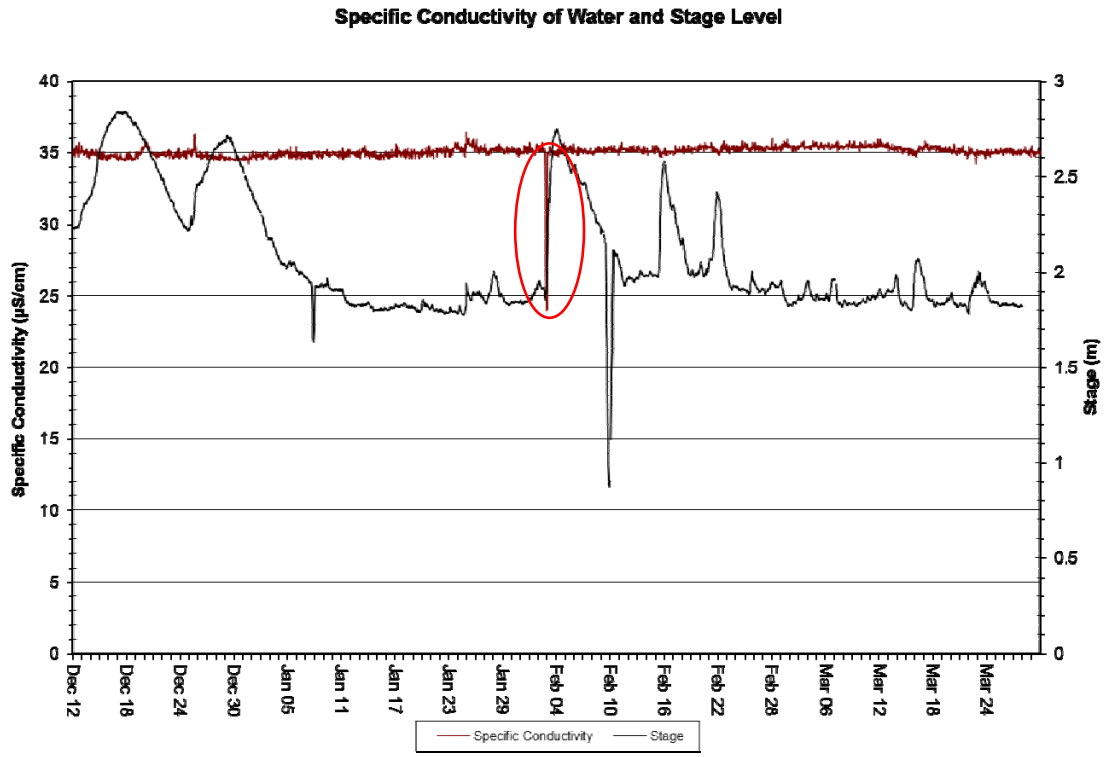

Figure 4: Specific conductivity (µs/cm) at Humber River from December 12, 2014, to March 30, 2015

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 12.02 mg/l (88.2% saturation) to 13.13 mg/l (94.5% saturation) (Figure 5).
- Over the first month of the deployment period DO (mg/l) shows a gradual increasing trend which is due to the decreasing temperature trend. For the remainder of the deployment DO is relatively stable.
- DO shows diurnal fluctuations which can be attributed to the diurnal temperature fluctuations.
- During this deployment period all of the DO values at Humber River were above the minimum guideline set for other life stages (6.5 mg/l) and the minimum guideline set for the protection of early life stages(9.5 mg/l), as determined by the Canadian Council of Ministers of the Environment (2007).

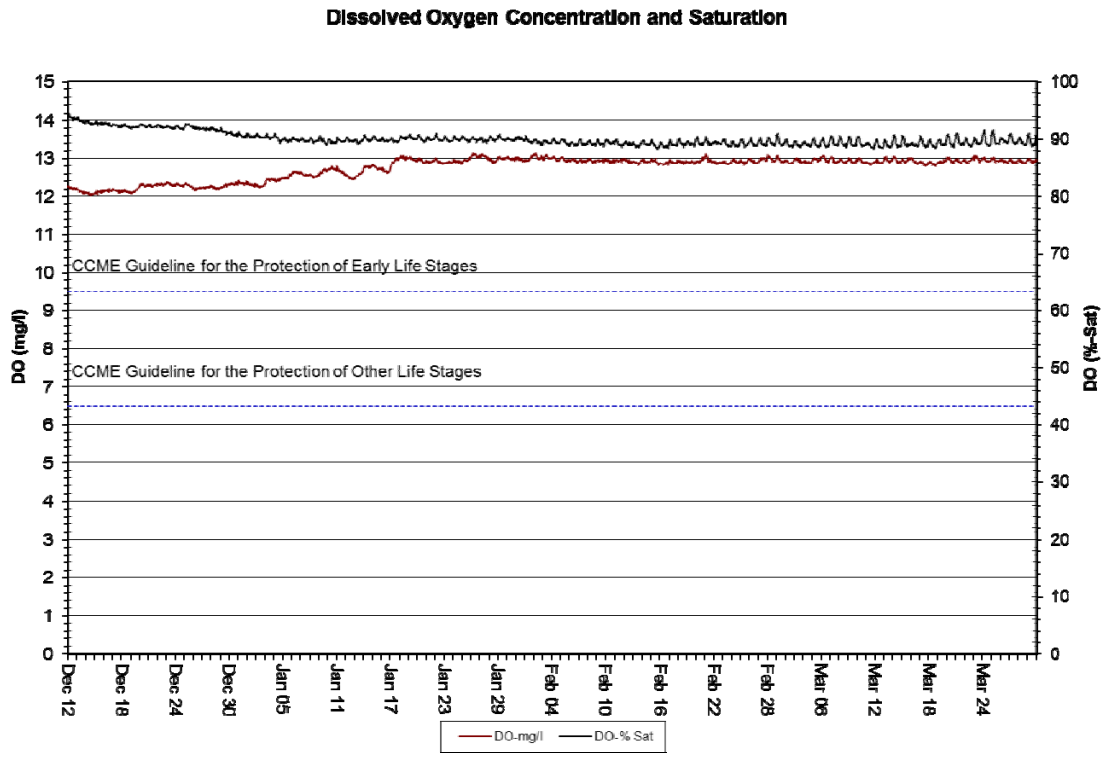

Figure 5: DO (mg/l & % saturation) at Humber River from December 12, 2014, to March 30, 2015

Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.0 NTU to 3000.0 NTU (Figure 6); however the extremely high turbidity reading are most likely related to interference from organic debris causing false readings. These false readings will be removed from the dataset.

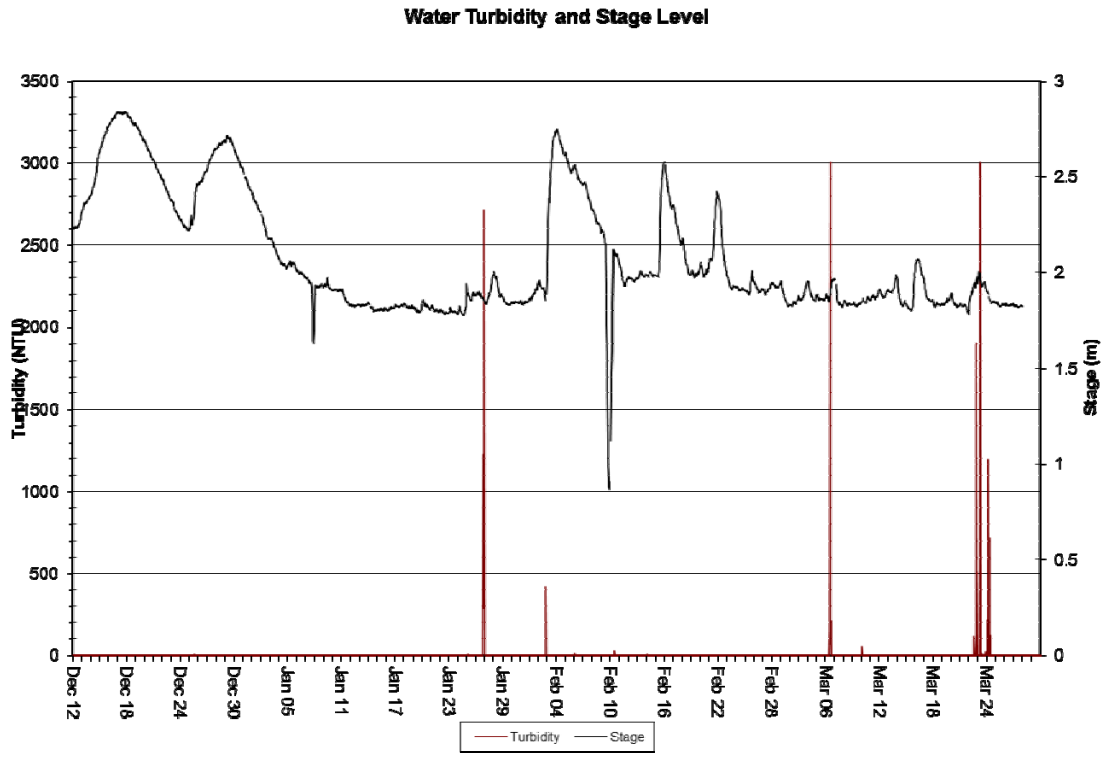

Figure 6: Turbidity (NTU) at Humber River from December 12, 2014, to March 30, 2015

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from December 12, 2014, to March 30, 2015.

- The performances of all sensors were rated good to excellent at the beginning, and fair 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 0.87 m to 2.84 m at Humber River at Humber Village, with corresponding flow ranging from 72.69 m^3/sec to 368.40 m^3/sec (Figure 1).
    - During this deployment period the water temperature at Humber River ranged from 0.06˚C to 4.39˚C. Temperature showed a decreasing trend over the initial month of the deployment period and then remains consistently cold for the remainder of it.
    - During this deployment period pH values at Humber River ranged from 6.93 units to 7.40 units. With a median value of 7.28, 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 24.0 µS/cm to 36.4 µS/cm.
    - During this deployment period dissolved oxygen [DO] values at Humber River ranged from 12.02 mg/l (88.2% saturation) to 13.13 mg/l (94.5% saturation). During this deployment period all of the DO values at Humber River were above the minimum guideline set for other life stages (6.5 mg/l) and the minimum guideline set for the protection of early life stages(9.5 mg/l), 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 3000.0 NTU; however the extremely high turbidity reading are most likely related to interference from organic debris causing false readings.

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 (12-12-2014 to 03-30-2015)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
12/12/2014	4.5	1.5	3	15	0	2.2
12/13/2014	7	3.5	5.3	12.7	0	2.1
12/14/2014	9	3	6	12	0	10
12/15/2014	7.5	1.5	4.5	13.5	0	9.9
12/16/2014	0.5	-1.5	-0.5	18.5	0	0
12/17/2014	0	-5	-2.5	20.5	0	0
12/18/2014	1.5	-3	-0.8	18.8	0	2.4
12/19/2014	1	-2	-0.5	18.5	0	4
12/20/2014	-0.5	-4	-2.3	20.3	0	0
12/21/2014	-1.5	-4.5	-3	21	0	0
12/22/2014	-2	-4.5	-3.3	21.3	0	0
12/23/2014	-2.5	-5	-3.8	21.8	0	0
12/24/2014	3	-3	0	18	0	0.8
12/25/2014	9.5	-1	4.3	13.7	0	37
12/26/2014	2	1	1.5	16.5	0	1.5
12/27/2014	1	-2	-0.5	18.5	0	0.5
12/28/2014	-1	-3	-2	20	0	0
12/29/2014	-3	-5	-4	22	0	3
12/30/2014	-9	-12	-10.5	28.5	0	4.2
12/31/2014	-9	-13	-11	29	0	3.5
1/1/2015	-3.5	-12	-7.8	25.8	0	0.5
1/2/2015	-3	-10	-6.5	24.5	0	6.5
1/3/2015	-12	-15	-13.5	31.5	0	2.7
1/4/2015	-7.5	-15	-11.3	29.3	0	14
1/5/2015	0	-9	-4.5	22.5	0	17
1/6/2015	-9	-10.5	-9.8	27.8	0	7
1/7/2015	-11	-13	-12	30	0	2.2
1/8/2015	-11	-20.5	-15.8	33.8	0	3.7
1/9/2015	2	-15	-6.5	24.5	0	10.9
1/10/2015	-4	-8	-6	24	0	6.2
1/11/2015	-5.5	-12.5	-9	27	0	3.8
1/12/2015	-2.5	-12	-7.3	25.3	0	6
1/13/2015	-8.5	-14.5	-11.5	29.5	0	0.8
1/14/2015	-5	-14.5	-9.8	27.8	0	0
1/15/2015	-4	-12	-8	26	0	0
1/16/2015	0	-14.5	-7.3	25.3	0	3
1/17/2015	-6	-11	-8.5	26.5	0	4

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
1/18/2015	3	-13.5	-5.3	23.3	0	0
1/19/2015	3	-6	-1.5	19.5	0	2.4
1/20/2015	3	-2	0.5	17.5	0	0.6
1/21/2015	-2.5	-7.5	-5	23	0	1
1/22/2015	-3	-5.5	-4.3	22.3	0	2.8
1/23/2015	-5	-7.5	-6.3	24.3	0	1
1/24/2015	8	-9.5	-0.8	18.8	0	18.2
1/25/2015	8	-3	2.5	15.5	0	10.2
1/26/2015	-6.5	-11.5	-9	27	0	0
1/27/2015	-5	-14.5	-9.8	27.8	0	21.8
1/28/2015	0.5	-11.5	-5.5	23.5	0	0
1/29/2015	-3	-6	-4.5	22.5	0	0
1/30/2015	-4	-8	-6	24	0	2
1/31/2015	5	-7.5	-1.3	19.3	0	8.7
2/1/2015	1	-1.5	-0.3	18.3	0	5.4
2/2/2015	-9.5	-13.5	-11.5	29.5	0	34.2
2/3/2015	8.5	-13	-2.3	20.3	0	2.8
2/4/2015	7	-13.5	-3.3	21.3	0	0.8
2/5/2015	2	-16	-7	25	0	48.3
2/6/2015	-4	-10.5	-7.3	25.3	0	24.4
2/7/2015	-7.5	-15.5	-11.5	29.5	0	3
2/8/2015	-9.5	-15	-12.3	30.3	0	1.4
2/9/2015	-13	-19.5	-16.3	34.3	0	0
2/10/2015	-9	-26	-17.5	35.5	0	2.4
2/11/2015	-12	-15	-13.5	31.5	0	0
2/12/2015	-13	-19	-16	34	0	2
2/13/2015	-7	-14.5	-10.8	28.8	0	8
2/14/2015	-7	-11	-9	27	0	0
2/15/2015	-2.5	-19	-10.8	28.8	0	25.4
2/16/2015	0.5	-8.5	-4	22	0	17.4
2/17/2015	-6.5	-13.5	-10	28	0	0
2/18/2015	-3	-19	-11	29	0	0
2/19/2015	-3	-12	-7.5	25.5	0	1.8
2/20/2015	4	-8.5	-2.3	20.3	0	5
2/21/2015	-5	-9	-7	25	0	1.4
2/22/2015	2.5	-10	-3.8	21.8	0	8.4
2/23/2015	-4	-8.5	-6.3	24.3	0	3.6
2/24/2015	-9.5	-13.5	-11.5	29.5	0	2

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
2/25/2015	0.5	-18	-8.8	26.8	0	10.2
2/26/2015	-4.5	-9.5	-7	25	0	3.2
2/27/2015	-6.5	-13	-9.8	27.8	0	0
2/28/2015	-6.5	-15	-10.8	28.8	0	1.8
3/1/2015	-3.5	-12	-7.8	25.8	0	0
3/2/2015	-2.5	-14	-8.3	26.3	0	10
3/3/2015	-7.5	-13	-10.3	28.3	0	3.8
3/4/2015	-4.5	-15.5	-10	28	0	5.2
3/5/2015	-4	-9.5	-6.8	24.8	0	0
3/6/2015	-13	-16.5	-14.8	32.8	0	0.8
3/7/2015	-3.5	-19	-11.3	29.3	0	0.8
3/8/2015	-1	-16	-8.5	26.5	0	0.6
3/9/2015	-11	-13.5	-12.3	30.3	0	0
3/10/2015	-2.5	-15.5	-9	27	0	2
3/11/2015	4	-15.5	-5.8	23.8	0	18
3/12/2015	-11	-13.5	-12.3	30.3	0	1.6
3/13/2015	-9.5	-16.5	-13	31	0	0
3/14/2015	-8.5	-16.5	-12.5	30.5	0	0
3/15/2015	-2.5	-17	-9.8	27.8	0	6.6
3/16/2015	-4.5	-11.5	-8	26	0	8.8
3/17/2015	-0.5	-8	-4.3	22.3	0	0
3/18/2015	2	-5.5	-1.8	19.8	0	5.2
3/19/2015	0.5	-3.5	-1.5	19.5	0	6.6
3/20/2015	-2	-7	-4.5	22.5	0	0
3/21/2015	4.5	-14.5	-5	23	0	8
3/22/2015	4.5	-4.5	0	18	0	11.3
3/23/2015	-2.5	-11	-6.8	24.8	0	3.4
3/24/2015	-2.5	-9	-5.8	23.8	0	0
3/25/2015	-0.5	-16	-8.3	26.3	0	0
3/26/2015	2	-10.5	-4.3	22.3	0	2.7
3/27/2015	6	0	3	15	0	0
3/28/2015	1	-2.5	-0.8	18.8	0	4.8
3/29/2015	1	-4	-1.5	19.5	0	0
3/30/2015	6	-11	-2.5	20.5	0	0