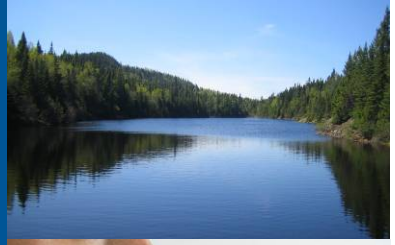




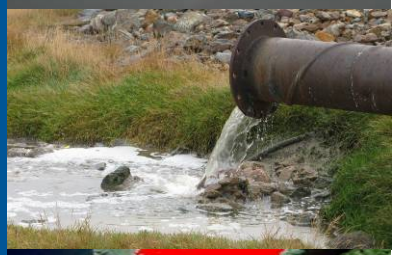


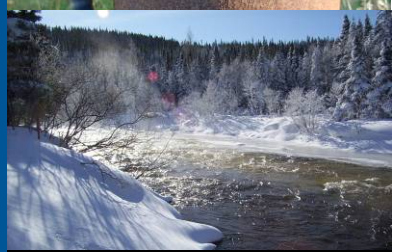

Real Time Water Quality Report

Humber River at Humber Village

Deployment Period
2017-06-14 to 2017-07-27

Government of Newfoundland & Labrador
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Water Resources Management Division
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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 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 June 14, 2017, to July 27, 2017.

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	2017-06-14	2017-07-27
Temperature	Excellent	Excellent
pH	Good	Good
Specific Conductivity	Excellent	Excellent
Dissolved Oxygen	Good	Fair
Turbidity	Excellent	Excellent

Deployment Notes

Water quality monitoring for this deployment period started on June 14, 2017 and continued without any significant operational issues until July 27, 2017, 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 1.62 m to 3.12 m at Humber River at Humber Village, with corresponding flow ranging from 163.93 m^3/sec to 424.08 m^3/sec (Figure 1).

- Flows over the deployment period were typical for the transition from late spring to summer with a steady decrease from spring runoff to summer low flow conditions.

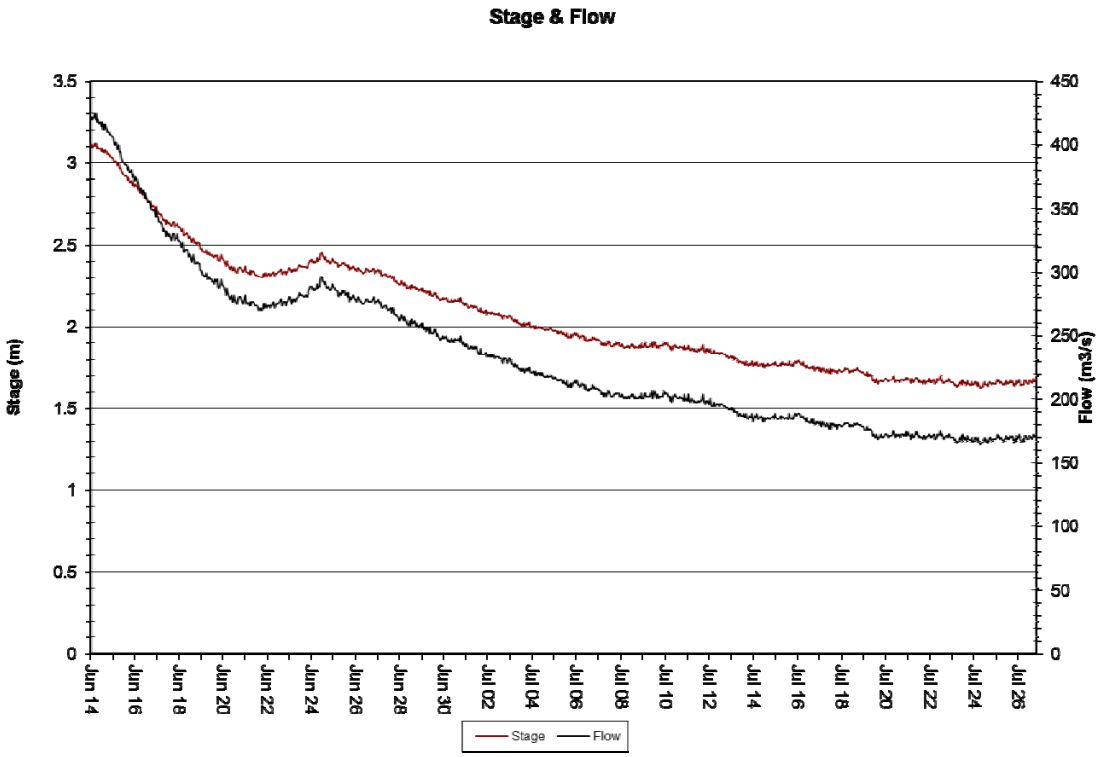

Figure 1: Stage Height (m) at Humber River from June 14, 2017, to July 27, 2017

Temperature

- During this deployment period the water temperature at Humber River ranged from 5.50˚C to 17.78˚C (Figure 2).
- Water temperature shows an increasing trend over the deployment period which is consistent with the transition from late spring to summer.
- During the deployment period there are a number of noticeable dips in water temperature (see inside red ovals) which correspond with cooler air temperatures; in particular with reference to the minimum temperature during the night. (Climate data is located in appendix B)
- The water temperature shows a diurnal trend which is related to the diurnal air temperature trend.

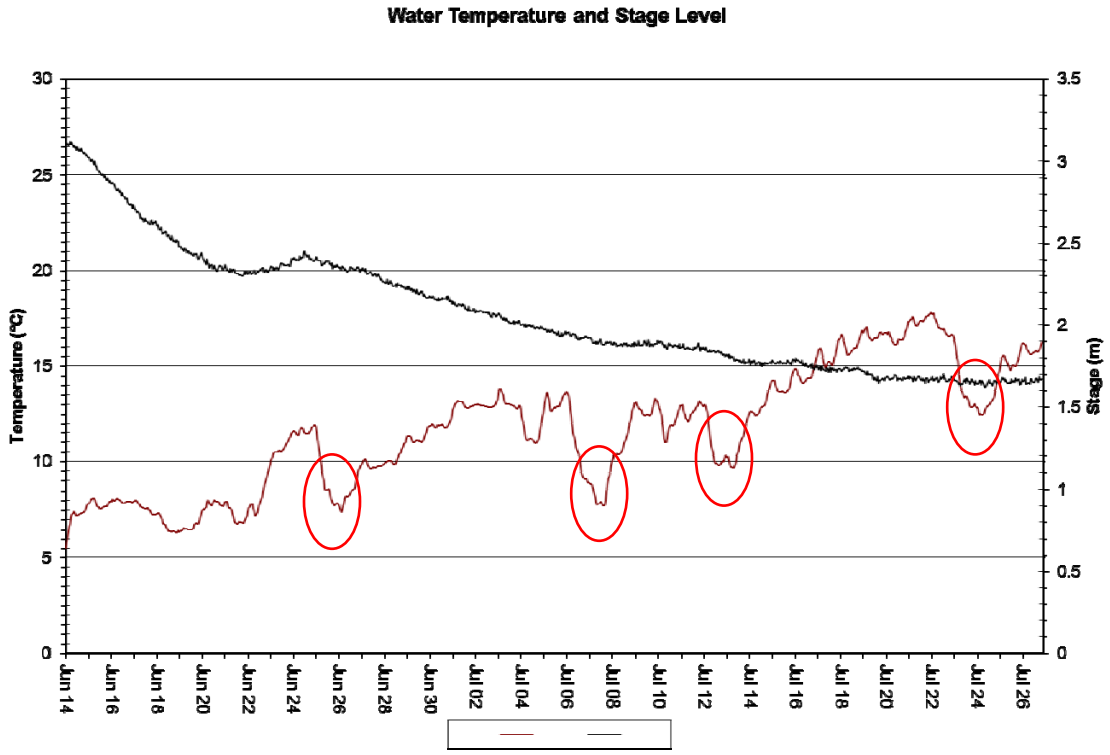

Figure 2: Temperature (°C) at Humber River from June 14, 2017, to July 27, 2017

pH

- During this deployment period pH values at Humber River ranged from 6.91 units to 7.27 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 7.03, 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).

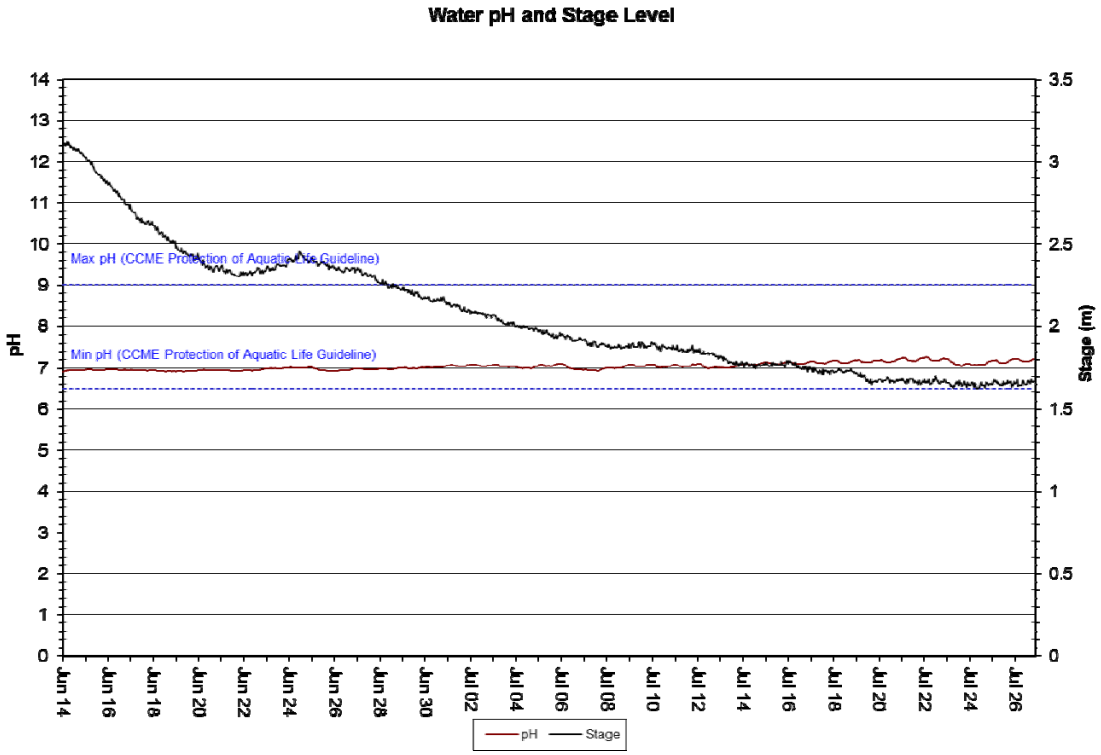

Figure 3: pH values recorded at Humber River from June 14, 2017, to July 27, 2017

Specific Conductivity

- During this deployment period specific conductivity at Humber River ranged from 35.3 µS/cm to 40.6 µS/cm (Figure 4).
- From approximately June 23rd to 25th there is a noticeable drop in specific conductivity (see inside red oval). This drop is most likely related to the increased flow for the same period.

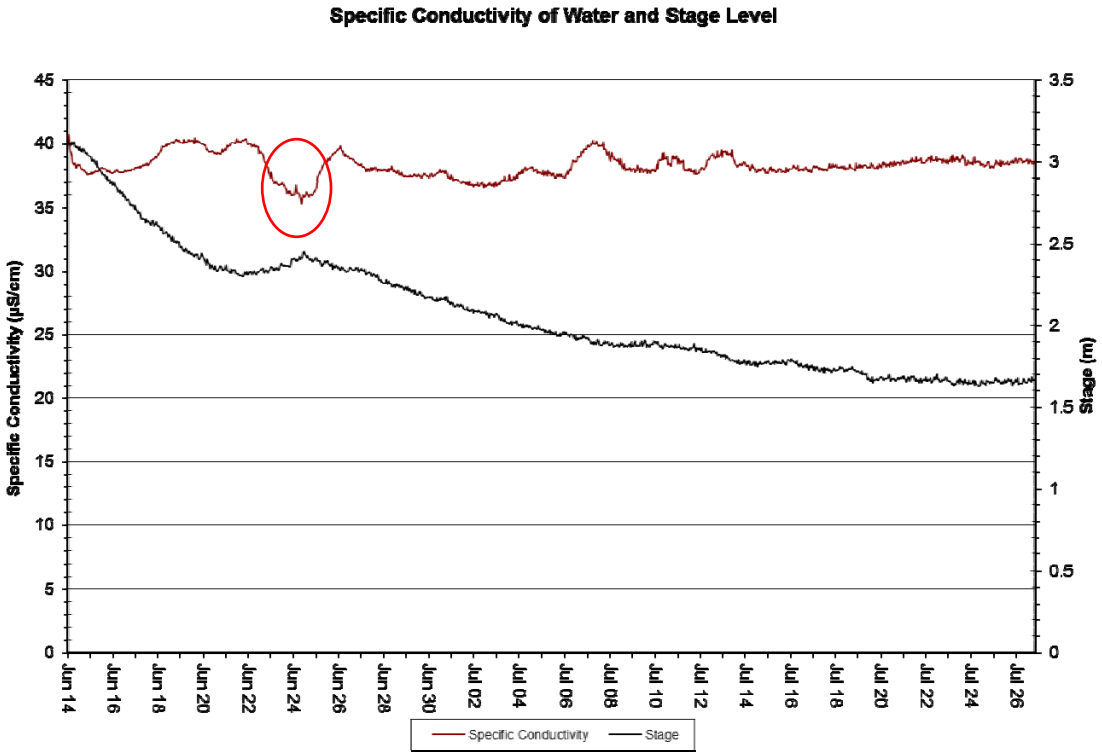

Figure 4: Specific conductivity (µs/cm) at Humber River from June 14, 2017, to July 27, 2017

Dissolved Oxygen

- During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.74 mg/l (99.4% saturation) to 12.40 mg/l (107.1% saturation) (Figure 5).
- Unfortunately, due to a technical issue, DO data is missing for the first two days of the deployment period.
- Over the deployment period DO(mg/l) shows a gentle decreasing trend which corresponds with the increasing temperature trend for the same period.
- DO shows diurnal fluctuations which are most evident in the percent saturation data. These diurnal trends are related to the diurnal temperature trends for the same period.
- During this deployment period all of the DO values at Humber River were above both 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).

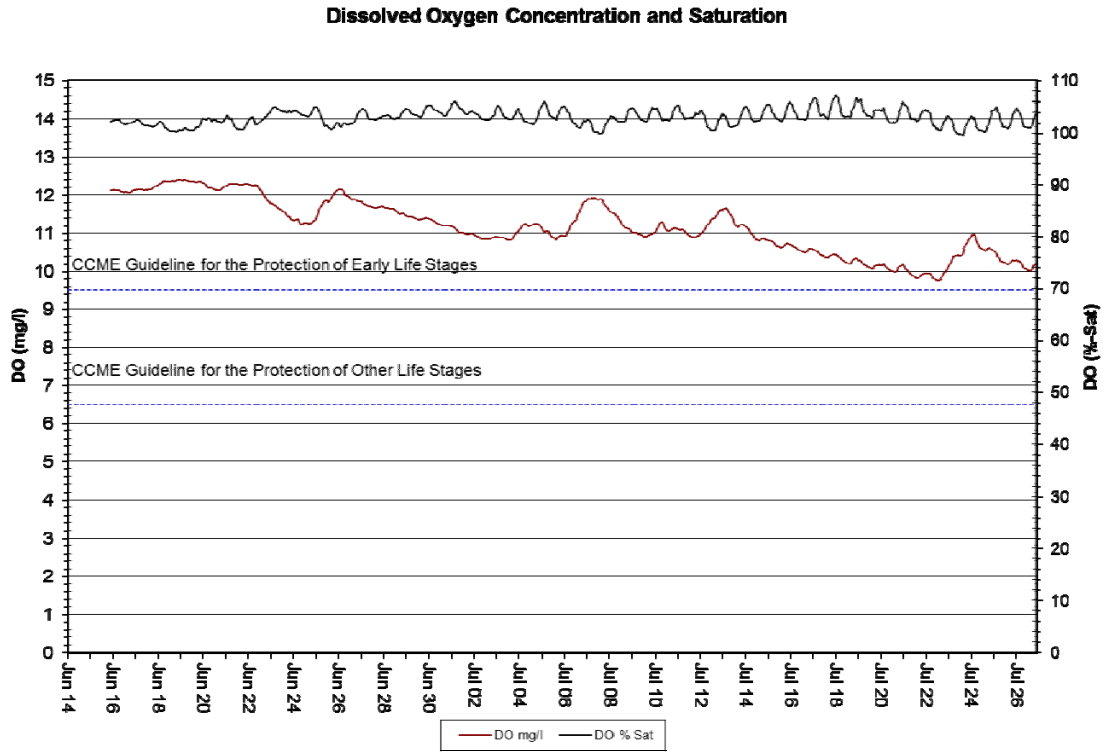

Figure 5: DO (mg/l & % saturation) at Humber River from June 14, 2017, to July 27, 2017

Turbidity

- During this deployment period turbidity values at Humber River ranged from 0.1 NTU to 0.8 NTU which is the typical background level for turbidity at this site (Figure 6).

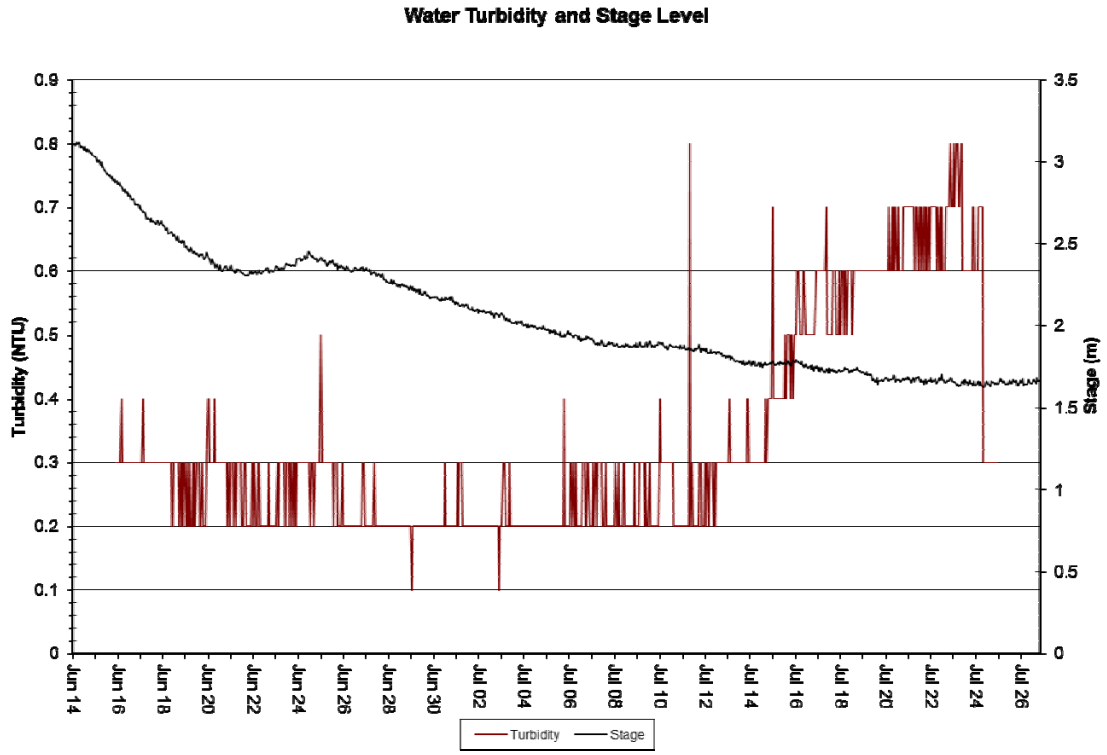

Figure 6: Turbidity (NTU) at Humber River from June 14, 2017, to July 27, 2017

Conclusions

- This monthly deployment report presents water quality and water quantity data recorded at Humber River at Humber Village from June 14, 2017, to July 27, 2017.
- 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 1.62 m to 3.12 m at Humber River at Humber Village, with corresponding flow ranging from 163.93 m^3/sec to 424.08 m^3/sec. These flows were typical for the transition from late spring to summer.
    - During this deployment period the water temperature at Humber River ranged from 5.50˚C to 17.78˚C and shows an increasing trend which is consistent with the transition from late spring to summer.
    - During this deployment period pH values at Humber River ranged from 6.91 units to 7.27 units and was quite stable. 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 35.3 µS/cm to 40.6 µS/cm.
    - During this deployment period dissolved oxygen [DO] values at Humber River ranged from 9.74 mg/l (99.4% saturation) to 12.40 mg/l (107.1% saturation) with a gentle decreasing trend which corresponds with the increasing temperature trend for the same period. All of the DO values during this deployment were above both 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 0.1 NTU to 0.8 NTU which is the typical background level for turbidity at this site.

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 (06-14-2017 to 07-27-2017)

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
6/14/2017	9.5	5	7.3	10.7	0	5.2
6/15/2017	12.5	1.5	7	11	0	0.2
6/16/2017	17.5	4	10.8	7.2	0	0
6/17/2017	16.5	7	11.8	6.2	0	3
6/18/2017	22	11	16.5	1.5	0	0.6
6/19/2017	22.5	15	18.8	0	0.8	0.2
6/20/2017	24.5	20	22.3	0	4.3	1.8
6/21/2017	24	15	19.5	0	1.5	0.4
6/22/2017	24	12.5	18.3	0	0.3	0
6/23/2017	16	12	14	4	0	14
6/24/2017	18.5	11.5	15	3	0	13.8
6/25/2017	21.5	13	17.3	0.7	0	0
6/26/2017	22	9.5	15.8	2.2	0	2
6/27/2017	20	8.5	14.3	3.7	0	0
6/28/2017	19	8	13.5	4.5	0	0.4
6/29/2017	22	9	15.5	2.5	0	0
6/30/2017	23	11.5	17.3	0.7	0	5.8
7/1/2017	19.5	15	17.3	0.7	0	0
7/2/2017	19	7.5	13.3	4.7	0	2.2
7/3/2017	25.5	14	19.8	0	1.8	0
7/4/2017	18	13	15.5	2.5	0	0.2
7/5/2017	22.5	7	14.8	3.2	0	0
7/6/2017	28	9.5	18.8	0	0.8	0
7/7/2017	24	16.5	20.3	0	2.3	11.2
7/8/2017	21	15.5	18.3	0	0.3	2.8
7/9/2017	26	15.5	20.8	0	2.8	0
7/10/2017	26	15.5	20.8	0	2.8	0
7/11/2017	28	15	21.5	0	3.5	0.8
7/12/2017	22	16	19	0	1	0.8
7/13/2017	22	11	16.5	1.5	0	0
7/14/2017	23	9.5	16.3	1.7	0	0
7/15/2017	25	10	17.5	0.5	0	0
7/16/2017	26.5	9	17.8	0.2	0	0
7/17/2017	27	16	21.5	0	3.5	0
7/18/2017	28.5	13	20.8	0	2.8	0
7/19/2017	28.5	15.5	22	0	4	0.8
7/20/2017	23.5	18	20.8	0	2.8	3.4

Date/Time	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Heat Deg Days (°C)	Cool Deg Days (°C)	Total Precip (mm)
7/21/2017	25.5	16	20.8	0	2.8	0.4
7/22/2017	19	16	17.5	0.5	0	0
7/23/2017	17.5	10	13.8	4.2	0	0
7/24/2017	18	10.5	14.3	3.7	0	0
7/25/2017	22	9	15.5	2.5	0	0
7/26/2017	25	7.5	16.3	1.7	0	0
7/27/2017	27.5	13	20.3	0	2.3	0