

# Real Time Water Quality Report Humber River at Humber Village

Deployment Period  
2021-05-19 to 2021-07-29



Government of Newfoundland & Labrador  
Department of Environment & Climate Change  
Water Resources Management Division



## General

The following public report is a presentation and interpretation of qualitative and quantitative data taken in real-time at the Humber River in Humber Village station. The deployment period took place between May 19, 2021, and July 27, 2021.

This station is a year-round operation as part of the Provincial Real Time Water Quality (RTWQ) network. A multi-parameter sonde device is deployed and tracks variables of interest including: temperature (°C), pH, dissolved oxygen (mg/L), specific conductivity (µS/cm), and turbidity (NTU). The sondes are linked to the monitoring network with staff at the Department of Environment and Climate Change (Water Resources Management Division – WRMD) monitoring the data remotely on a regular basis.

In the event of anomalous activity, staff can travel to the location and investigate any inquiries that could arise from internal or external disruptions. This site in particular is easy to access. Typically, the instrument is removed on monthly to bi-monthly intervals in order to conduct routine maintenance/calibration, after which the instrument is redeployed within 48 hours.

## Quality Assurance/Quality Control (QA/QC)

During the beginning and end of deployment periods, a routine QA/QC performance test is administered on both the instrument that is being removed and the new one to be deployed. The methodology of this protocol can be found in Appendix A.

The purpose is to determine the accuracy of the instrument’s sensors by cross-examining its initial readings against a control sonde which is deployed at the same time to compare parameters. Depending on these readings, the sensors of each parameter receive a qualitative rank (See Table 1) based on whether or not readings fall within a specified threshold. This will further ensure the integrity of the data’s accuracy, so that WRMD scientists deliver reliable results to the public.

Table 1: QA/QC protocol for deployment performance testing of sonde equipment for ranking of data accuracy.

Parameter	Rating				
	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

With the exception of water quantity data (i.e. stage height), all other data used in the preparation of graphs and subsequent discussion below adhere to the stringent QA/QC protocol. The stage data is raw data that is transmitted via satellite and published on WRMD’s webpage. It has not been corrected for backwater effect. Water Survey of Canada is responsible of QA/QC of water quantity data. Corrected data can be obtained upon request.

Table 2: QA/QC water quality performance results for the beginning and end of deployment period.

<b>Station: Humber River at Humber Village</b>		
Stage of Deployment (Date)	Deployment (May 19, 2021)	Removal (July 27, 2021)
<i>Parameter (Unit)</i>	<i>Rank</i>	<i>Rank</i>
Temperature (°C)	Good	Good
pH (dimensionless unit)	Good	Fair
Specific Conductivity (µS/cm)	Excellent	Fair
Dissolved Oxygen (mg/L)	Excellent	Good
Turbidity (NTU)	Marginal <sup>1</sup>	Excellent
1) Possible issue with QA/QC sonde tainted result.		

### Deployment Notes

This deployment took place over the course of 70 days (May 19, 2021, to July 27, 2021), during which there were no significant interruptions or data loss.

### Data Interpretation

The following interpretations for the Humber River stations will cover the following six parameters: (1) Stage (m); (2) Temperature (°C); (3) pH; (4) Specific Conductivity (µS/cm); (5) Dissolved Oxygen (mg/L); (6) Turbidity (NTU).

### 1) Stage

- Stage ranged between 1.63 m and 2.82 m with an average stage height of 2.07 m
- Flow ranged from 165.34 m<sup>3</sup>/s to 364.54 m<sup>3</sup>/s with an average speed of 234.20 m<sup>3</sup>/s.
- The stage fluctuated throughout the deployment period.
- Climate data taken from Environment Canada (See Appendix C) showed several episodes of high precipitation that correlate to the peaks shown in Figure 1, indicative that the stage height and flow were influenced by multiple events resulting from an introduction of high-volume precipitate in a short period of time to the system.
- The precipitation and warmer seasonal temperatures may have increased melt of the snowpack in the upper reaches of the Humber River, contributing to large increases downstream at this time of year.

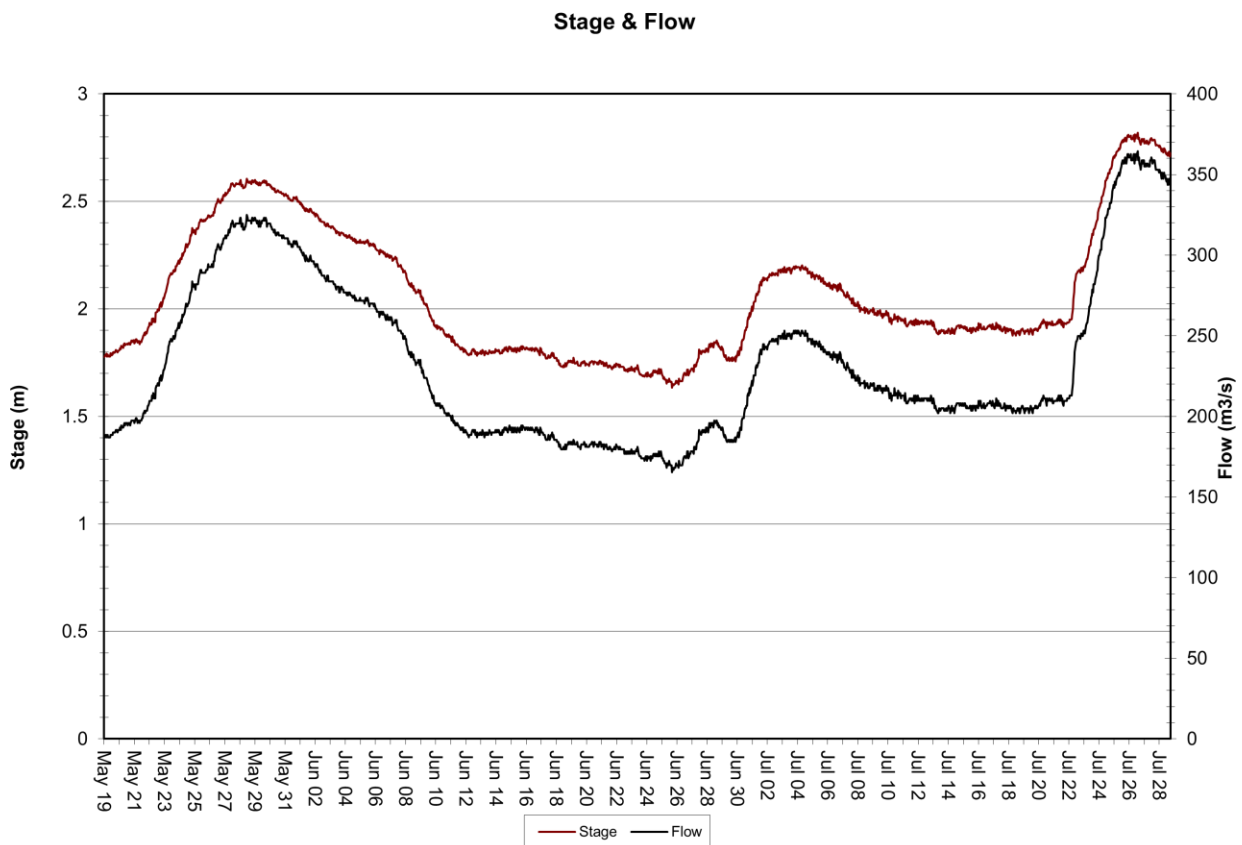


Figure 1: Stage & Flow at Humber River from May 19 to July 27, 2021

## 2) Temperature

- Throughout the deployment period, the water temperature ranged between 5.10 °C and 16.89 °C, with an average temperature of 11.04 °C.
- Data displayed a gradual increasing trend throughout the deployment. This is expected as the spring season progresses into the summer.
- The frequent “peaks” and “valleys” seen in the water temperature data is evidence of the diurnal cycle between night and day. Temperatures during hours of daylight are generally warmer than hours of darkness.

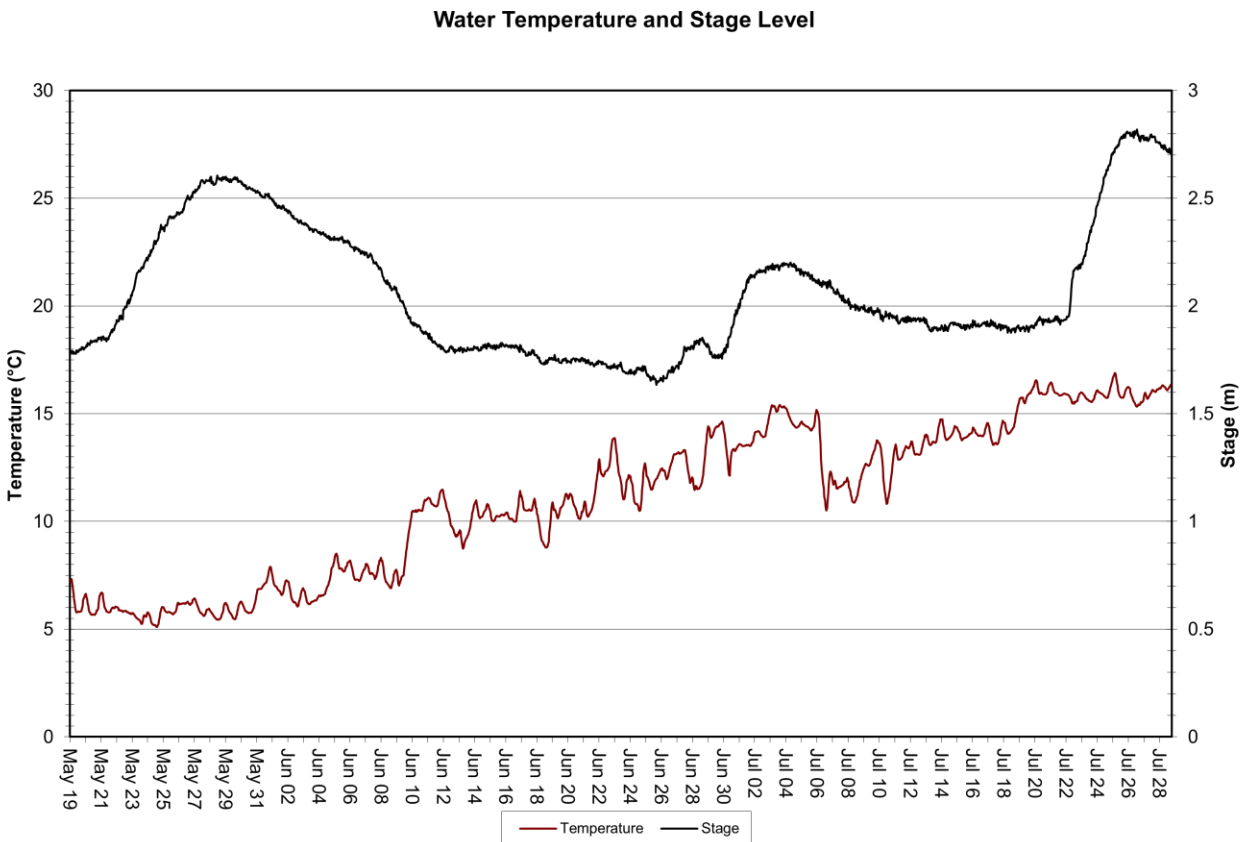


Figure 2: Temperature (°C) at Humber River from May 19 to July 27, 2021

### 3) pH

- pH ranged between 6.98 and 7.26 during the deployment period, with an average of 7.09.
- This parameter was stable throughout the course of the deployment period with no profound findings.
- The overall pH data falls within the threshold of acceptance for the protection of aquatic life as outlined by the Canadian Council of Ministers of the Environment (CCME) (2007).

Water pH and Stage Level

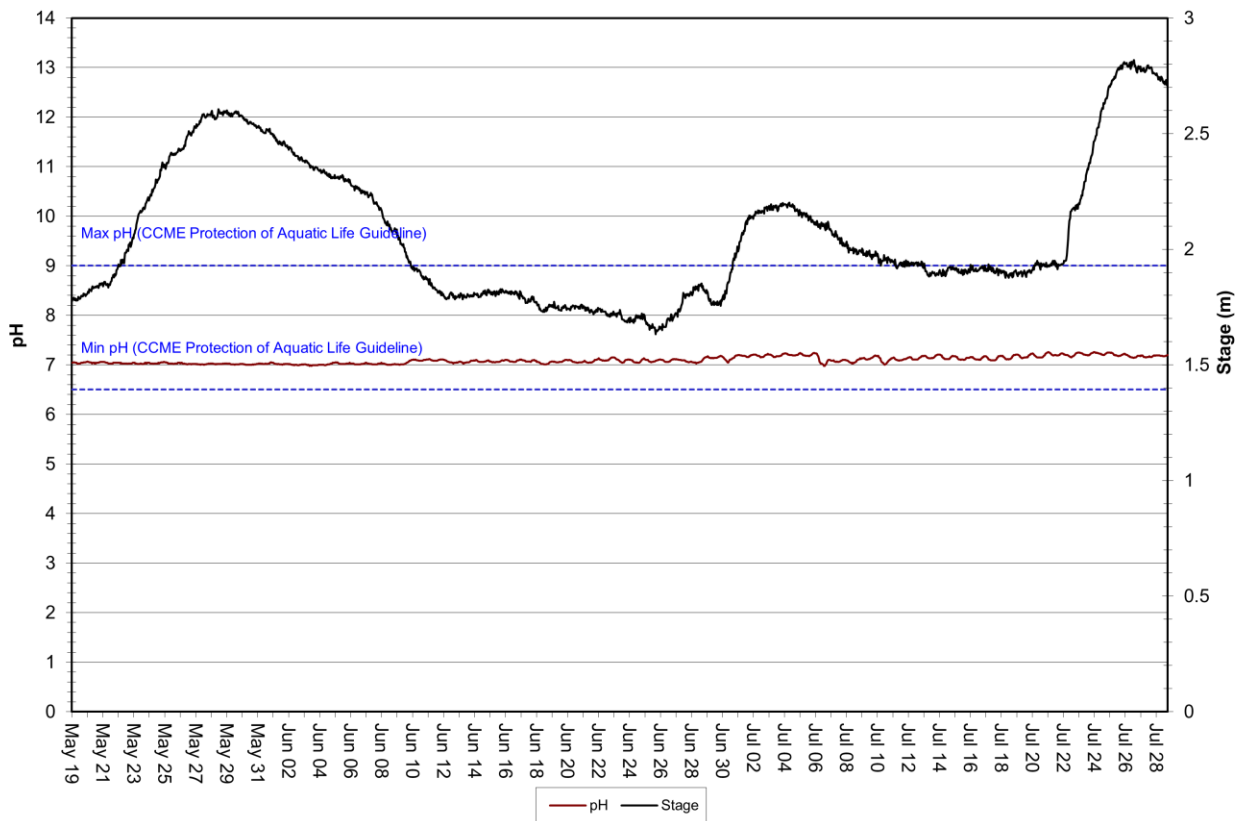


Figure 3: pH values recorded at Humber River from May 19 to July 27, 2021

#### 4) Specific Conductivity

- Throughout the deployment period, specific conductivity ranged between 40.7  $\mu\text{S}/\text{cm}$  and 43.3  $\mu\text{S}/\text{cm}$ , with an average of 41.7  $\mu\text{S}/\text{cm}$ .
- The data was stable throughout the deployment with no remarkable findings.
- Minor turbulence throughout the deployment is associated with normal background level fluctuations.

Specific Conductivity of Water and Stage Level

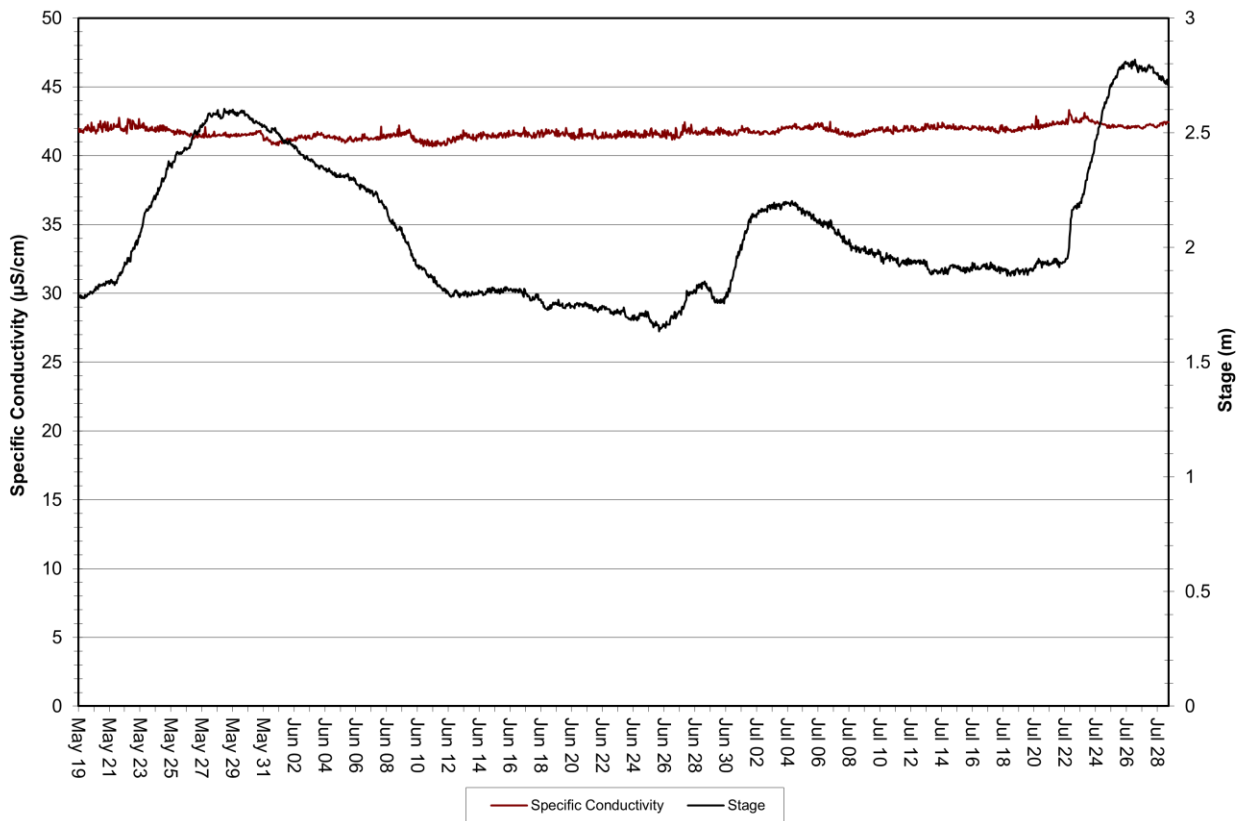


Figure 4: Specific conductivity ( $\mu\text{S}/\text{cm}$ ) at Humber River from May 19 to July 27, 2021



### 5) Dissolved Oxygen

- During the deployment period, dissolved oxygen values ranged from 9.73 mg/L to 12.70 mg/L, with an average of 11.17 mg/L.
- Dissolved oxygen concentrations were inversely proportional to the water temperature. This is normal as temperature directly affects water’s capacity to dissolve oxygen.
- While there were some slight disturbances seen through the month of June, there was an overall decreasing trend as spring transitioned into summer with warmer temperatures.
- All values meet the guidelines for the protection of freshwater aquatic life for the protection of early and other life stages as set by the CCME (2007).

**Dissolved Oxygen Concentration and Saturation with Water Temperature**

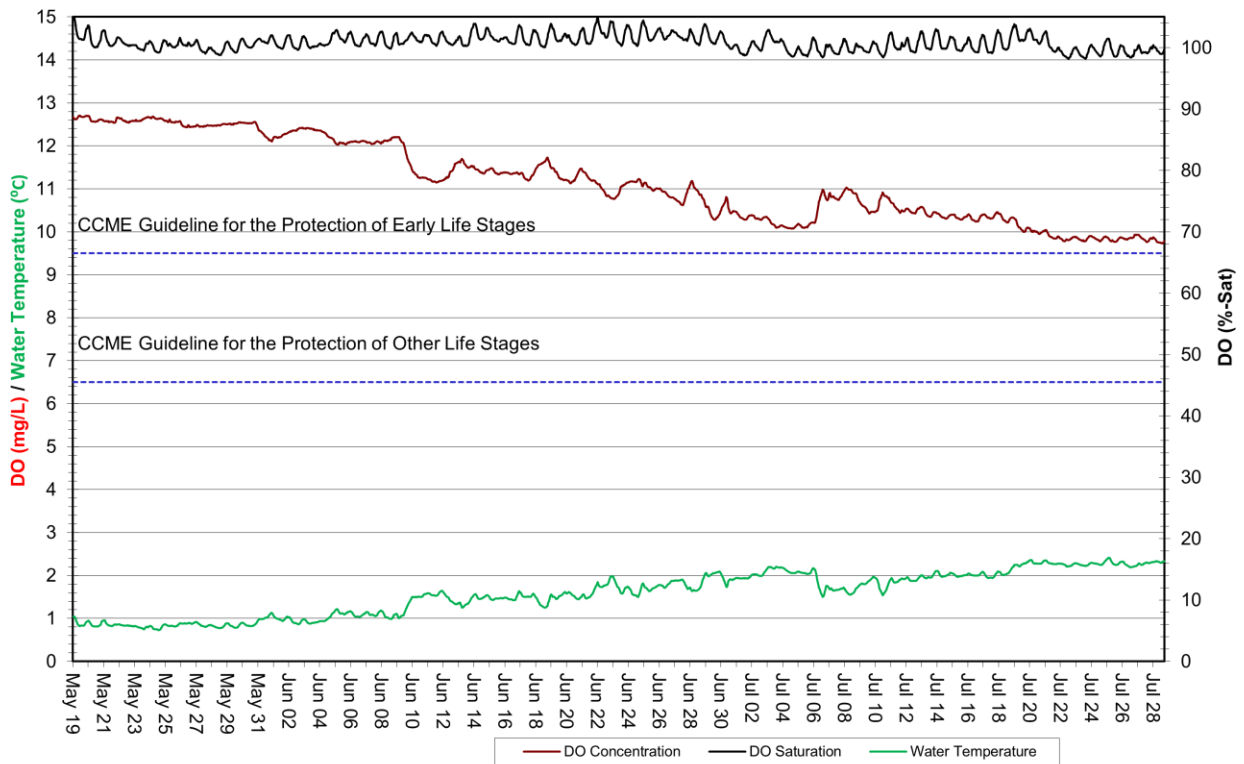


Figure 5: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River from May 19 to July 27, 2021

## 6) Turbidity

- Throughout the deployment period, turbidity ranged from 1.1 NTU to 4.0 NTU, with an average turbidity of 1.2 NTU.
- Turbidity was generally stable across the duration, with one remarkable disturbance July 22, 2021, where turbidity peaked at 4.0 NTU. This correlates to a significant rainfall event that took place on the same date, according to climate data taken from Environment Canada (See Appendix C). This is supported by the increase in stage height at that time, showing that the turbidity of the water column was likely stirred with such a high volume of precipitation in one day.

Water Turbidity and Stage Level

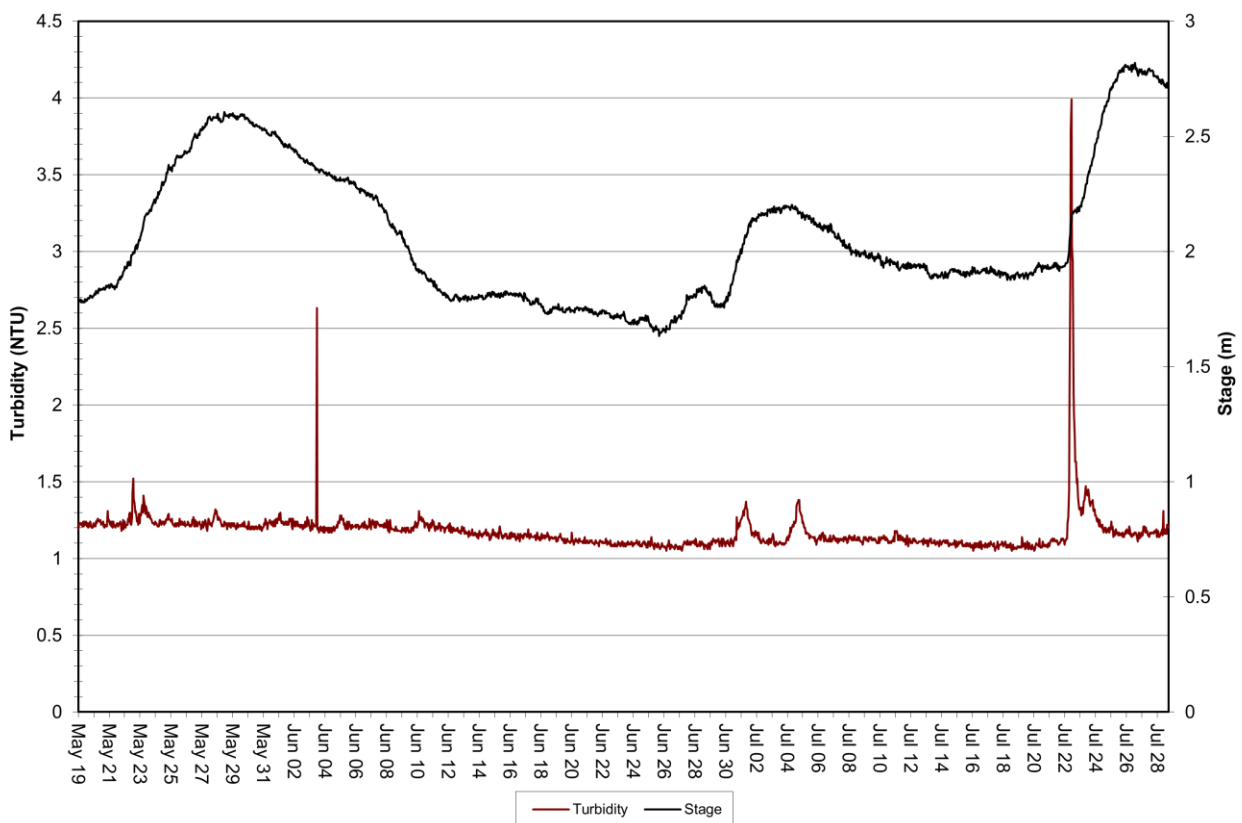


Figure 6: Turbidity (NTU) at Humber River from May 19 to July 27, 2021

## Conclusions

- This deployment report outlines the findings of water quality and water quantity data recorded over a period of 70 days at the Humber River at Humber Village May 19, 2021, and July 27, 2021.
- QA/QC rankings at the start of the deployment duration were mostly satisfactory, with 2/5 sensors ranking “Excellent”, 2/5 sensors ranking “Good”, and 1/5 sensors (turbidity) ranking as “Marginal”. At removal, some performances had deteriorated with the exception of specific

conductivity and turbidity; Specific conductivity's absolute difference remained within the threshold to maintain a "Good" ranking; Turbidity's score had increased in quality, reporting a threshold that met the conditions of an "Excellent" sensor. 2/5 sensors ranked "Good", 2/5 sensors ranked "Fair", and 1/5 sensors ranked "Excellent".

- As seen in the previous deployment report, the turbidity sensor performance test was questionable as the QA/QC sonde returned a value that greatly exceeded the result of the field sonde (which returned a value that was consistent with the data trend monitored throughout that deployment). The same QA/QC sonde is used during deployment/removal of field sondes. Based on the grab sample to field sonde turbidity (absolute difference = 0.5 NTU) ranking of "Excellent", the turbidity sensor for the QA/QC sonde was erroneous.
- The following are summarized statements regarding the findings at Humber River:
  - o Stage & Flow: Stage ranged from 1.63 m to 2.82 m, averaging at 2.07 m. Flow ranged from 165.34 m<sup>3</sup>/s to 364.54 m<sup>3</sup>/s, averaging 234.20 m<sup>3</sup>/s. The frequent fluctuation in the data is likely attributed to precipitation events and late seasons snowpack melt that increased the parameters simultaneously throughout the deployment period.
  - o Water Temperature: Ranged from 5.10 °C to 16.89 °C, averaging 11.04 °C. Relatively stable throughout deployment period with a steady increase as spring continued into summer.
  - o pH: Ranged from 6.98 to 7.26, averaging at 7.09. Remained stable, no profound findings. Data fell within the threshold of acceptance for the protection of aquatic life as outlined by the CCME.
  - o Specific Conductivity: Ranged from 40.7 µS/cm to 43.3 µS/cm, averaging at 41.7 µS/cm. Remained relatively stable, no profound findings.
  - o Dissolved Oxygen: Ranged from 9.73 mg/L to 12.70 mg/L, averaging at 11.17 mg/L. Mild fluctuations, but continued decrease overall as the water temperatures warmed into summer. All data remained in the acceptable range for the protection of early and other life stages of aquatic life as outlined by the CCME, although the trendline approached the threshold by the end of the deployment period when water temperatures were warmest.
  - o Turbidity: Ranged from 1.1 NTU to 4.0 NTU, averaging at 1.2 NTU. Remained relatively stable, with one remarkable event that took place on July 22, 2021 related to precipitation.

## 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://cegg-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)<sup>1</sup>.

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.

Parameter	Rating				
	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

<sup>1</sup> 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>

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	$> \pm 1$
Turbidity <40 NTU (NTU)	$\leq \pm 2$	$> \pm 2$ to 5	$> \pm 5$ to 8	$> \pm 8$ to 10	$> \pm 10$
Turbidity > 40 NTU (%)	$\leq \pm 5$	$> \pm 5$ to 10	$> \pm 10$ to 15	$> \pm 15$ to 20	$> \pm 20$

## APPENDIX B

### WRMD Climate Station – Humber Village at Humber Village Bridge

Date	Air Temp (Avg) °C	Air Temp (Min) °C	Air Temp (Max) °C	Total Precipitation (mm)
May 19, 2021	10.220	1.082	18.620	0
May 20, 2021	10.588	4.377	17.250	0
May 21, 2021	17.473	10.290	24.540	0
May 22, 2021	12.811	9.220	15.280	0
May 23, 2021	8.333	4.142	13.040	0
May 24, 2021	3.843	1.520	6.054	0
May 25, 2021	9.884	2.878	15.500	0
May 26, 2021	10.333	5.007	15.460	0
May 27, 2021	13.704	7.465	17.440	0
May 28, 2021	6.348	4.931	7.899	0
May 29, 2021	9.487	4.960	14.050	0
May 30, 2021	11.259	2.069	19.390	0
May 31, 2021	11.835	4.493	17.120	0
June 1, 2021	14.587	9.640	19.180	0
June 2, 2021	15.752	9.620	22.390	0
June 3, 2021	17.794	8.790	24.980	0
June 4, 2021	15.673	13.900	18.900	0
June 5, 2021	18.112	12.780	24.540	0
June 6, 2021	13.757	8.380	17.330	0
June 7, 2021	16.105	5.605	24.330	0
June 8, 2021	21.227	11.070	27.530	0
June 9, 2021	12.743	6.945	17.950	0
June 10, 2021	8.789	4.716	13.460	0
June 11, 2021	10.469	5.825	13.280	0
June 12, 2021	13.168	7.943	19.610	0
June 13, 2021	10.568	8.030	13.540	0
June 14, 2021	13.457	5.537	20.340	0
June 15, 2021	14.753	8.930	19.720	0
June 16, 2021	13.848	11.150	15.680	0
June 17, 2021	16.441	11.780	21.640	0
June 18, 2021	17.469	11.380	23.330	0
June 19, 2021	19.379	9.490	27.490	0
June 20, 2021	17.710	14.330	20.840	0
June 21, 2021	18.116	14.220	23.620	0
June 22, 2021	20.346	12.140	28.370	0
June 23, 2021	21.215	15.610	28.050	0

June 24, 2021	17.924	11.790	23.550	0
June 25, 2021	18.730	9.490	25.600	0
June 26, 2021	17.746	11.760	22.010	0
June 27, 2021	19.874	18.170	21.070	0
June 28, 2021	19.522	14.560	23.110	0
June 29, 2021	17.280	10.220	24.130	0
June 30, 2021	17.092	14.170	20.940	0
July 1, 2021	10.124	9.010	12.350	0
July 2, 2021	11.318	8.440	15.790	0
July 3, 2021	15.508	6.300	24.610	0
July 4, 2021	12.363	10.490	14.380	0
July 5, 2021	12.660	10.570	15.300	0
July 6, 2021	18.920	12.350	31.560	0.011
July 7, 2021	19.413	15.380	22.100	0
July 8, 2021	13.128	7.452	15.450	0
July 9, 2021	12.055	4.041	19.060	0
July 10, 2021	17.668	11.850	23.440	0
July 11, 2021	17.646	9.520	26.450	0
July 12, 2021	15.297	11.260	19.600	0
July 13, 2021	16.739	9.030	23.770	0
July 14, 2021	19.540	10.910	26.870	0
July 15, 2021	20.022	14.860	23.680	0
July 16, 2021	22.073	19.000	25.330	0
July 17, 2021	21.227	17.610	24.880	0
July 18, 2021	20.866	15.380	26.400	0
July 19, 2021	21.003	12.830	28.830	0
July 20, 2021	20.980	18.830	25.680	0
July 21, 2021	17.285	14.570	20.160	0
July 22, 2021	12.567	11.560	13.750	0
July 23, 2021	13.039	11.380	15.560	0
July 24, 2021	14.169	11.420	18.640	0
July 25, 2021	18.504	12.660	25.410	0
July 26, 2021	17.649	11.330	24.560	0
July 27, 2021	20.649	17.020	25.620	0

Note: Abnormal precipitation data points to possible issues with precipitation monitoring equipment.

### APPENDIX C

#### Environment Canada – Historical Climate Data (Precipitation Only) in Corner Brook Vicinity (Near Humber Village)

Date	Total Precipitation (mm)
May 19, 2021	0
May 20, 2021	0
May 21, 2021	6.4
May 22, 2021	17.6
May 23, 2021	16.2
May 24, 2021	0
May 25, 2021	0
May 26, 2021	6.8
May 27, 2021	0
May 28, 2021	0
May 29, 2021	0
May 30, 2021	0
May 31, 2021	9
June 1, 2021	0
June 2, 2021	0
June 3, 2021	1.6
June 4, 2021	0
June 5, 2021	0
June 6, 2021	0
June 7, 2021	0
June 8, 2021	0
June 9, 2021	0
June 10, 2021	0
June 11, 2021	0
June 12, 2021	0.4
June 13, 2021	0
June 14, 2021	0
June 15, 2021	0.8
June 16, 2021	6.6
June 17, 2021	0
June 18, 2021	0
June 19, 2021	0
June 20, 2021	0
June 21, 2021	0
June 22, 2021	4.4



June 23, 2021	0.4
June 24, 2021	0
June 25, 2021	0
June 26, 2021	12.2
June 27, 2021	35
June 28, 2021	0
June 29, 2021	0
June 30, 2021	17.6
July 1, 2021	6.4
July 2, 2021	0
July 3, 2021	0
July 4, 2021	1
July 5, 2021	1
July 6, 2021	0
July 7, 2021	0
July 8, 2021	0
July 9, 2021	10.2
July 10, 2021	2.2
July 11, 2021	2
July 12, 2021	0
July 13, 2021	0
July 14, 2021	0
July 15, 2021	0.4
July 16, 2021	4.6
July 17, 2021	0
July 18, 2021	0
July 19, 2021	4.5
July 20, 2021	1.2
July 21, 2021	10.4
July 22, 2021	52.2
July 23, 2021	14.6
July 24, 2021	0.4
July 25, 2021	0
July 26, 2021	0.6
July 27, 2021	6.4