



# Real Time Water Quality Report

## Humber River at Humber Village

Deployment Period  
2022-10-25 to 2023-01-09

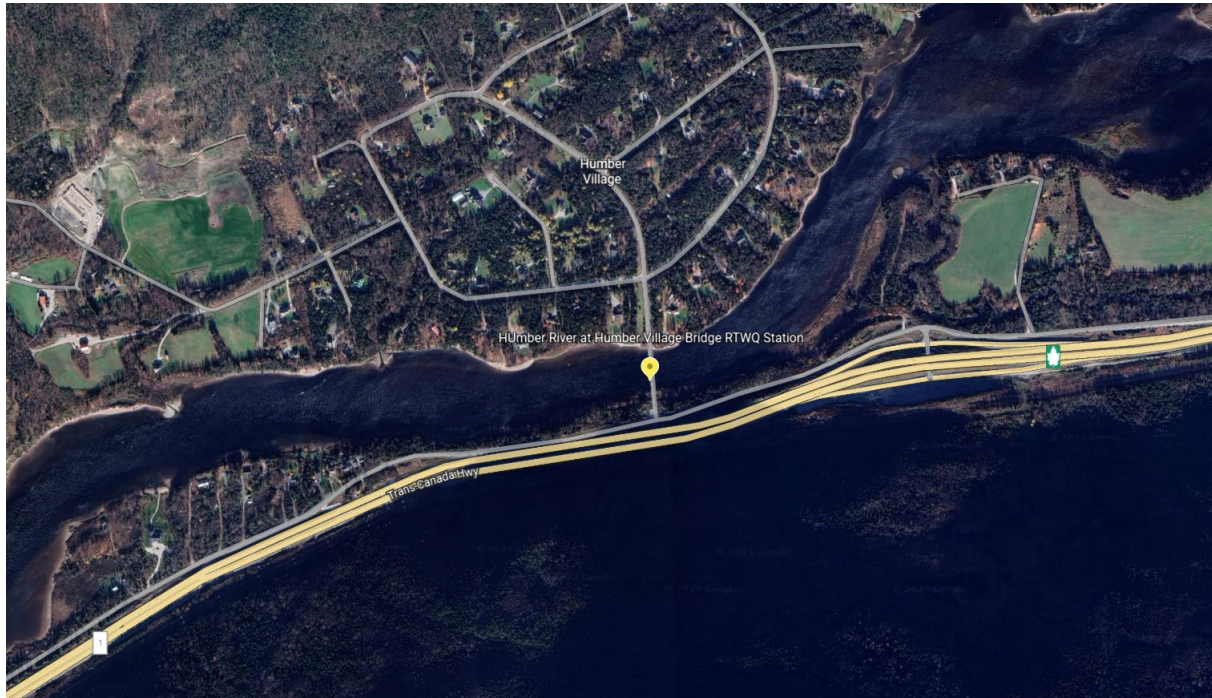


Government of Newfoundland & Labrador  
Department of Environment and Climate Change  
Water Resources Management Division



## General

The following public report is a presentation and interpretation of qualitative and quantitative data collected in real-time at the “Humber River at Humber Village Bridge” station from October 25, 2022 to January 09, 2023.



**Figure 1: Humber River at Humber Village Bridge Real Time Water Quality station location**

This station operates year-round as part of the Provincial Real Time Water Quality (RTWQ) network. A multi-parameter sonde is deployed and records parameters of interest including: temperature (°C), pH, dissolved oxygen (mg/L), specific conductivity ( $\mu\text{S}/\text{cm}$ ), total dissolved solids (g/L) 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 potential 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 24 hours.

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

A routine QA/QC performance test is administered on the instrument at the beginning and end of each deployment period. 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), 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 for QA/QC of water quantity data. Corrected data can be obtained upon request.

pH comparison at the time of deployment were ranked as “Poor” due to a failed pH sensor on the control sonde.

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

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Humber River at Humber Village Bridge	October 25, 2022	Deployment	Excellent	Poor	Excellent	Excellent	Excellent
	January 09, 2023	Removal	Excellent	Poor	Good	Fair	Excellent

### Deployment Notes

This deployment took place over the course of 74 days (October 25, 2022 to January 09, 2023), 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: Stage (m); (2) Temperature (°C); (3) pH; (4) Specific Conductivity ( $\mu\text{S}/\text{cm}$ ); (5) Dissolved Oxygen (mg/L); (6) Turbidity (NTU).

### Temperature

- Throughout the deployment period, the water temperature ranged between 2.88 °C and 12.19 °C, with an average temperature of 6.37 °C.
- Temperatures gradually decreased throughout the deployment, typical for the late fall to early winter seasons.
- Water temperature values display a natural diurnal pattern with temperatures increasing during the day and decreasing overnight. The magnitude of variation was influenced by daily air temperature fluctuations as well as precipitation events.

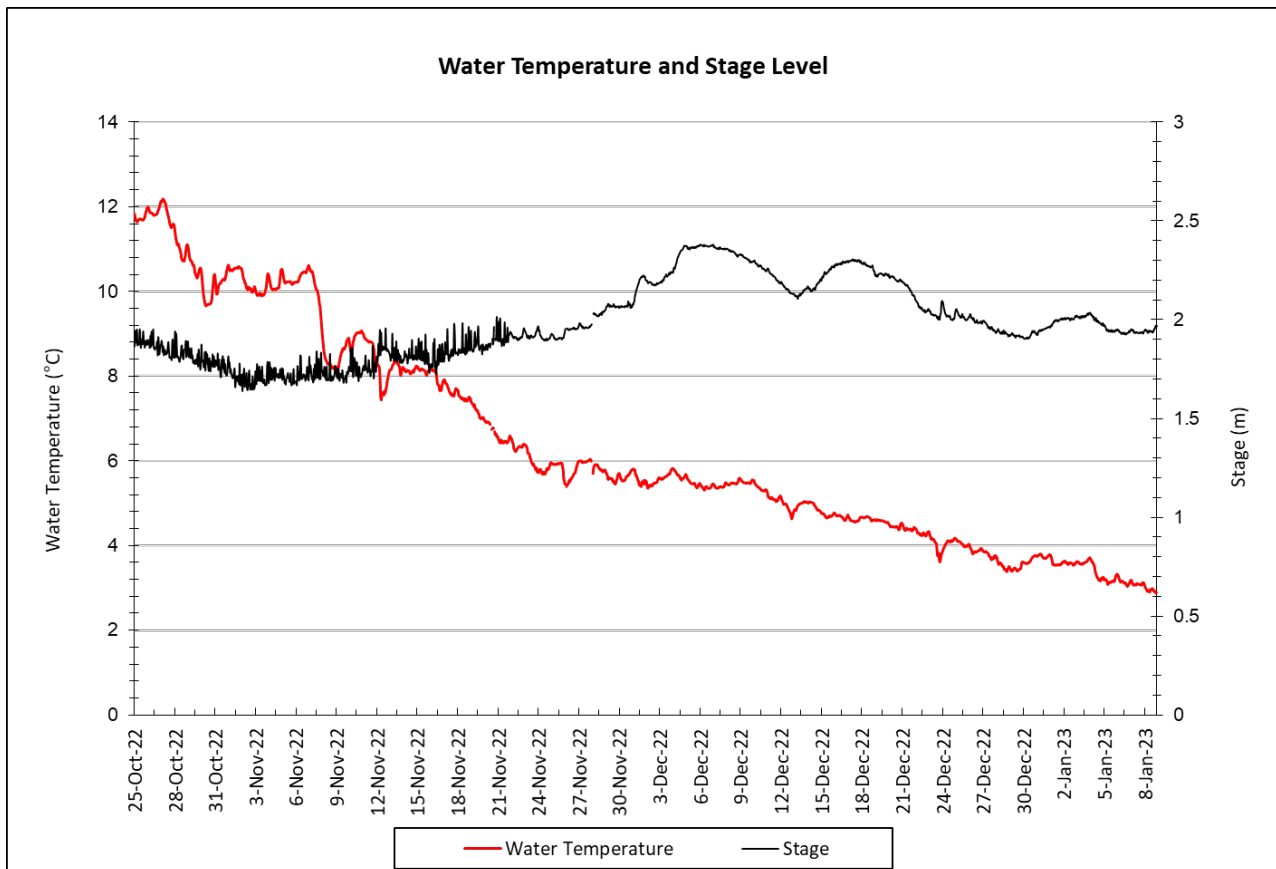


Figure 2: Water Temperature and Stage at Humber River at Humber Village Bridge

## pH

- pH ranged between 6.87 and 7.16 during the deployment period, with an average of 7.05 pH units.
- The pH data remained within the acceptable range for the protection of aquatic life as outlined by the Canadian Council of Ministers of the Environment (CCME) (2007).

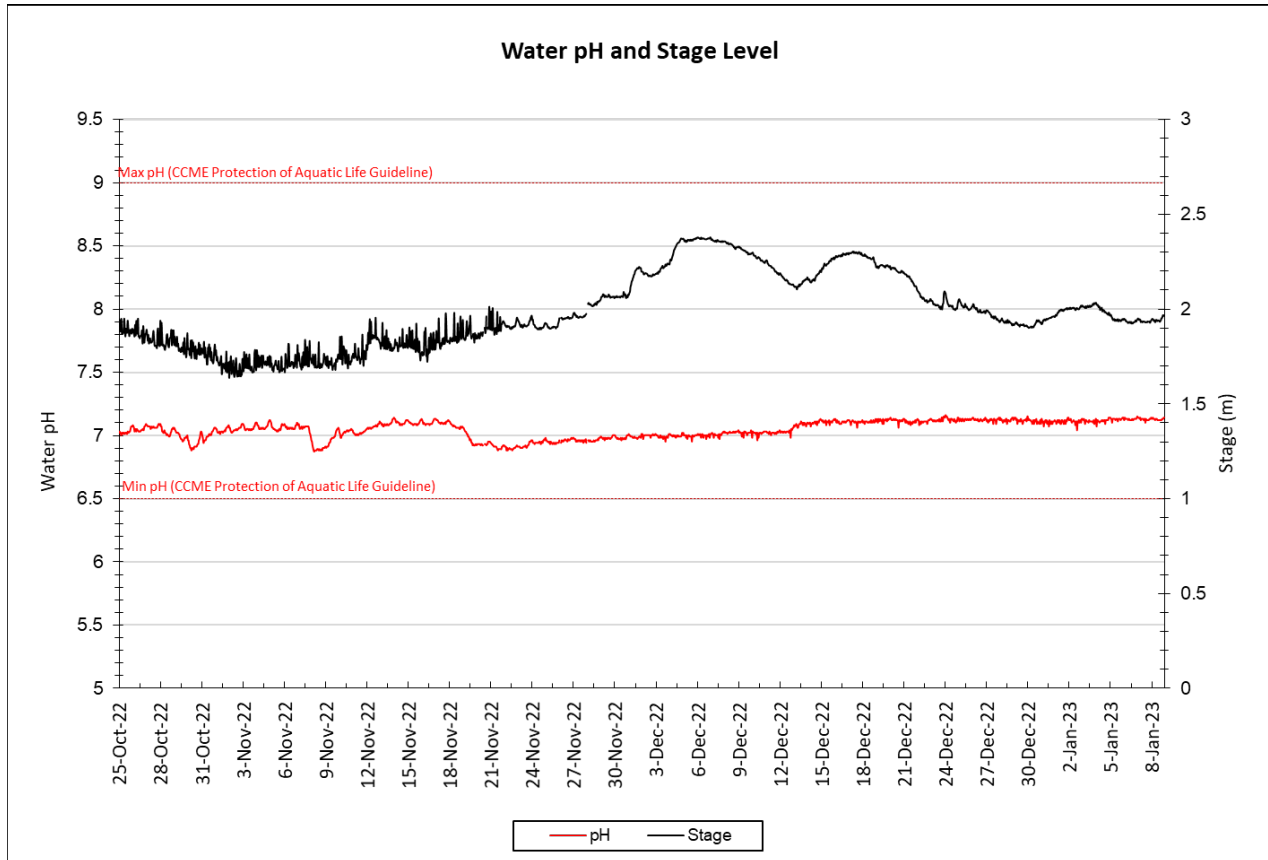
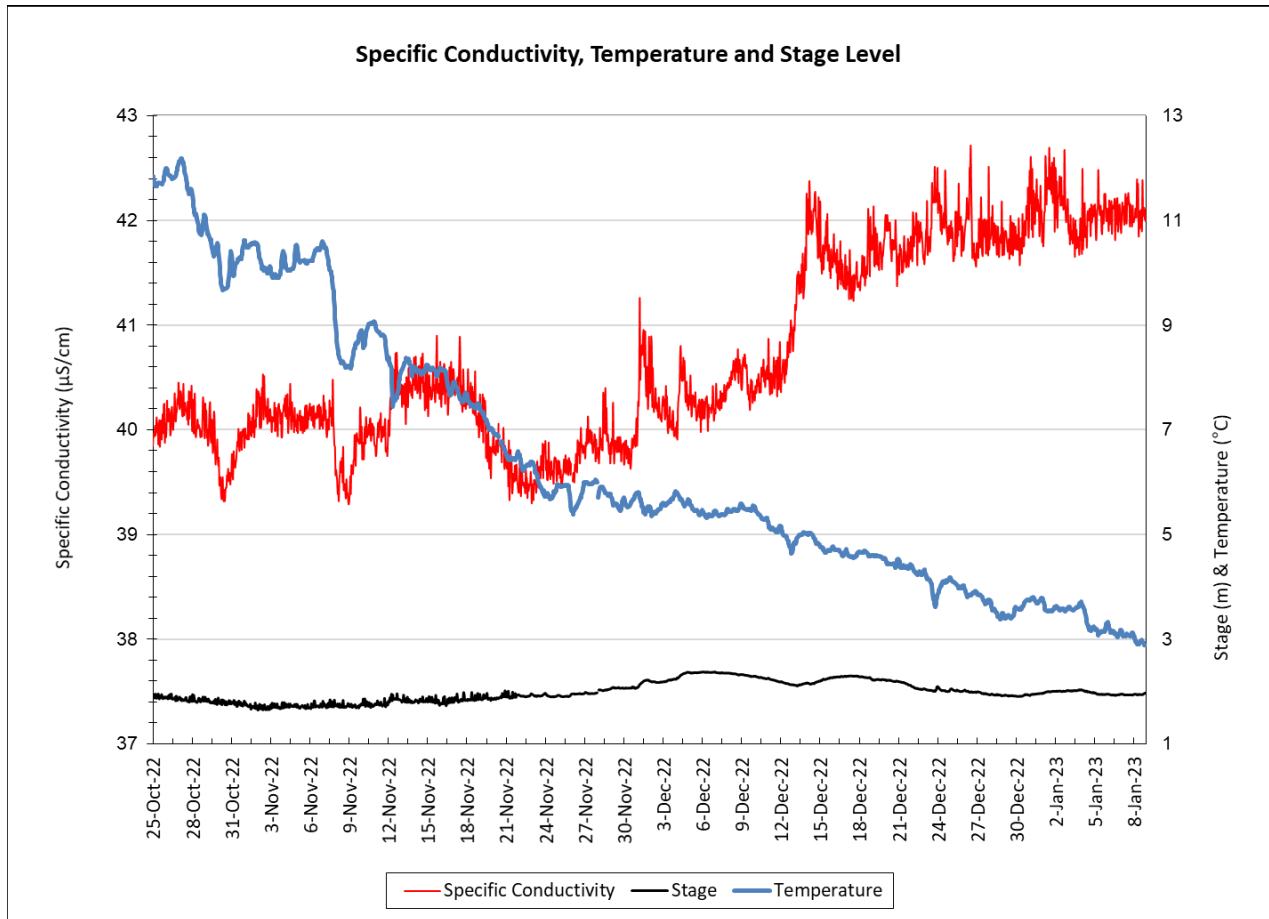


Figure 3: pH values recorded at Humber River at Humber Village Bridge

### Specific Conductivity

- Throughout the deployment period, specific conductivity ranged between 39.3  $\mu\text{S}/\text{cm}$  and 42.7  $\mu\text{S}/\text{cm}$ , with an average of 40.7  $\mu\text{S}/\text{cm}$ .
- Figure 4 illustrates the overall increase of specific conductivity throughout this deployment. The fluctuations observed throughout the deployment are directly related to changes in temperature and precipitation/stage.



**Figure 4: Specific Conductivity at Humber River at Humber Village Bridge**

## Dissolved Oxygen

- During the deployment period, dissolved oxygen concentrations ranged from 10.45 mg/L to 12.99 mg/L, with an average of 11.88 mg/L. Dissolved oxygen percent-saturation ranged from 92.9% to 98.6%, with an average of 96.0%.
- Dissolved oxygen is inversely related to water temperature, meaning that oxygen level increases in lower temperatures, and decrease in higher temperatures.
- This data shows a normal trend as fall progresses to winter, with cooling water bringing higher levels of concentrated oxygen.
- All values remained above the threshold of the CCME guidelines for the protection of other life stages and the protection of early life stages (CCME, 2007) throughout the deployment.

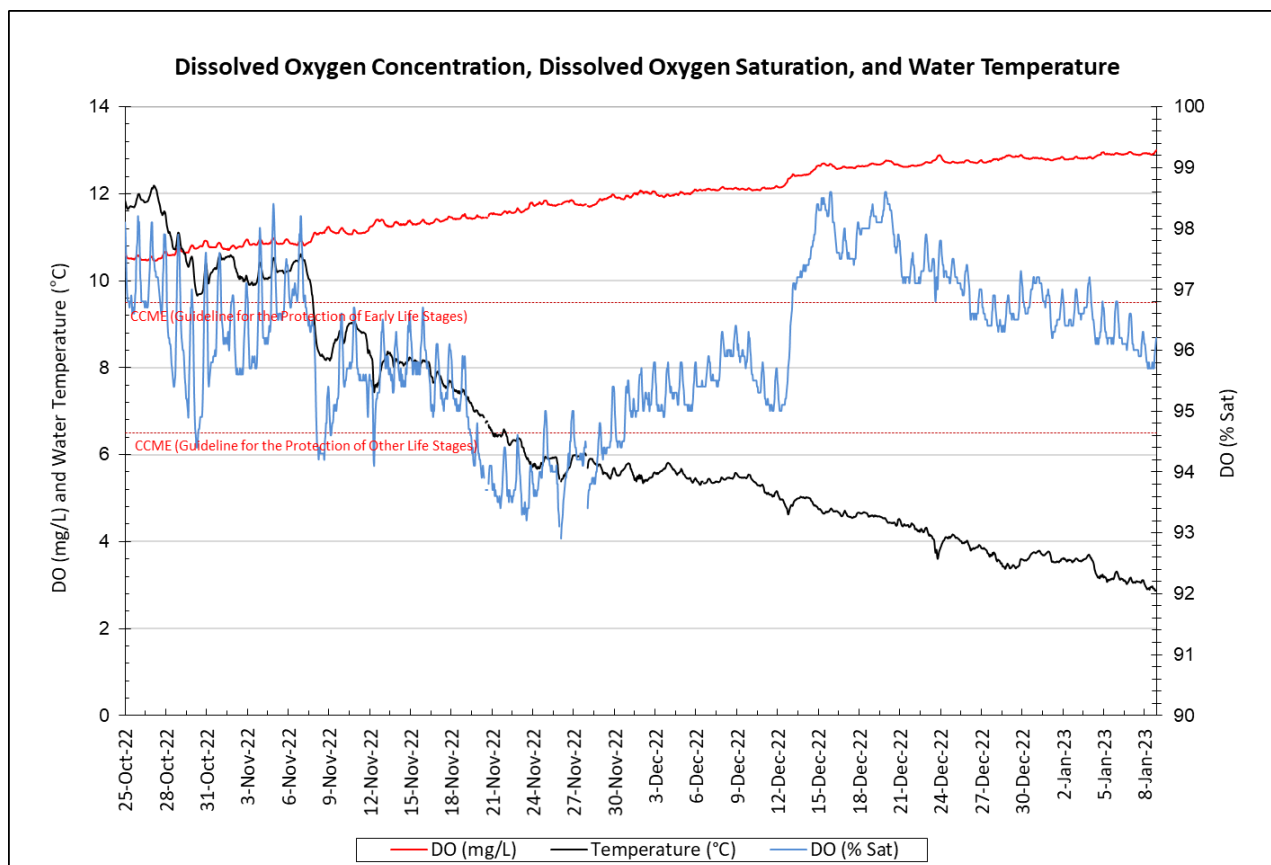
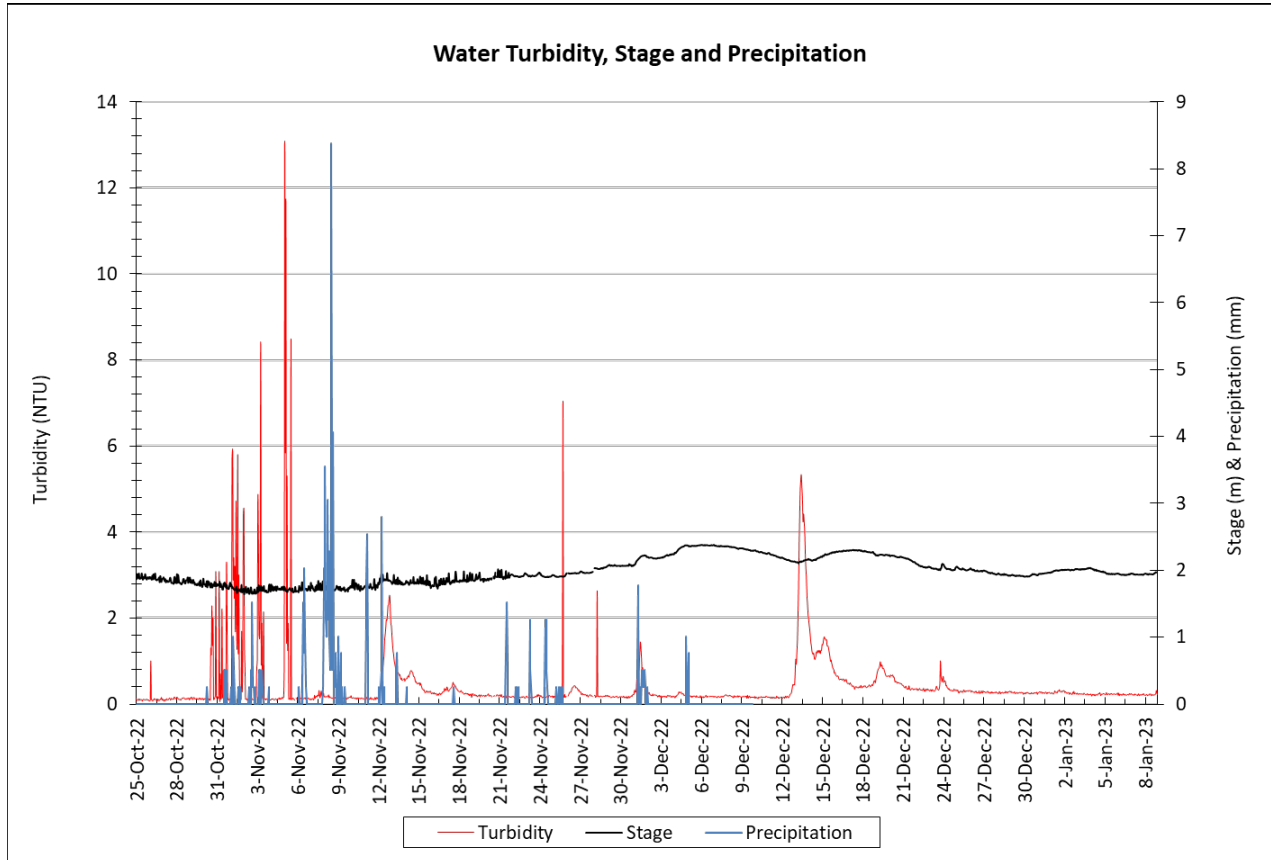


Figure 5: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River at Humber Village Bridge



### Turbidity

- Throughout the deployment period, turbidity ranged from 0.1 NTU to 13.0 NTU, with an average turbidity of 0.4 NTU.
- Turbidity was relatively stable during the deployment, with the exception of periodic spikes corresponding with increases in precipitation.



**Figure 6: Turbidity, Stage, & Precipitation at Humber River at Humber Village Bridge**

## Conclusions

- This deployment report outlines the findings of water quality and water quantity data recorded over a period of 46 days at the Humber River at Humber Village from October 25, 2022 to January 09, 2023.
- The following are summarized statements regarding the findings at Humber River:
  - o Water Temperature: Ranged from 2.88 °C to 12.19 °C, averaging 6.37 °C. Gradually decreased throughout the deployment with frequent fluctuations caused by combination of diurnal fluctuations in the air temperature, occasional precipitative episodes and normal seasonal trends.
  - o pH: Ranged from 6.87 to 7.16, averaging 7.05 pH units. Remained stable, and data was within the threshold of acceptance for the protection of aquatic life as outlined by the CCME.
  - o Specific Conductivity: Ranged from 39.3 µS/cm to 42.7 µS/cm, averaging at 40.7 µS/cm. Specific conductivity increased throughout this deployment. This is a normal occurrence during periods of low stage and decreasing temperature.
  - o Dissolved Oxygen: Concentration ranged from 10.45 mg/L to 12.99 mg/L, averaging at 11.88 mg/L; percent-saturation ranged from 92.9% to 98.6%, averaging at 96.0%. Concentrations increased overall due to the decreasing temperature typical of the fall & winter season. Dissolved oxygen data met the acceptance thresholds of the CCME's guidelines for the protection of other life stages and early life stages.
  - o Turbidity: Ranged from 0.1 NTU to 13.0 NTU, averaging 0.4 NTU. Turbidity was relatively stable during the deployment, with the exception of periodic spikes corresponding with increases in precipitation.
  - o Stage: Stage ranged from 1.64 m to 2.38 m, averaging at 1.99 m.

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## 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.cme.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
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

<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>

## APPENDIX B

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

Date	Average Air Temp (°C)	Minimum Air Temp (°C)	Maximum Air Temp (°C)	Total Precipitation (mm)
25-Oct-2022	14.11	10.99	19.56	0.000
26-Oct-2022	16.32	13.96	19.51	0.000
27-Oct-2022	15.99	13.03	21.06	0.508
28-Oct-2022	8.96	7.47	13.02	0.000
29-Oct-2022	8.90	5.35	13.02	0.000
30-Oct-2022	10.59	7.02	13.80	0.000
31-Oct-2022	9.50	5.12	14.97	0.000
1-Nov-2022	6.65	1.77	11.65	0.000
2-Nov-2022	7.81	3.75	10.72	8.128
3-Nov-2022	4.35	3.36	6.71	0.254
4-Nov-2022	9.82	6.38	14.98	0.000
5-Nov-2022	13.81	9.77	18.94	0.000
6-Nov-2022	10.84	7.38	17.36	0.254
7-Nov-2022	15.71	10.85	18.14	5.588
8-Nov-2022	6.29	3.44	10.00	6.604
9-Nov-2022	2.57	1.80	3.21	0.508
10-Nov-2022	4.84	0.82	7.42	0.254
11-Nov-2022	4.70	2.34	6.44	2.032
12-Nov-2022	1.51	0.94	2.16	9.906
13-Nov-2022	1.20	0.72	1.78	7.112
14-Nov-2022	1.87	0.88	3.08	15.748
15-Nov-2022	1.66	0.44	3.35	9.652
16-Nov-2022	-0.38	-1.27	0.59	0.000
17-Nov-2022	1.31	-0.86	4.86	2.286
18-Nov-2022	1.72	-0.07	2.98	4.572
19-Nov-2022	0.53	-0.55	2.22	1.270
20-Nov-2022	0.57	-3.88	3.66	10.668
21-Nov-2022	-0.11	-1.56	1.54	0.762
22-Nov-2022	-0.44	-1.59	1.75	0.762
23-Nov-2022	-1.15	-5.44	1.72	0.254
24-Nov-2022	-3.39	-5.62	-1.75	0.000
25-Nov-2022	-0.12	-2.10	1.53	0.254
26-Nov-2022	0.63	-1.93	1.61	0.000
27-Nov-2022	2.81	1.94	4.16	12.954
28-Nov-2022	2.26	1.32	3.60	20.828
29-Nov-2022	-0.81	-3.39	2.52	1.016
30-Nov-2022	-4.23	-6.94	-2.25	0.000
1-Dec-2022	3.03	-4.81	8.20	19.304
2-Dec-2022	0.99	-0.41	2.55	0.508
3-Dec-2022	0.97	-0.28	5.17	0.000
4-Dec-2022	5.48	3.27	7.79	10.414

Date	Average Air Temp (°C)	Minimum Air Temp (°C)	Maximum Air Temp (°C)	Total Precipitation (mm)
5-Dec-2022	0.33	-4.50	3.04	0.762
6-Dec-2022	-2.07	-4.98	0.68	0.000
7-Dec-2022	0.82	-0.28	1.83	0.000
8-Dec-2022	3.71	1.75	5.40	0.254
9-Dec-2022	3.75	2.12	5.51	0.000
10-Dec-2022	0.23	-3.34	1.88	0.000
11-Dec-2022	-4.84	-5.83	-3.31	0.000
12-Dec-2022	-4.79	-5.66	-3.34	0.000
13-Dec-2022	2.08	-3.95	6.41	2.794
14-Dec-2022	3.74	3.26	4.09	29.972
15-Dec-2022	2.47	1.76	3.51	2.794
16-Dec-2022	2.30	1.56	3.10	0.254
17-Dec-2022	0.95	-0.18	1.86	0.254
18-Dec-2022	3.05	1.16	4.52	0.508
19-Dec-2022	2.97	2.23	3.38	10.668
20-Dec-2022	2.36	0.67	3.31	2.032
21-Dec-2022	-0.49	-1.92	1.02	0.000
22-Dec-2022	-0.66	-2.04	0.81	2.540
23-Dec-2022	-2.45	-3.90	-1.26	0.254
24-Dec-2022	2.41	-1.79	6.47	17.018
25-Dec-2022	2.31	0.11	4.35	0.762
26-Dec-2022	-1.04	-2.89	0.67	1.016
27-Dec-2022	-1.26	-2.74	0.34	1.270
28-Dec-2022	-4.30	-5.20	-2.16	2.032
29-Dec-2022	-4.85	-7.00	-2.73	0.508
30-Dec-2022	-1.94	-4.21	0.48	0.254
31-Dec-2022	4.93	1.27	6.15	9.652
1-Jan-2023	2.52	0.98	3.77	10.922
2-Jan-2023	-0.52	-2.41	0.88	6.858
3-Jan-2023	-1.62	-3.23	-0.28	0.762
4-Jan-2023	0.98	-5.98	2.98	3.810
5-Jan-2023	-7.07	-7.92	-6.37	0.000
6-Jan-2023	-4.95	-6.99	-3.20	0.000
7-Jan-2023	-3.61	-5.09	-1.78	0.000
8-Jan-2023	-2.98	-5.63	-0.81	3.556
9-Jan-2023	-5.02	-7.18	-1.96	1.270