



Real Time Water Quality Report Humber River at Humber Village

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



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

General

The following 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 September 09 to October 25, 2022.



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 ($^{\circ}\text{C}$), 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 provincial 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 a potential water quality event, staff can travel to the location and investigate potential causes. 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 comparing 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.

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	September 09, 2022	Deployment	Excellent	Fair	Excellent	Excellent	Excellent
	October 25, 2022	Removal	Excellent	Poor	Excellent	Good	Excellent

Deployment Notes

This deployment took place over the course of 46 days (September 09, 2022 to October 25, 2022), 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 (µS/cm); (5) Dissolved Oxygen (mg/L); (6) Turbidity (NTU).

Temperature

- Throughout the deployment period, the water temperature ranged between 10.39 °C and 19.72 °C, with an average temperature of 14.20 °C.
- Temperatures gradually decreased throughout the deployment, typical for the fall season.
- 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.

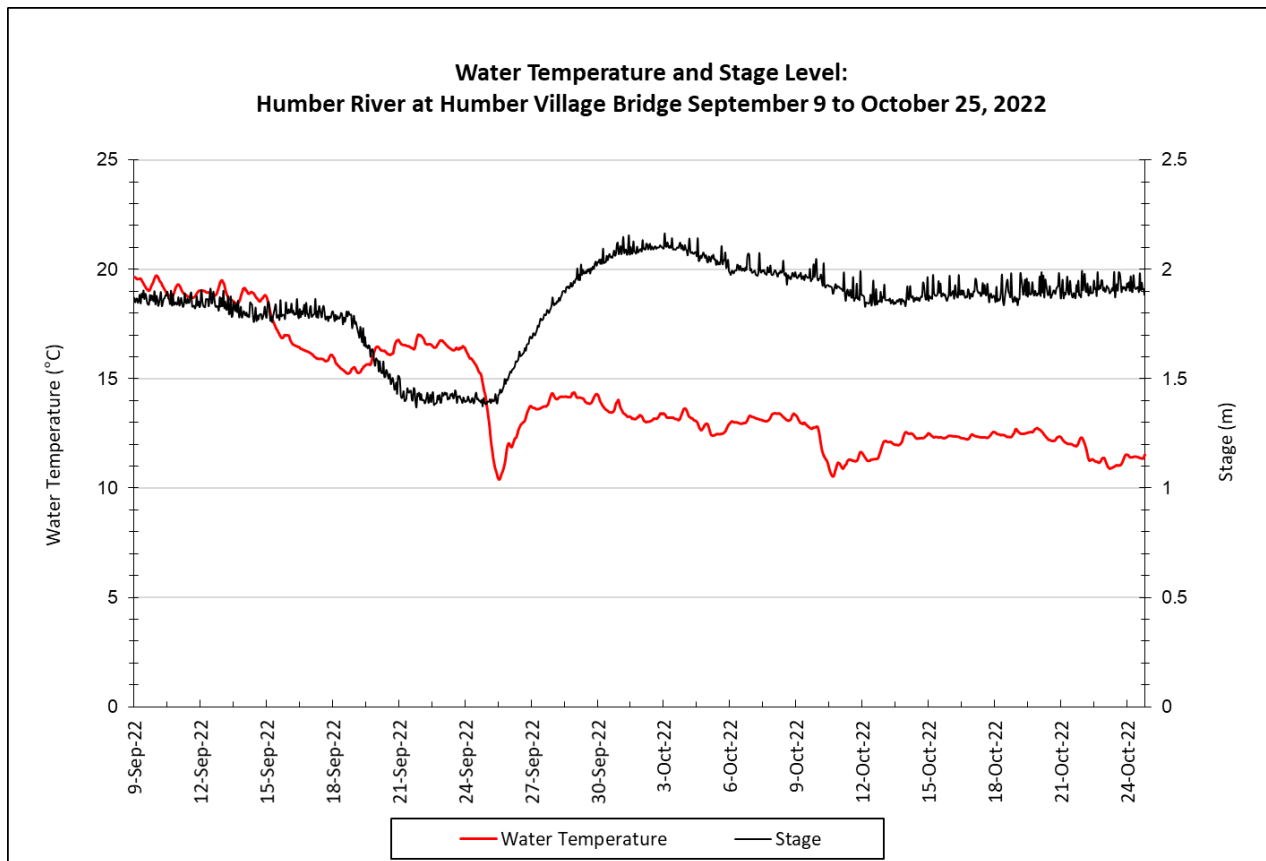


Figure 2: Water Temperature and Stage at Humber River at Humber Village Bridge

pH

- pH ranged between 6.77 and 7.23 during the deployment period, with an average of 7.04 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).

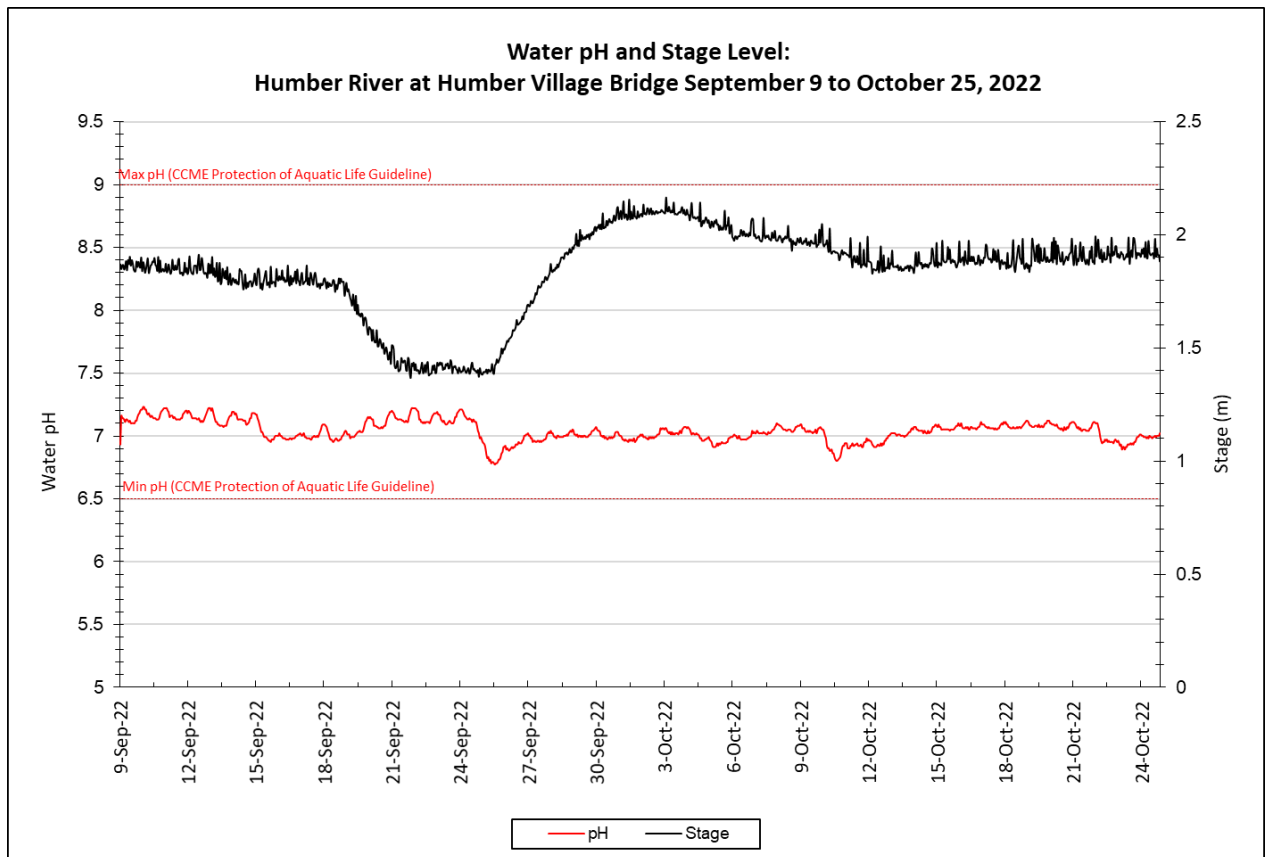


Figure 3: pH values recorded at Humber River at Humber Village Bridge

Specific Conductivity

- Throughout the deployment period, specific conductivity ranged between 40.4 $\mu\text{S}/\text{cm}$ and 44.0 $\mu\text{S}/\text{cm}$, with an average of 41.3 $\mu\text{S}/\text{cm}$.
- Figure 4 illustrates the overall decrease of specific conductivity throughout this deployment. The fluctuations observed throughout the deployment are directly related to changes in temperature and precipitation/stage.

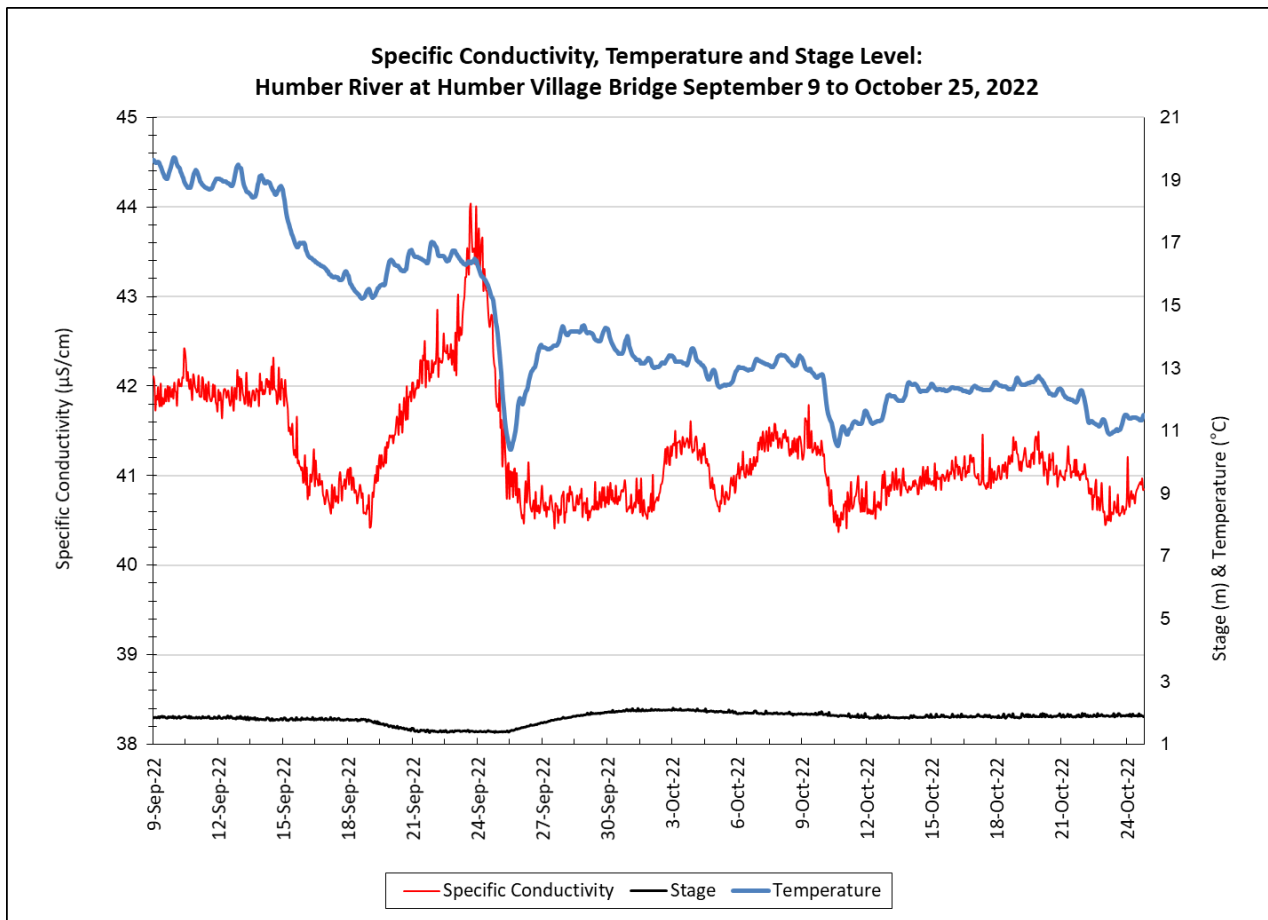


Figure 4: Specific Conductivity at Humber River at Humber Village Bridge

Total Dissolved Solids

- The values for total dissolved solids (TDS) was steady at 0.0300 g/L for duration of this deployment.

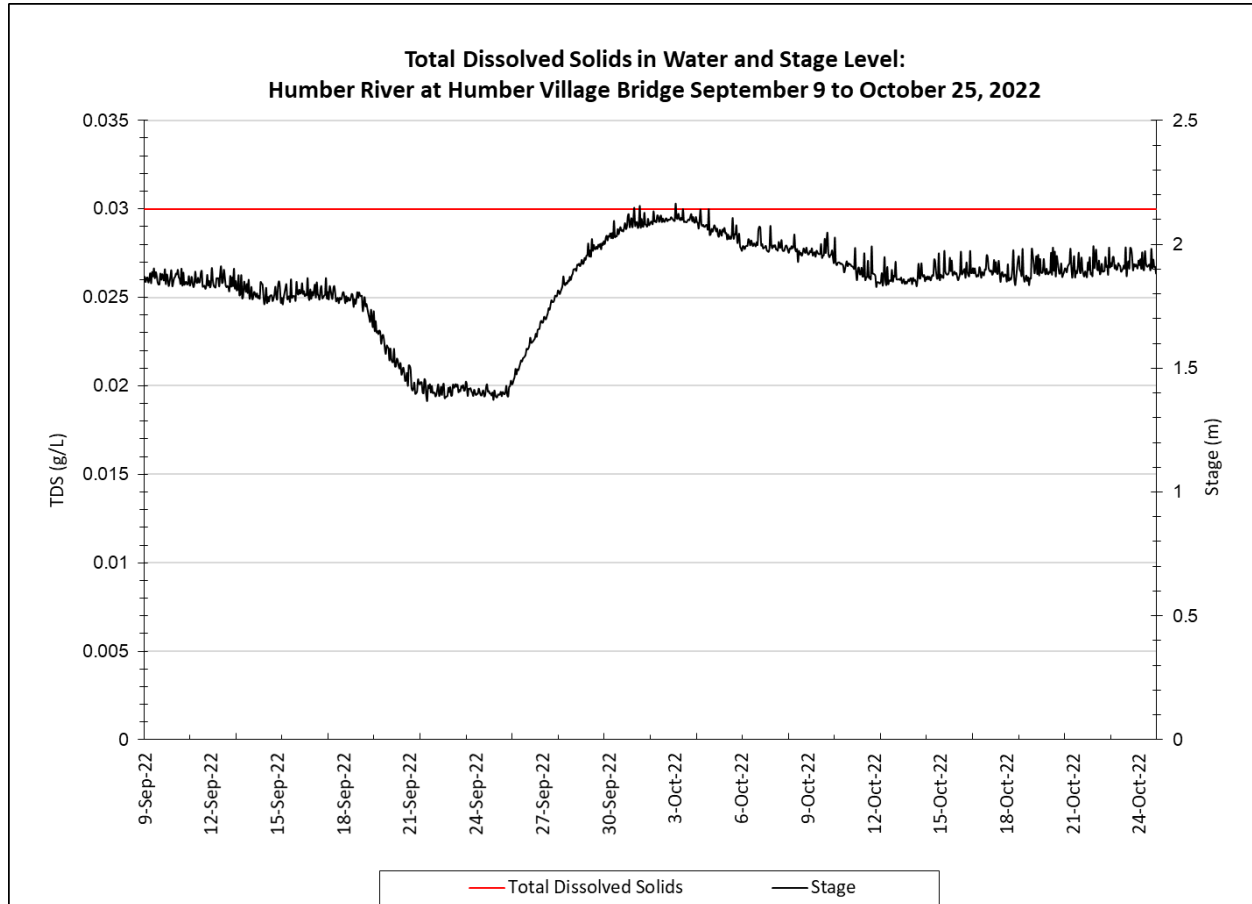


Figure 5: TDS at Humber River at Humber Village Bridge

Dissolved Oxygen

- During the deployment period, dissolved oxygen concentrations ranged from 8.99 mg/L to 10.74 mg/L, with an average of 9.98 mg/L. Dissolved oxygen percent-saturation ranged from 93.0% to 100.4%, with an average of 97.0%.
- Dissolved oxygen is inversely related to water temperature, meaning that oxygen level increases in lower temperatures, and decreases in higher temperatures.
- This data shows a normal trend as fall progresses, with cooling water resulting in higher levels of concentrated oxygen.
- All values remained above the threshold of the CCME guidelines for the protection of other life stages. Values were below the threshold for the protection of early life stages in early September but increased above the threshold in mid-late September as temperatures began to decrease (CCME, 2007).

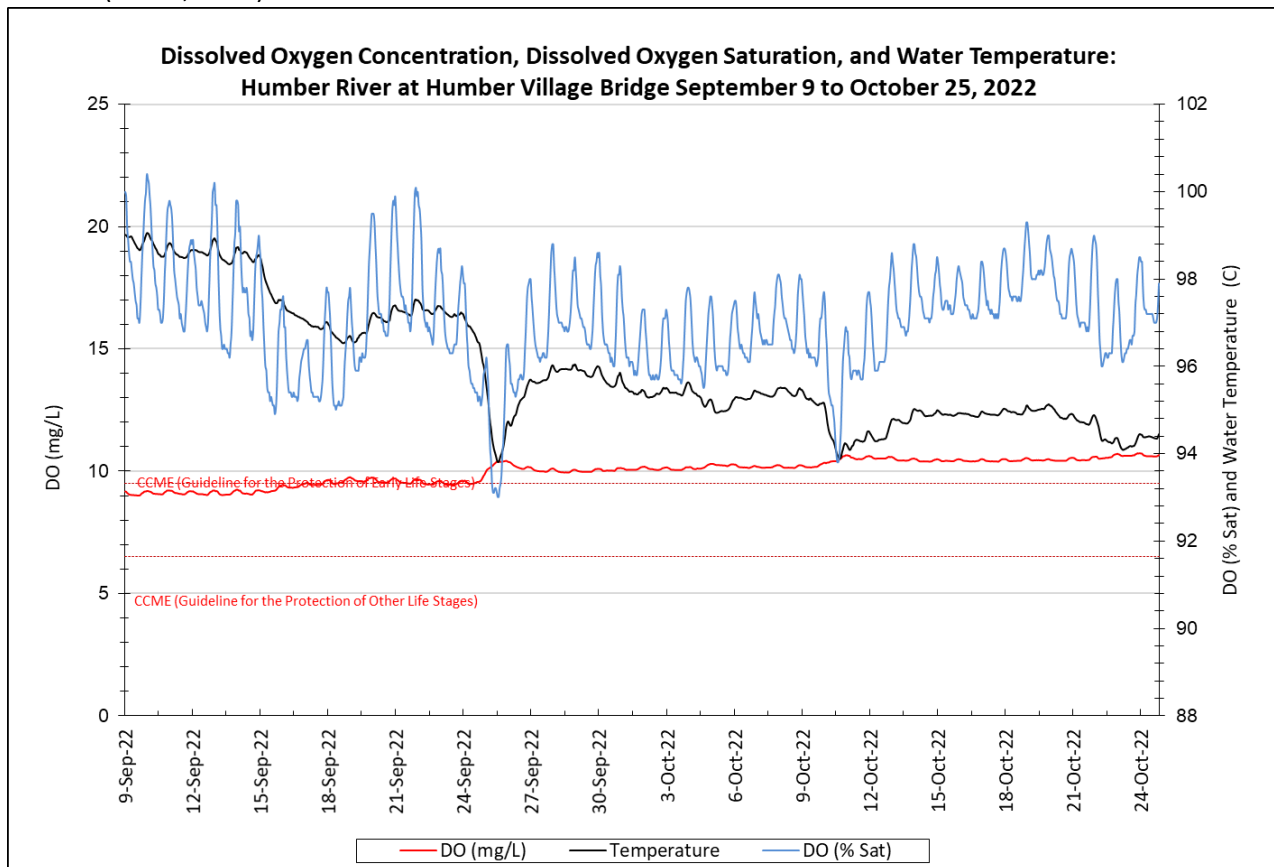


Figure 6: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River at Humber Village Bridge

Turbidity

- Throughout the deployment period, turbidity ranged from 0.0 NTU to 1.9 NTU, with an average turbidity of 0.1 NTU.
- Turbidity was relatively stable during the deployment, with the exception of periodic spikes corresponding with increases in precipitation.

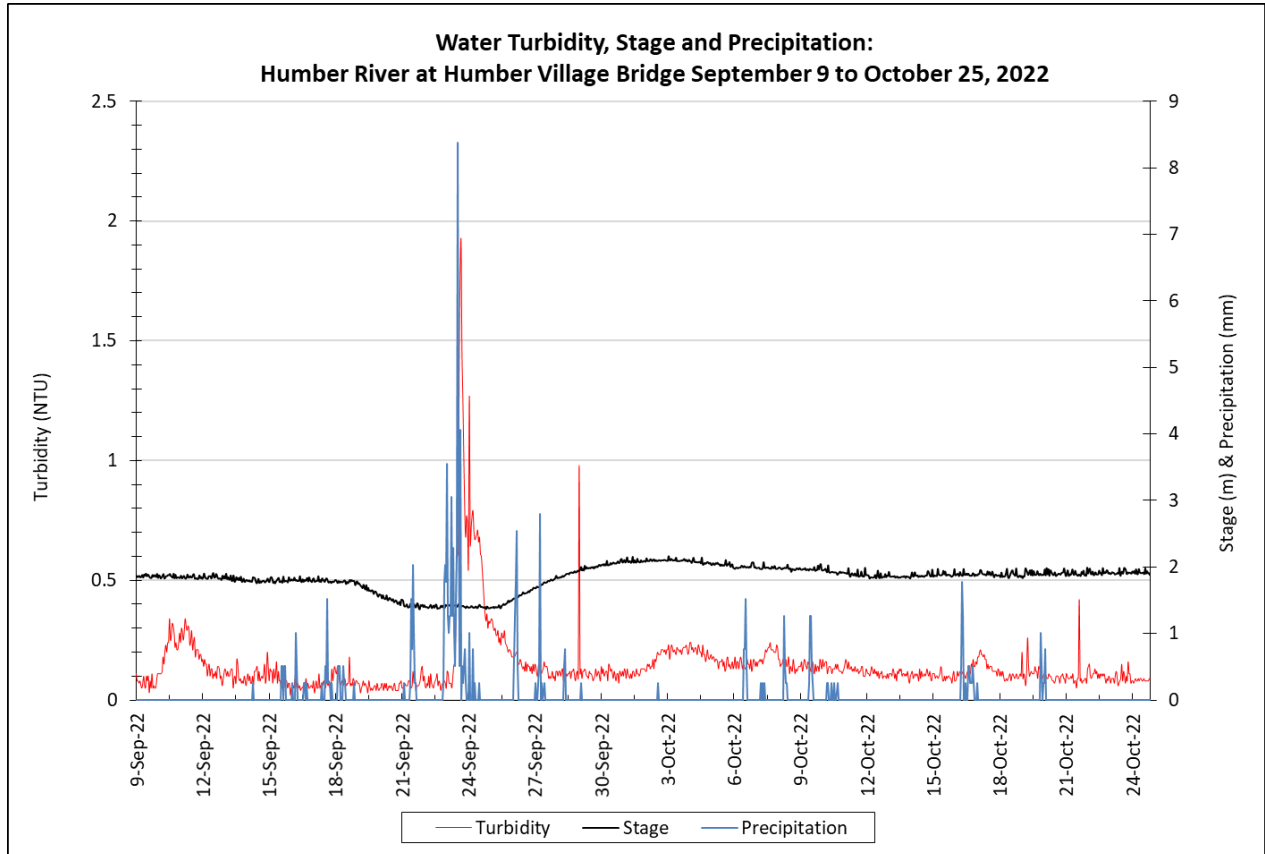


Figure 7: Turbidity, Stage, & Precipitation at Humber River at Humber Village Bridge

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 September 9, 2022, to October 25, 2022.
- The following are summarized statements regarding the findings at Humber River:
 - Water Temperature: Ranged from 10.39 °C to 19.72 °C, averaging 14.20 °C. Gradually decreased throughout the deployment with frequent fluctuation caused by combination of diurnal fluctuations in the air temperature, occasional precipitative episodes and normal seasonal trends.
 - pH: Ranged from 6.77 to 7.23, averaging 7.04 pH units. Remained stable, and data was within the threshold of acceptance for the protection of aquatic life as outlined by the CCME.
 - Specific Conductivity: Ranged from 40.4 µS/cm to 44.0 µS/cm, averaging at 41.3 µS/cm. Specific conductivity decreased throughout this deployment. This is a normal occurrence during periods of low stage and temperature.
 - Dissolved Oxygen: Concentration ranged from 8.99 mg/L to 10.74 mg/L, averaging at 9.98 mg/L; percent-saturation ranged from 93.0% to 100.4%, averaging at 97.0%. Concentrations increased overall due to the decreasing temperature typical of the fall season. Dissolved oxygen data met the acceptance thresholds of the CCME's guidelines for the protection of other life stages. However, levels did not meet the criteria for early life stages in early-mid September but did increase above threshold values as temperature decreased.
 - Turbidity: Ranged from 0.0 NTU to 1.9 NTU, averaging 0.1 NTU. Turbidity was relatively stable during the deployment, with the exception of periodic spikes corresponding with increases in precipitation.
 - Stage: Stage ranged from 1.37 m to 2.17 m, averaging at 1.84 m. Stage decreased in late September and then stabilised throughout the remainder of the deployment.

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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)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.

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

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

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)
9-Sep-2022	17.49	13.22	22.43	0.00
10-Sep-2022	14.41	8.97	20.19	0.00
11-Sep-2022	15.22	11.40	20.09	0.00
12-Sep-2022	16.67	13.21	20.33	0.00
13-Sep-2022	18.46	13.24	24.76	0.00
14-Sep-2022	18.01	11.83	26.40	0.25
15-Sep-2022	17.35	13.10	19.79	0.00
16-Sep-2022	13.84	11.12	19.00	3.81
17-Sep-2022	12.99	11.27	15.85	0.76
18-Sep-2022	11.60	9.79	13.99	5.08
19-Sep-2022	11.21	9.29	14.02	0.76
20-Sep-2022	11.77	7.03	18.00	0.00
21-Sep-2022	12.03	6.38	17.95	0.25
22-Sep-2022	17.38	14.11	21.33	6.10
23-Sep-2022	18.04	15.50	22.53	20.83
24-Sep-2022	16.16	12.63	20.96	24.38
25-Sep-2022	11.28	8.96	13.55	0.25
26-Sep-2022	14.70	8.46	20.03	6.10
27-Sep-2022	17.96	14.08	22.24	4.06
28-Sep-2022	18.40	15.72	21.33	0.76
29-Sep-2022	13.79	11.03	17.17	1.02
30-Sep-2022	12.48	9.67	16.61	0.00
1-Oct-2022	12.20	6.10	18.09	0.00
2-Oct-2022	6.44	2.27	10.46	0.00
3-Oct-2022	6.53	2.57	10.96	0.25
4-Oct-2022	11.03	6.61	17.21	0.00
5-Oct-2022	12.55	6.91	19.98	0.00
6-Oct-2022	9.99	4.33	17.18	0.00
7-Oct-2022	11.97	8.89	15.43	4.06
8-Oct-2022	11.90	8.81	15.70	2.29
9-Oct-2022	9.72	7.34	13.04	0.25
10-Oct-2022	7.99	5.88	11.35	4.06
11-Oct-2022	8.58	5.24	11.60	0.76
12-Oct-2022	10.25	6.76	13.98	0.00
13-Oct-2022	10.39	4.69	18.24	0.00
14-Oct-2022	10.19	4.74	17.13	0.00
15-Oct-2022	8.53	5.60	13.70	0.00
16-Oct-2022	10.24	6.37	13.36	3.56
17-Oct-2022	12.14	10.30	14.60	3.05
18-Oct-2022	12.94	11.28	14.71	0.00
19-Oct-2022	13.70	10.33	16.94	0.00
20-Oct-2022	15.66	8.94	19.39	2.29
21-Oct-2022	10.05	5.89	14.25	0.00
22-Oct-2022	11.63	6.96	16.89	0.00
23-Oct-2022	13.07	8.81	17.78	0.00
24-Oct-2022	10.92	7.00	17.91	0.00
25-Oct-2022	7.09	5.67	8.77	0.00