



Real Time Water Quality Report Humber River at Humber Village

Deployment Period
2023-01-09 to 2023-03-29



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

General

The following report is a summary of water quality monitoring data collected in real-time at the Humber River at Humber Village Bridge station from January 9 to March 29, 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) monitoring network. A multi-parameter sonde is deployed in the river 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). Staff at the Department of Environment and Climate Change (Water Resources Management Division-WRMD) monitor the data for potential environmental impacts. The sonde undergoes routine maintenance/calibration on a regular basis, after which the instrument is redeployed, generally 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 (Appendix A) based on whether readings fall within a specified threshold. This will further ensure the integrity of the data's accuracy, so that the monitoring station delivers reliable results.

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 1: 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	January 09, 2023	Deployment	Good	Good	Excellent	Excellent	Excellent
	March 29, 2023	Removal	Excellent	Good	Excellent	Excellent	Excellent

All performance rankings at deployment and removal were ‘good’ or ‘excellent’.

Deployment Notes

This deployment took place over the course of 80 days (January 09 to March 29, 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 (µS/cm); (5) Dissolved Oxygen (mg/L); (6) Turbidity (NTU).

Temperature

- Throughout the deployment period, the water temperature ranged between 0.39 °C and 2.91 °C, with an average temperature of 1.34 °C.
- Temperatures gradually decreased until late February at which point it began to increase, typical for the winter 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.

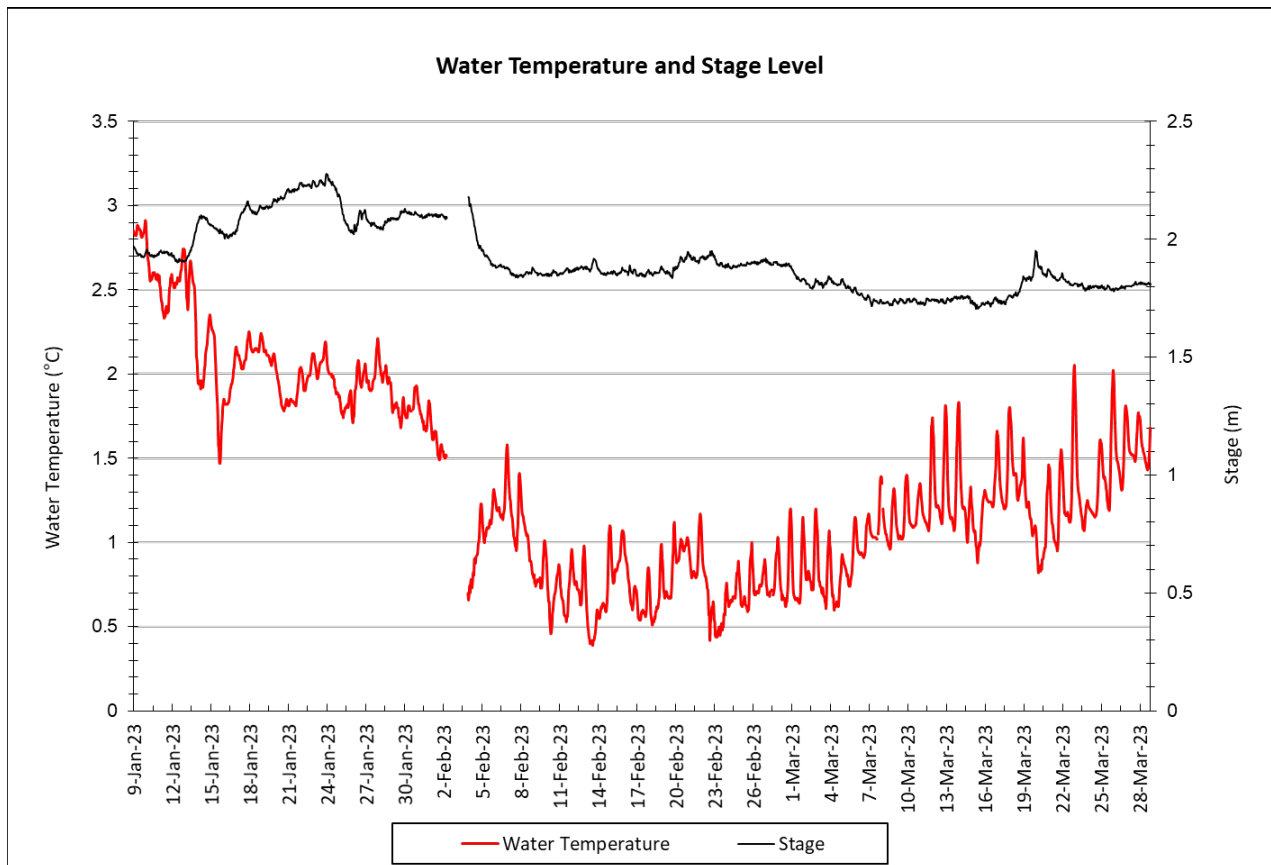


Figure 2: Water Temperature and Stage at Humber River at Humber Village Bridge

pH

- pH ranged between 6.96 and 7.05 during the deployment period, with an average of 7.01 pH units.
- The pH data was steady throughout deployment and remained within the acceptable range for the protection of aquatic life as outlined by the Canadian Council of Ministers of the Environment (CCME) (2007).

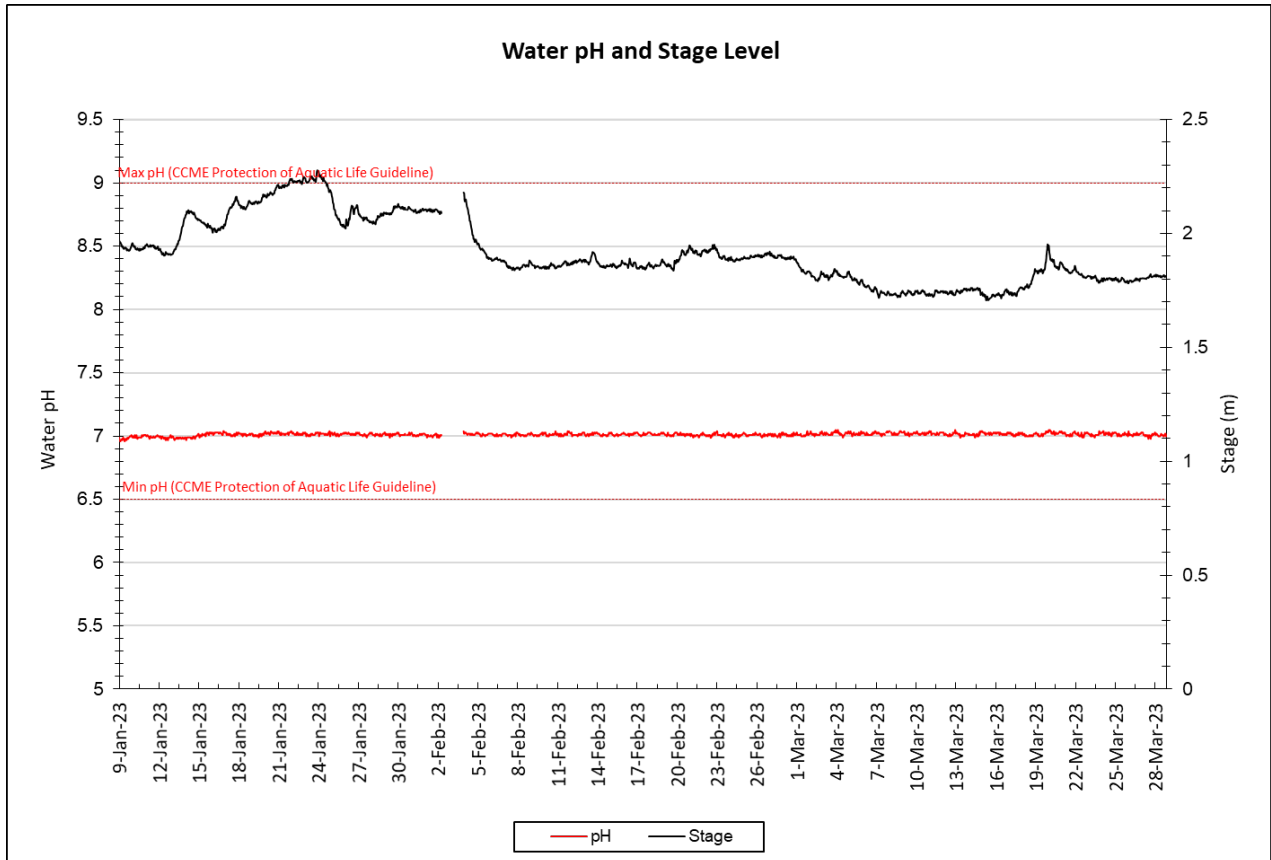


Figure 3: pH values recorded at Humber River at Humber Village Bridge

Specific Conductivity

- Throughout the deployment period, specific conductivity ranged between 42.8 $\mu\text{S}/\text{cm}$ and 47.6 $\mu\text{S}/\text{cm}$, with an average of 45.1 $\mu\text{S}/\text{cm}$.
- 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.

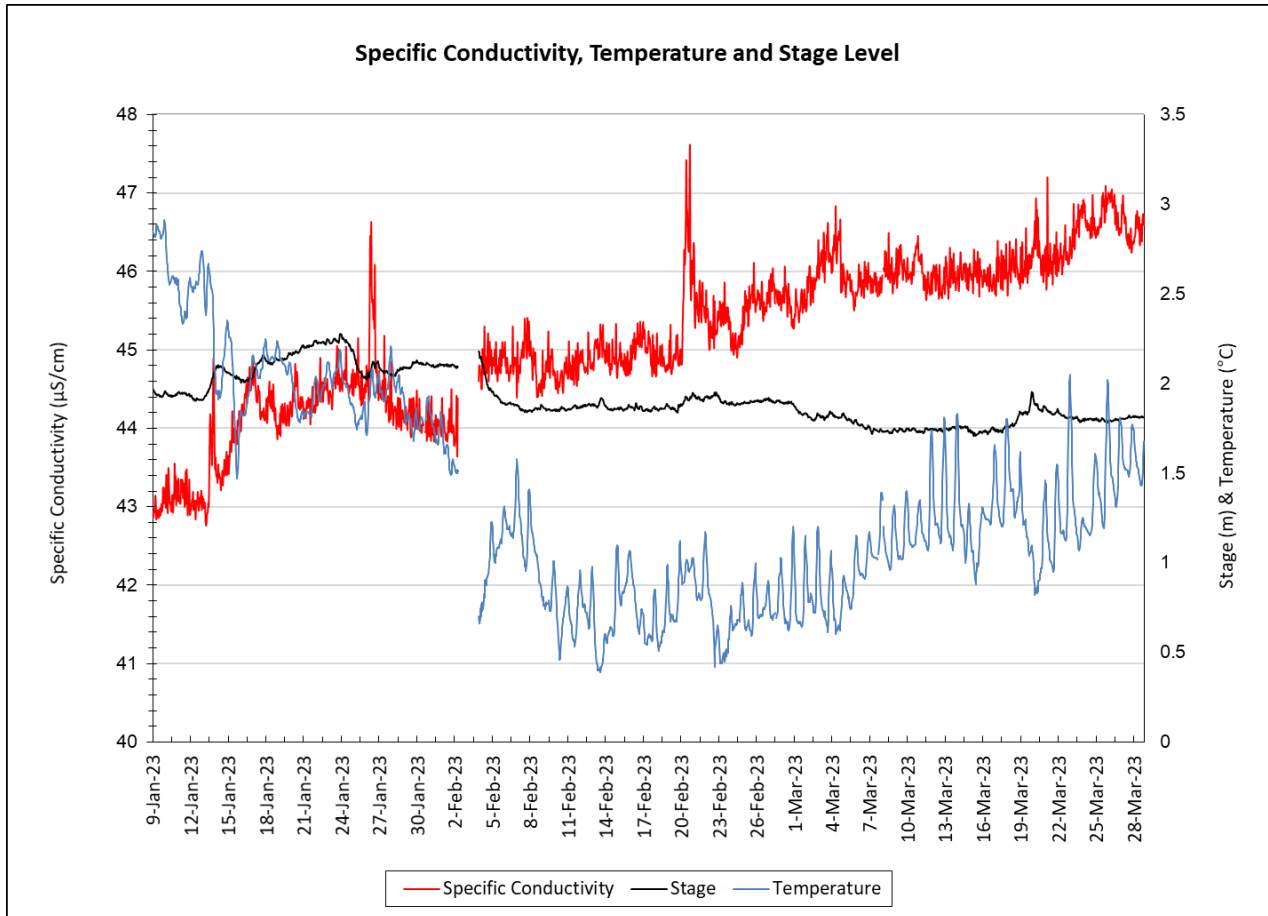


Figure 4: Specific Conductivity at Humber River at Humber Village Bridge

Dissolved Oxygen

- During the deployment period, dissolved oxygen concentrations ranged from 12.97 mg/L to 13.95 mg/L, with an average of 13.69 mg/L. Dissolved oxygen percent-saturation ranged from 95.5% to 99.5%, with an average of 97.2%.
- Dissolved oxygen is inversely related to water temperature: oxygen levels increase in lower water temperatures, and decrease in higher water temperatures.
- This data shows a normal trend as winter progresses, 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.

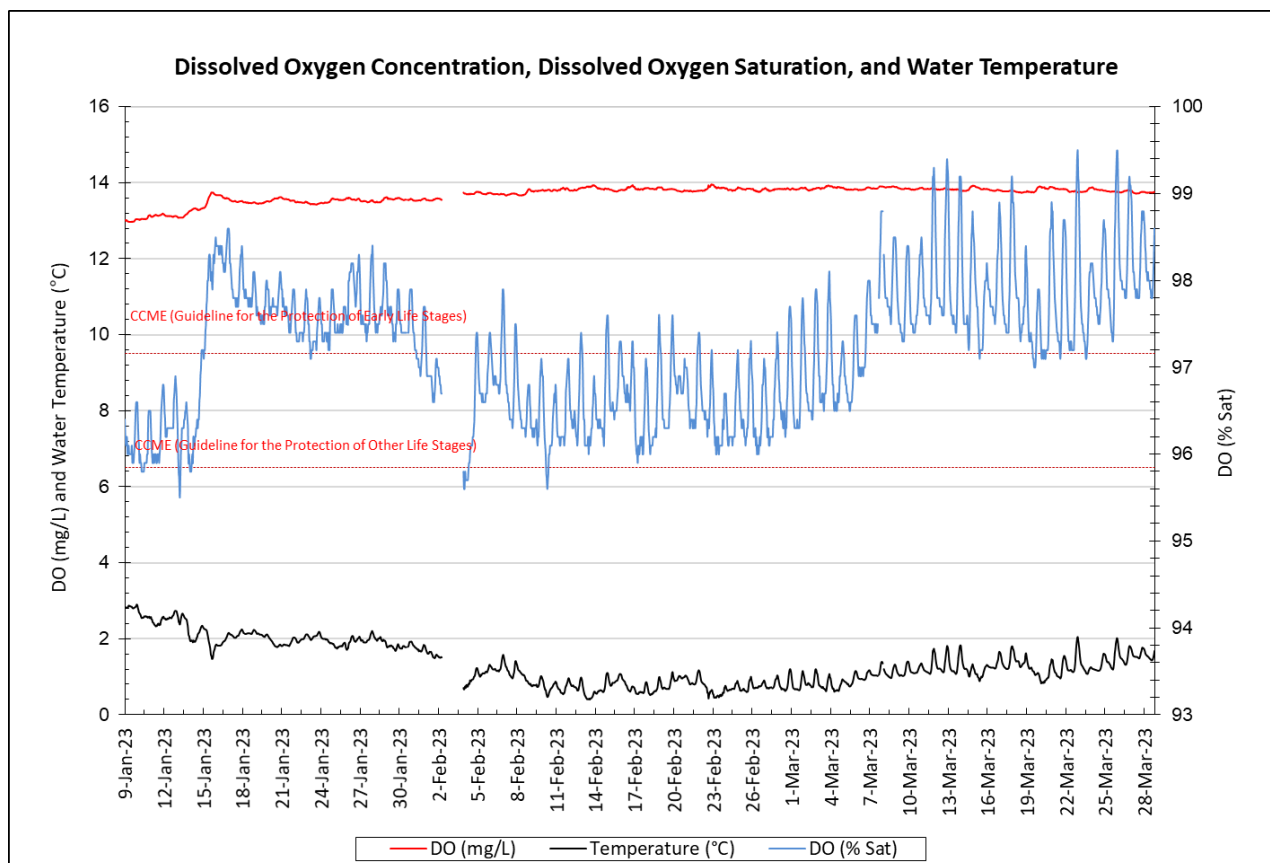


Figure 5: DO (mg/L & % saturation) with Water Temperature (°C) at Humber River at Humber Village Bridge

Turbidity & Stage

- Throughout the deployment period, turbidity ranged from 0.1 NTU to 2.5 NTU, with an average turbidity of 0.3 NTU.
- Turbidity was relatively stable during the deployment, with the exception of periodic spikes generally corresponding with increases in precipitation and stage.
- Stage ranged from 1.71 m to 2.28 m, averaging at 1.91 m.

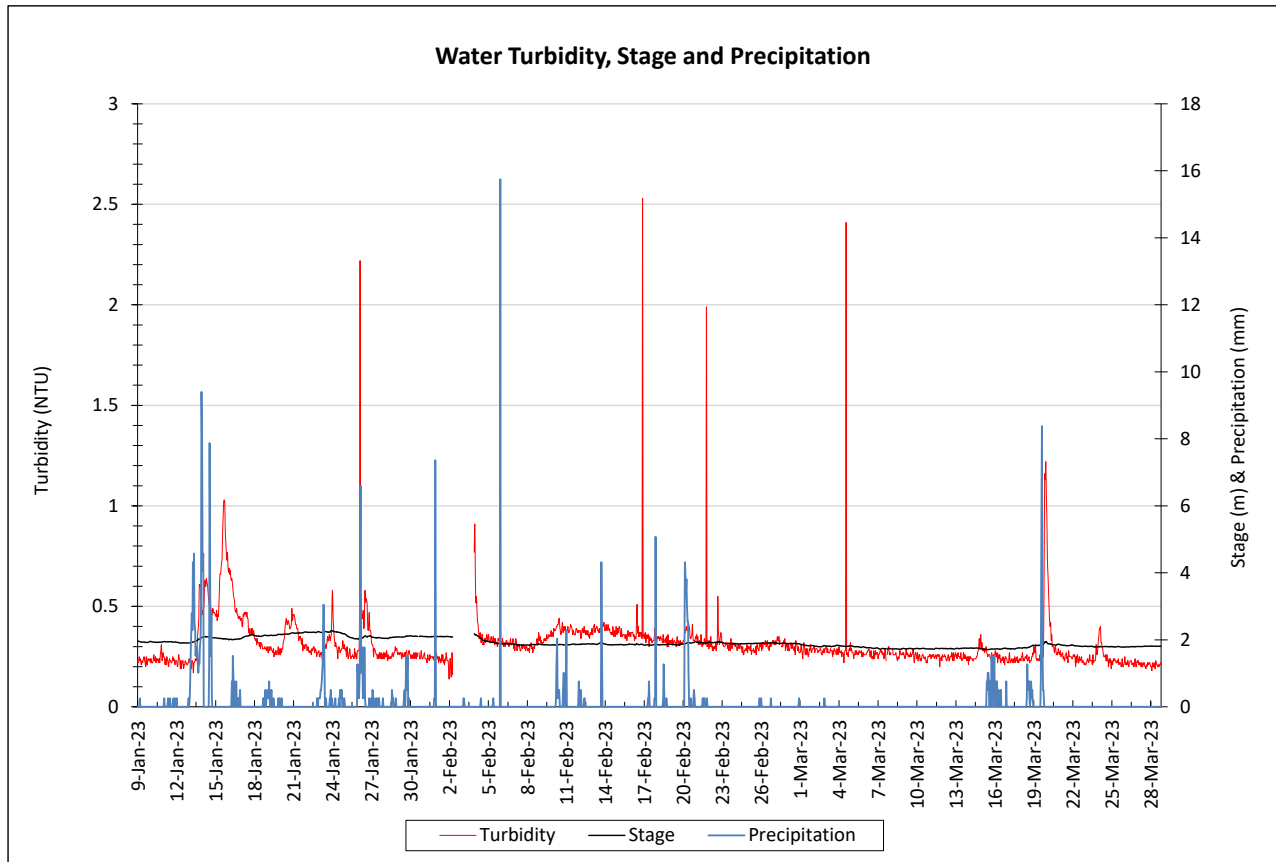


Figure 6: Turbidity, Stage, & Precipitation at Humber River at Humber Village Bridge

Conclusions

- This deployment report summarizes the real time water quality and quantity monitoring data recorded at the Humber River at Humber Village Bridge station over a period of 80 days. No unusual events or data anomalies were evident.
- All parameters displayed trends typical for this waterbody at this time of year. Dissolved oxygen and pH values were all within the recommended CCME guidelines for the Protection of Aquatic Life.

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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://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, water quality parameters, as measured by both sondes, are recorded. 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. After Sonde readings have stabilized, water quality parameters, are measured by both sondes and recorded. 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-Jan-2023	-6.30	-7.18	-6.00	0.254
10-Jan-2023	-7.86	-10.54	-5.62	0.000
11-Jan-2023	-7.33	-11.17	-5.60	0.254
12-Jan-2023	-7.25	-8.83	-6.08	1.270
13-Jan-2023	-3.14	-7.94	1.97	17.780
14-Jan-2023	0.07	-2.22	3.80	53.596
15-Jan-2023	-0.32	-1.32	0.63	16.764
16-Jan-2023	-0.14	-1.97	1.88	0.762
17-Jan-2023	4.36	1.93	9.10	5.080
18-Jan-2023	3.07	0.57	5.08	0.000
19-Jan-2023	2.05	0.16	3.15	4.318
20-Jan-2023	-1.01	-1.78	-0.32	1.016
21-Jan-2023	-2.04	-2.68	-1.20	0.000
22-Jan-2023	-2.46	-4.73	-0.35	0.000
23-Jan-2023	0.80	-1.91	2.30	8.382
24-Jan-2023	2.01	0.05	3.97	6.096
25-Jan-2023	-3.68	-6.88	0.14	2.286
26-Jan-2023	-1.92	-6.66	6.27	19.304
27-Jan-2023	1.56	-3.78	10.09	4.572
28-Jan-2023	-2.75	-4.70	-0.37	1.270
29-Jan-2023	-2.55	-5.96	1.88	1.270
30-Jan-2023	-3.58	-6.94	1.60	6.096
31-Jan-2023	-5.09	-9.39	-2.20	0.000
1-Feb-2023	-10.16	-12.19	-7.13	7.874
2-Feb-2023	-10.65	-15.69	-5.03	0.000
3-Feb-2023	-3.79	-10.14	1.19	0.508
4-Feb-2023	-13.12	-16.46	-8.40	0.000
5-Feb-2023	-6.40	-8.78	-2.93	0.254
6-Feb-2023	-4.52	-8.10	-1.65	16.004
7-Feb-2023	-11.67	-14.08	-8.30	0.000
8-Feb-2023	-9.45	-14.97	-2.42	0.000
9-Feb-2023	-6.45	-9.82	-1.68	0.000
10-Feb-2023	-7.31	-10.06	-5.51	3.556
11-Feb-2023	-6.33	-8.04	-4.77	6.096
12-Feb-2023	-6.28	-9.09	-2.51	1.270
13-Feb-2023	-5.35	-10.94	-2.57	0.508
14-Feb-2023	-7.37	-11.49	-4.68	5.588
15-Feb-2023	-4.23	-10.21	0.76	0.000
16-Feb-2023	2.42	-2.53	6.53	0.000
17-Feb-2023	-2.46	-6.42	3.64	0.254
18-Feb-2023	-7.95	-10.56	-6.36	6.604

Date	Average Air Temp (°C)	Minimum Air Temp (°C)	Maximum Air Temp (°C)	Total Precipitation (mm)
19-Feb-2023	-4.25	-8.91	-1.10	2.032
20-Feb-2023	-0.52	-8.84	4.78	18.542
21-Feb-2023	2.25	-3.78	7.49	7.366
22-Feb-2023	-3.90	-6.85	-0.83	1.270
23-Feb-2023	-10.70	-14.28	-4.64	0.000
24-Feb-2023	-14.85	-16.80	-12.86	0.000
25-Feb-2023	-14.50	-16.47	-12.06	0.000
26-Feb-2023	-15.61	-21.41	-10.36	0.508
27-Feb-2023	-12.23	-16.42	-10.02	0.254
28-Feb-2023	-11.17	-15.39	-6.21	0.000
1-Mar-2023	-13.68	-20.28	-5.77	0.254
2-Mar-2023	-7.09	-16.07	-2.98	0.000
3-Mar-2023	-5.69	-12.20	-1.27	0.254
4-Mar-2023	-6.14	-8.15	-3.60	0.000
5-Mar-2023	-4.93	-8.29	-3.04	0.000
6-Mar-2023	-2.46	-5.05	-0.03	0.000
7-Mar-2023	-0.17	-2.06	2.81	0.000
8-Mar-2023	2.64	1.58	4.25	0.000
9-Mar-2023	1.99	0.63	4.02	0.000
10-Mar-2023	1.37	-1.04	3.02	0.000
11-Mar-2023	3.27	1.92	4.78	0.000
12-Mar-2023	2.65	-0.15	6.75	0.000
13-Mar-2023	0.72	-3.09	5.66	0.000
14-Mar-2023	-0.67	-6.52	6.47	0.000
15-Mar-2023	-1.98	-3.79	-0.30	0.000
16-Mar-2023	0.65	-2.40	2.14	12.954
17-Mar-2023	2.96	-0.81	6.65	1.270
18-Mar-2023	2.32	-1.87	7.66	0.000
19-Mar-2023	2.06	0.41	4.42	5.842
20-Mar-2023	-1.61	-2.98	1.00	17.524
21-Mar-2023	-0.40	-1.83	1.42	0.000
22-Mar-2023	-2.40	-7.13	1.94	0.000
23-Mar-2023	-1.49	-6.30	3.77	0.000
24-Mar-2023	-2.35	-5.83	0.34	0.000
25-Mar-2023	1.61	-1.23	5.35	0.000
26-Mar-2023	0.40	-5.90	5.96	0.000
27-Mar-2023	2.12	-0.10	5.09	0.000
28-Mar-2023	2.60	0.71	5.10	0.000
29-Mar-2023	1.15	0.08	2.45	0.000