Real-Time Water Quality Deployment Report

Lower Churchill River Network

July 5/6/14 to
August 9/10, 2023

Newfoundland Labrador

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

Contents

Prepared by:
Brenda Congram
Environmental Scientist
Department of Environment and Climate Change
Water Resources Management Division
brendacongram@gov.nl.ca

Real-Time Water Quality Deployment Report

Lower Churchill River Network

July 5/6/14 to August 9/10, 2023

Real Time Water Quality Monitoring

- Staff with the Department of Environment and Climate Change monitor real-time water quality data on a regular basis.
- This deployment report discusses water quality related events occurring at four stations on the Lower Churchill River: Churchill River below Metchin River, Churchill River above Grizzle Rapids, Churchill River below Muskrat Falls and Churchill River at English Point.
- A real-time water quality monitoring instrument was deployed at Churchill River above Grizzle Rapids on July 5th. Instruments were deployed at Churchill River below Muskrat Falls and at English Point on July 6th, and an instrument was deployed at Churchill River below Metchin River on July 14th.
- The instrument at Churchill River at English Point was removed on August 9th, for a deployment period of 34 days. Instruments at Churchill River above Grizzle Rapids and Churchill River below Muskrat Falls were removed on August 10th, for deployment periods of 36 and 35 days, respectively.
- The instrument at Churchill River below Metchin River was not removed from the water until September 5th. For the purposes of this report, data from this station will be reported as if it had been removed on August 9th, for a deployment period of 26 days.

Quality Assurance and Quality Control

- As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. This procedure is based on the approach used by the United States Geological Survey.
- At deployment and removal, a QA/QC instrument is temporarily deployed alongside the field instrument. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments**.** Based on the degree of difference between parameters recorded by the field instrument and QA/QC instrument at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

Table 1: Instrument Performance Ranking classifications for deployment and removal

	Rank				
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 > 35µS/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

- It should be noted that the temperature sensor on any instrument is the most important. All other parameters can be broken down into three groups: temperature dependent, temperature compensated and temperature independent. Because the temperature sensor is not isolated from the rest of the instrument, the entire instrument must be at the same temperature before the sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

- Deployment and removal comparison rankings for the Lower Churchill River stations deployed from July 5/6/14 to August 9/10, 2023 are summarized in Table 2.

Table 2: Comparison rankings for Lower Churchill River stations July 5/6/14 to August 9/10, 2023

Churchill River Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Below Metchin River	July 14, 2023	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	August 9, 2023	Removal	N/A	N/A	N/A	N/A	N/A
Above Grizzle Rapids	July 5, 2023	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	August 10, 2023	Removal	Excellent	Good	Excellent	Excellent	Excellent
Below Muskrat Falls	July 6, 2023	Deployment	Good	Good	Excellent	Excellent	Excellent
	August 10, 2023	Removal	Excellent	Fair	Excellent	Excellent	Excellent
At English Point	July 6, 2023	Deployment	Fair	Good	Good	Excellent	Excellent
	August 9, 2023	Removal	Excellent	Excellent	Excellent	Excellent	Excellent

- **Churchill River below Metchin River**
  - At deployment, all parameters ranked as ‘excellent’.
  - Comparison rankings are not available for removal since this instrument was not physically removed from the water on the date in question.
- **Churchill River above Grizzle Rapids**
  - At deployment, all parameters ranked as either ‘excellent’ or ‘good’.
  - At removal, all parameters ranked as either ‘excellent’ or ‘good'.
- **Churchill River below Muskrat Falls**
  - At deployment, all parameters ranked as either ‘excellent’ or ‘good’.
  - At removal, all parameters ranked as ‘excellent’ except for pH, which was ‘fair’.
- **Churchill River at English Point**
  - At deployment, all parameters ranked as either ‘excellent’ or ‘good’ except for temperature, which was ‘fair’.
  - At removal, all parameters ranked as ‘excellent’.

Data Interpretation

- The following graphs and discussion illustrate water quality related events occurring from July 5/6/14 to August 9/10, 2023 on the Lower Churchill River Network.
- With the exception of water quantity data (stage & flow), all data used in the preparation of the graphs and subsequent discussion below adhere to stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

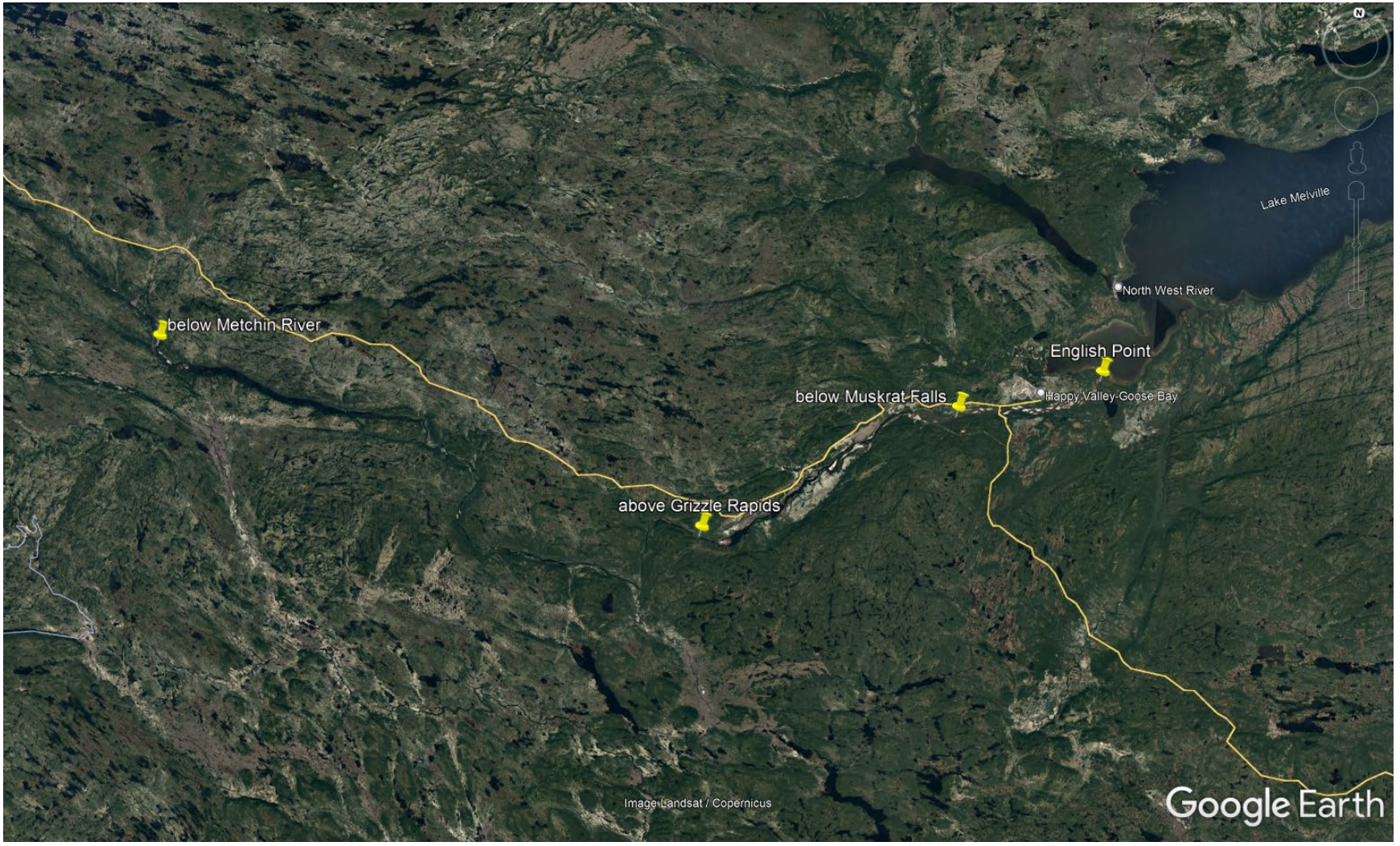

Figure 1: Lower Churchill Network of Real-Time Water Quality Stations

Churchill River below Metchin River

Water Temperature

- Over the deployment period, water temperature ranged from 16.8°C to 21.6°C, with a median value of 19.6°C (Figure 2). Air temperature data was obtained from the Metchin River near TLH Weather Station.
- Water temperature was slightly decreasing over the course of deployment, which is to be expected as air temperatures were also slowly decreasing across the summer season. Water temperature data exhibits a diurnal pattern as expected, and closely correlates with ambient air temperatures.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

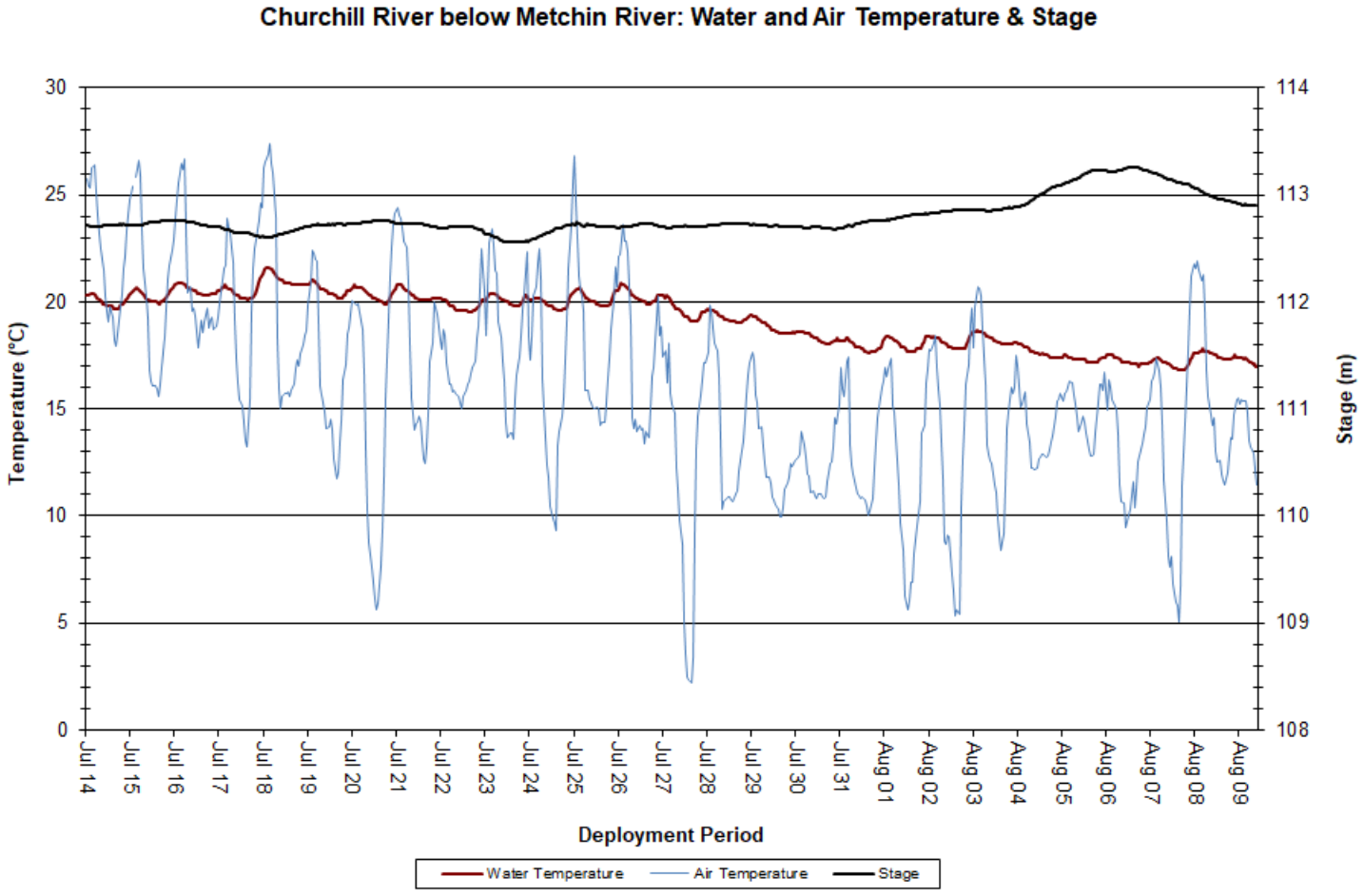

Figure 2: Water and Air Temperature & Stage at Churchill River below Metchin River

pH

- Over the deployment period, pH values ranged from 6.96 to 7.22 pH units, with a median value of 7.11 (Figure 3).
- pH values were quite stable over the course of deployment, remaining within the CCME's Guidelines for the Protection of Aquatic Life for the duration of the deployment period. A slight decrease in pH towards the end of deployment correlated closely with a significant increase in stage.
- Photosynthesis uses up hydrogen molecules; this causes the concentration of hydrogen ions to decrease, which in turn causes pH to increase. For this reason, pH may be higher during daylight hours and during the growing season when photosynthesis is at a maximum. This is illustrated by the diurnal fluctuations in pH values (Figure 3).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

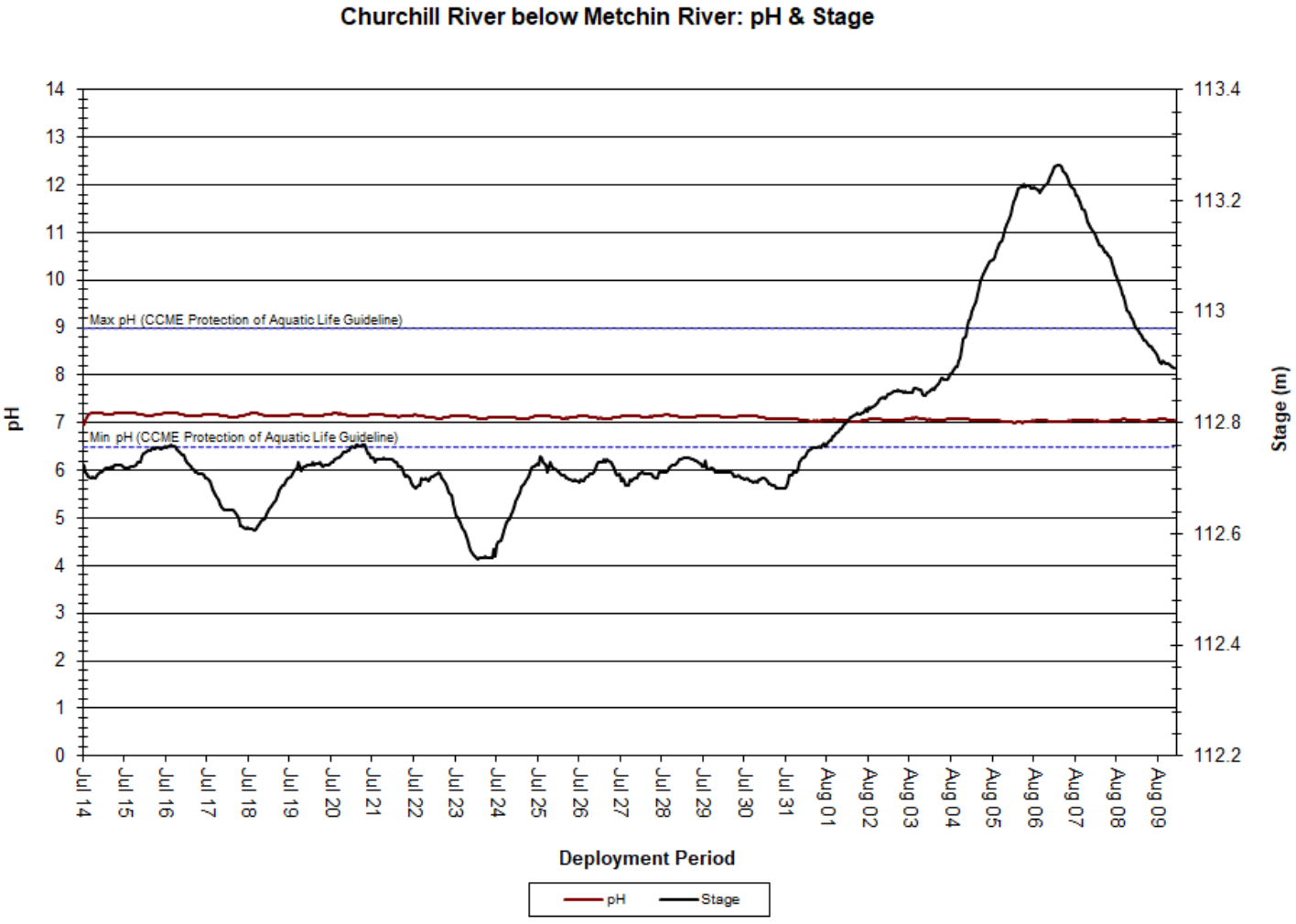

Figure 3: pH & Stage at Churchill River below Metchin River

Specific Conductivity

- Over the deployment period, specific conductivity ranged from 20.9µS/cm to 34.6µS/cm, with a median value of 22.4µS/cm (Figure 4).
- The relationship between conductivity and stage is generally inversed. When stage levels increase, specific conductivity levels decrease as the increased amount of water in the river system dilutes solids that are present. This relationship is somewhat evident in the graph below (Figure 4).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

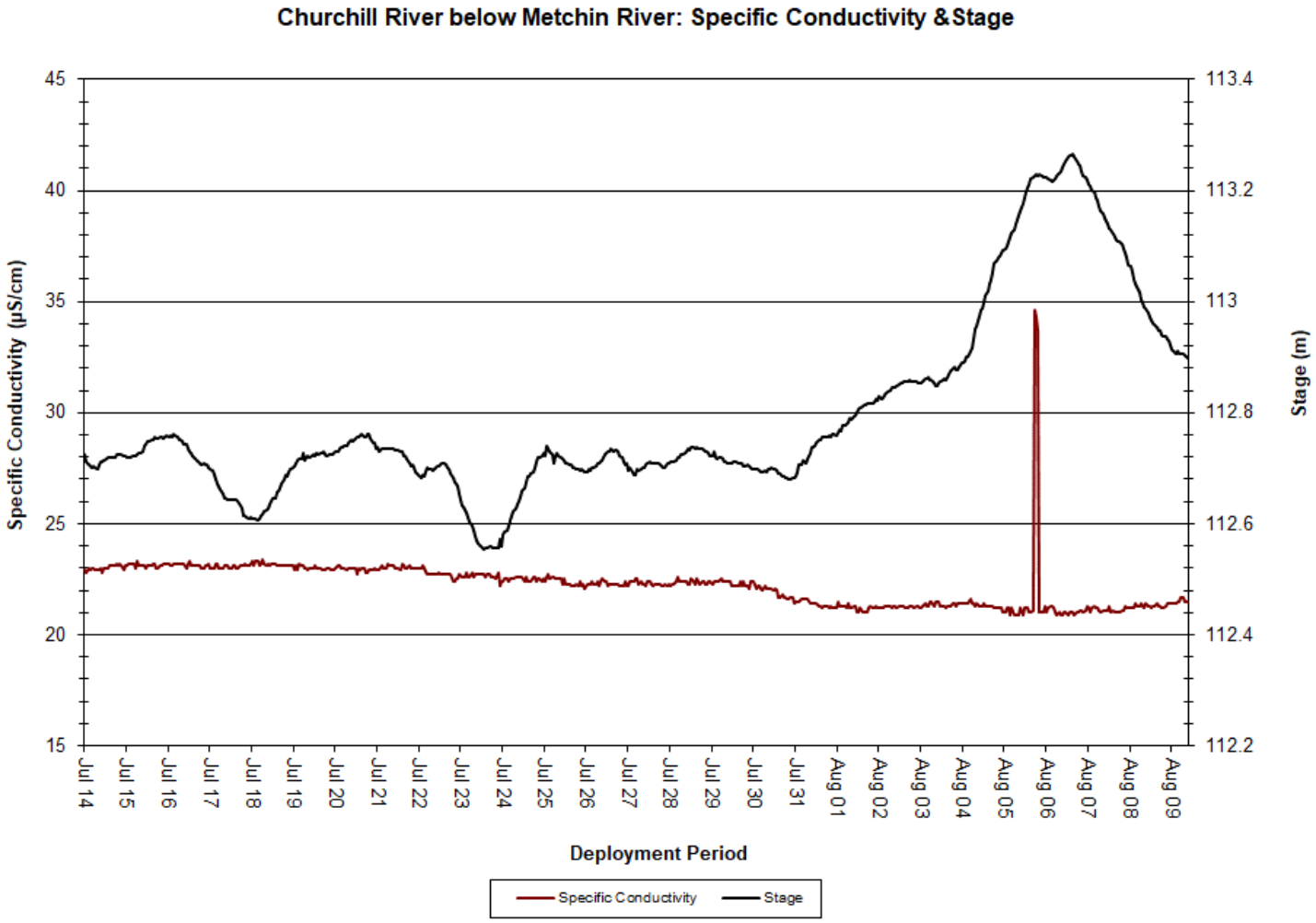

Figure 4: Specific Conductivity & Stage at Churchill River below Metchin River

Dissolved Oxygen

- Over the deployment period, dissolved oxygen content ranged from 8.62mg/L to 9.28mg/L, with a median value of 8.89mg/L. Saturation of dissolved oxygen ranged from 93.2% to 101.5%, with a median value of 96.0% (Figure 5).
- There is an evident relationship between water temperature and dissolved oxygen. Over the deployment period, dissolved oxygen levels were slowly increasing as water temperatures were slowly decreasing. Dissolved oxygen also follows a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures. Generally, dissolved oxygen levels are higher in a waterbody during cooler temperatures.
- Dissolved oxygen levels were below the CCME's Guideline for the Protection of Early Life Stages for the duration of deployment, which is to be expected. Dissolved oxygen levels remained above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment.

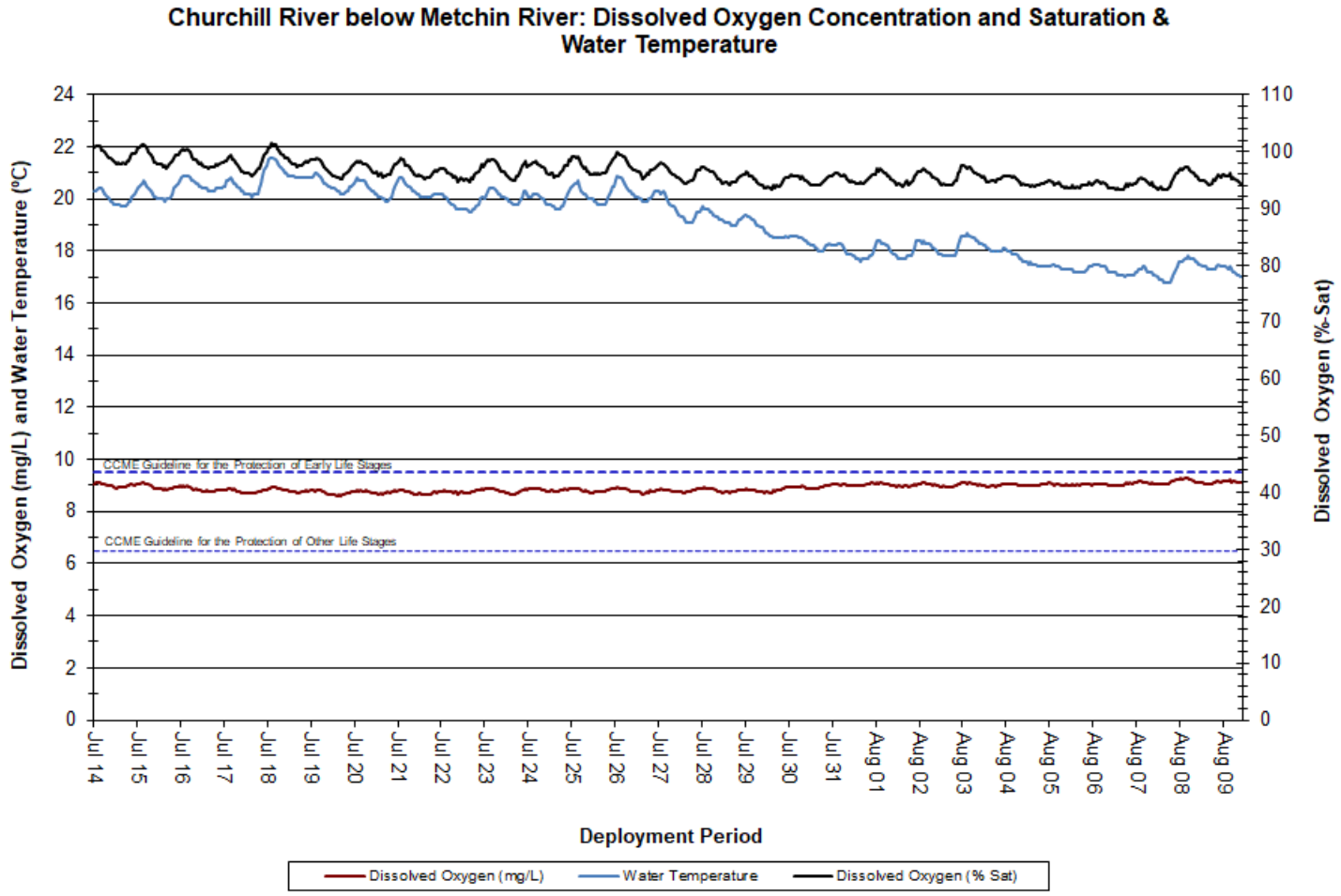

Figure 5: Dissolved Oxygen & Water Temperature at Churchill River below Metchin River

Turbidity

- Over the deployment period, turbidity ranged from 0 NTU to 5.0 NTU, with a median value of 0 NTU (Figure 6). A median value of 0 NTU indicates a very low level of natural background turbidity in the waterbody. Precipitation data was obtained from the Metchin River near TLH Weather Station.
- This station is located at a wide and deep section of the Churchill River and therefore turbidity levels are typically less susceptible to precipitation events as compared to other areas.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

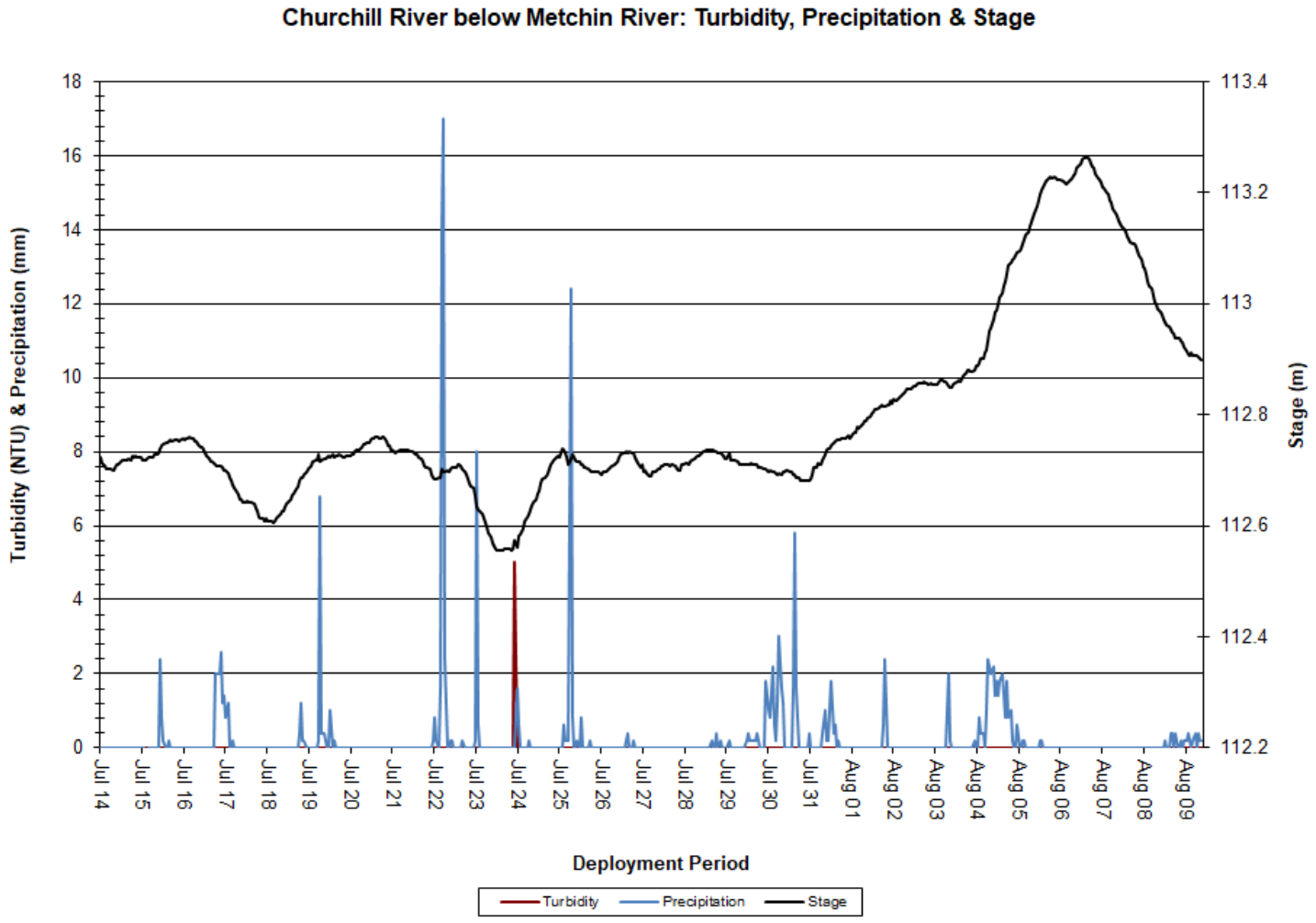

Figure 6: Turbidity, Precipitation & Stage at Churchill River below Metchin River

Stage and Flow

- Over the deployment period, stage levels ranged from 112.555m to 113.265m, with a median value of 112.727m. Flow ranged from 1123.619m^3/s to 1339.110m^3/s, with a median value of 1181.522m^3/s (Figure 7). Precipitation data was obtained from the Metchin River near TLH Weather Station.
- Stage and flow were slightly increasing over the course of deployment. Precipitation events across the same period somewhat correlate with increases in both stage and flow (Figure 8).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

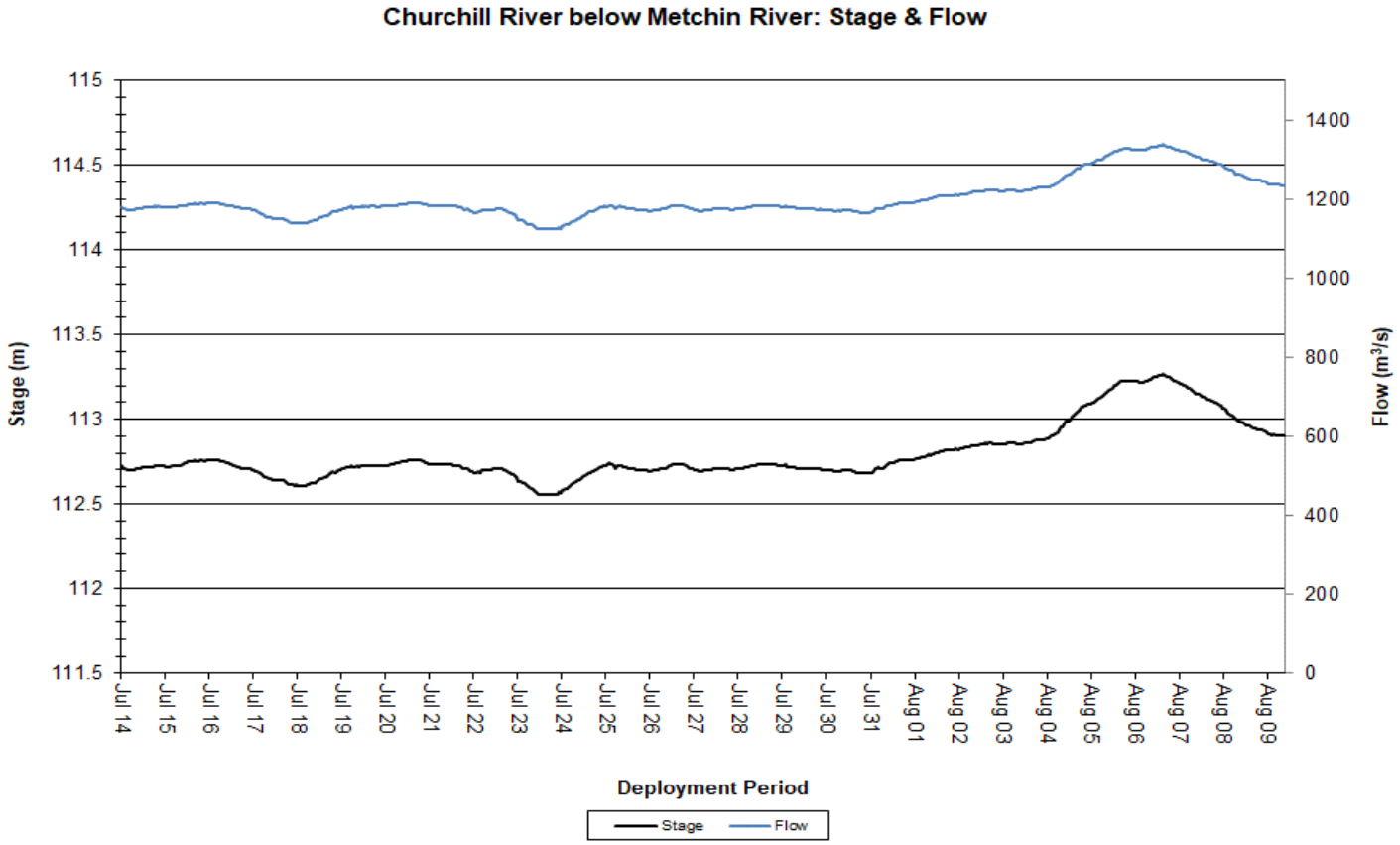

Figure 7: Stage & Flow at Churchill River below Metchin River

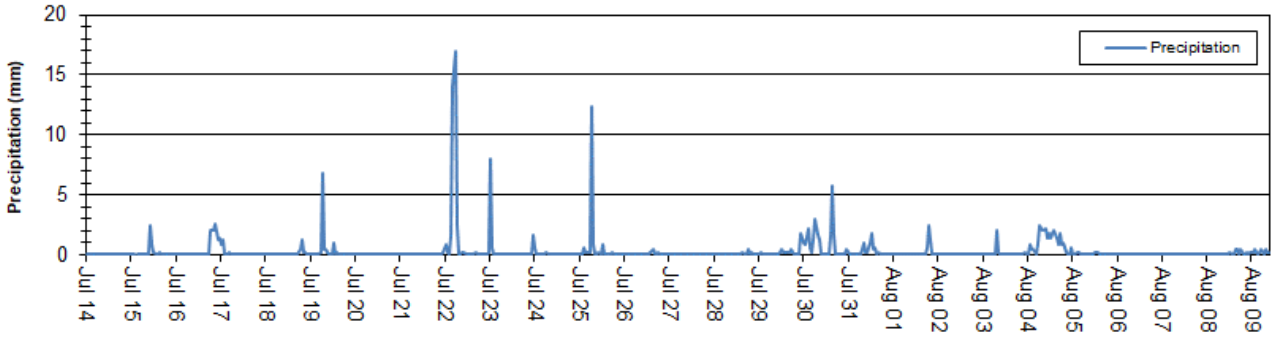

Figure 8: Precipitation at Churchill River below Metchin River

Churchill River above Grizzle Rapids

Water Temperature

- Over the deployment period, water temperature ranged from 15.9°C to 21.5°C, with a median value of 19.3°C (Figure 9). Air temperature data was obtained from the Metchin River near TLH Weather Station.
- Water temperature slowly increased through mid-July and then started to decrease again. This trend is to be expected as air temperatures followed a similar trend through the summer season. Water temperature data exhibits a diurnal pattern, and closely correlates with ambient air temperatures.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

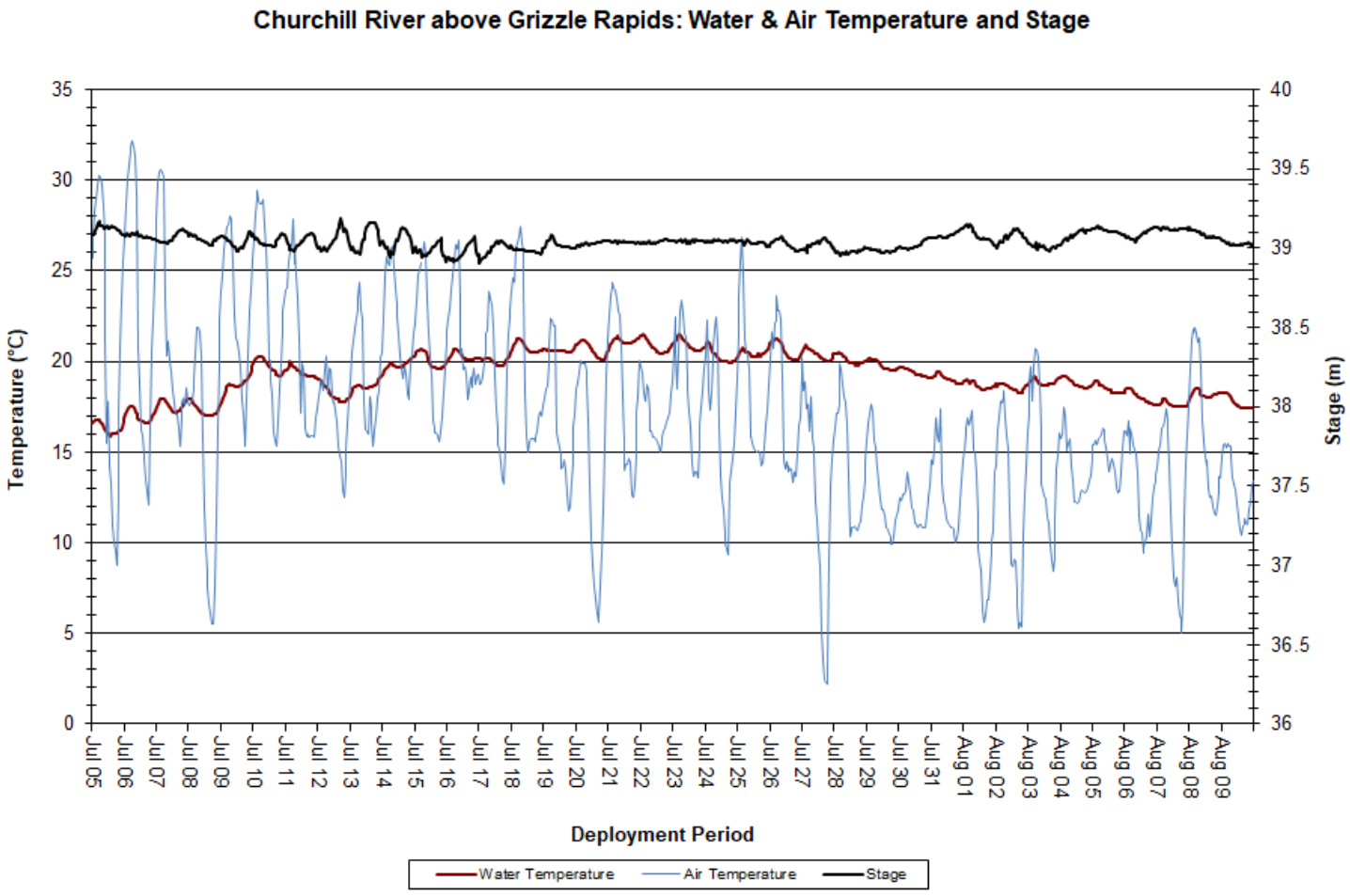

Figure 9: Water and Air Temperature & Stage at Churchill River above Grizzle Rapids

pH

- Over the deployment period, pH values ranged from 6.84 pH units to 7.06 pH units, with a median value of 6.94 (Figure 10).
- pH values were quite stable and remained within the CCME's Guidelines for the Protection of Aquatic Life for the duration of deployment.
- Photosynthesis uses up hydrogen molecules; this causes the concentration of hydrogen ions to decrease, which in turn causes pH to increase. For this reason, pH may be higher during daylight hours and during the growing season when photosynthesis is at a maximum. This is illustrated by the diurnal fluctuations in pH values (Figure 10).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

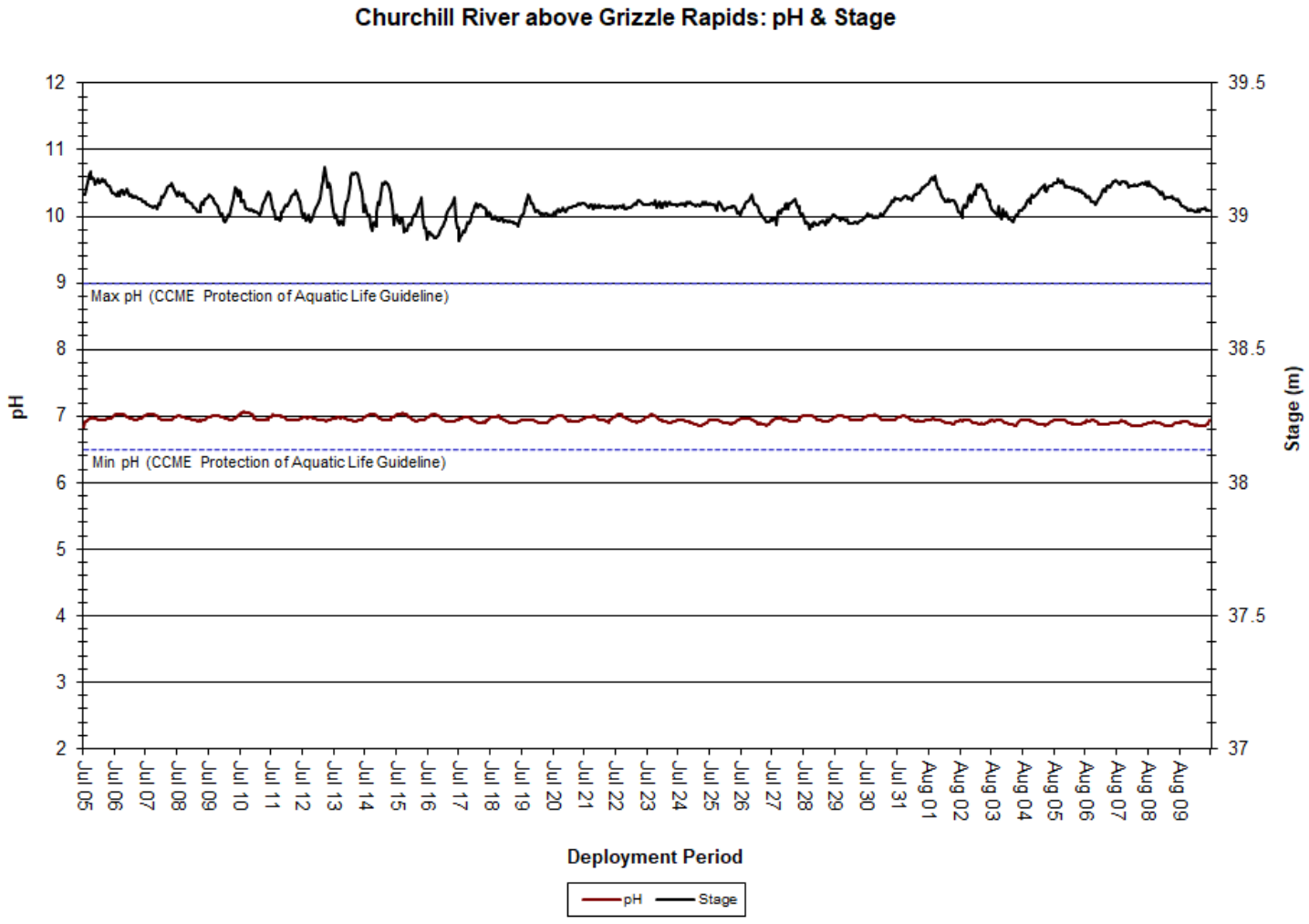

Figure 10: pH & Stage at Churchill River above Grizzle Rapids

Specific Conductivity

- Over the deployment period, specific conductivity ranged from 20.5µS/cm to 24.3µS/cm, with a median of 22.0µS/cm (Figure 11).
- The relationship between conductivity and stage is generally inversed. When stage levels increase, specific conductivity levels generally decrease as the increased amount of water in the river system dilutes solids that are present. This relationship is only somewhat evident in the graph below, likely because this station is located at a deep and wide section of the Churchill River and other factors in the water column influence conductivity levels.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

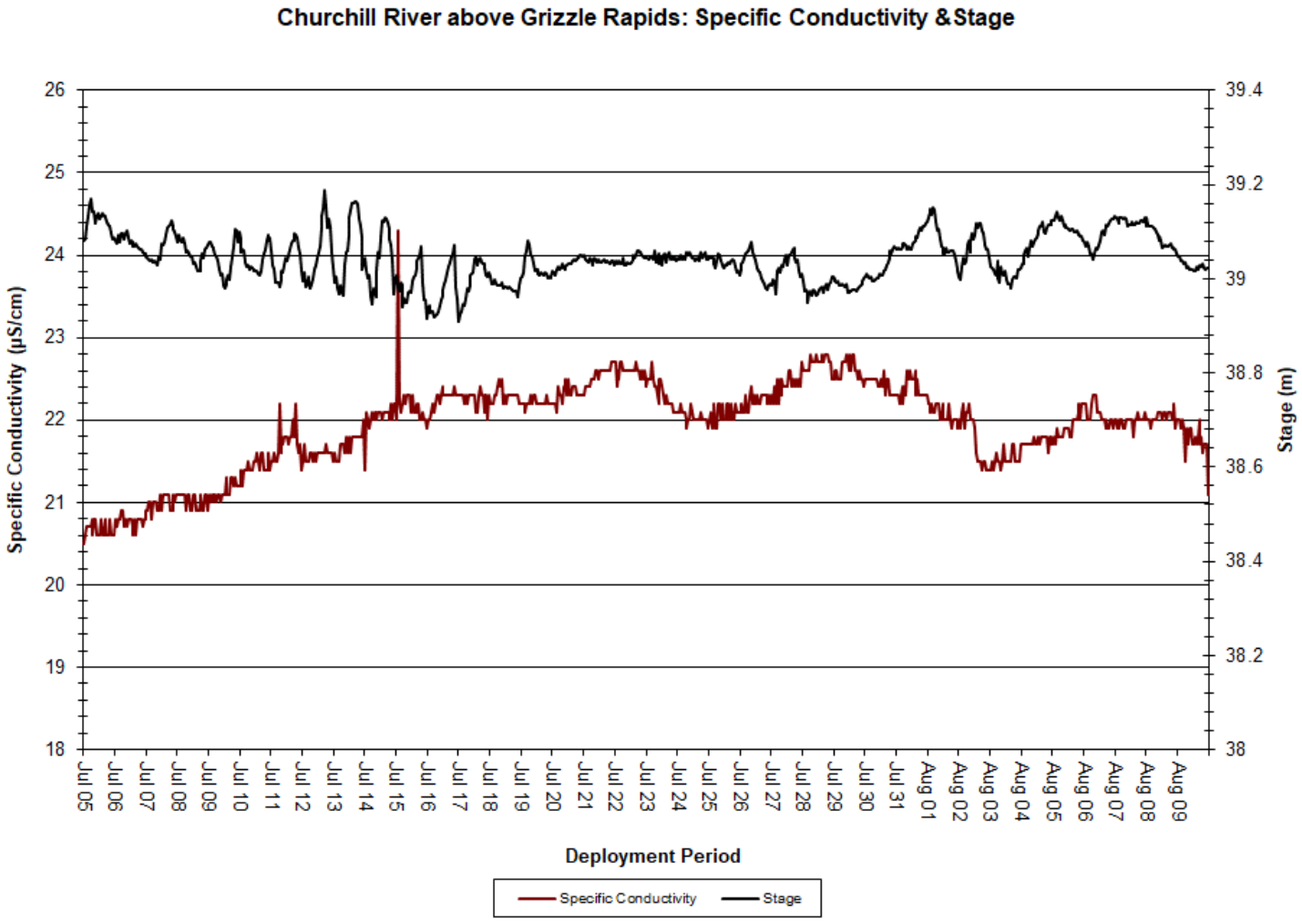

Figure 11: Specific Conductivity & Stage at Churchill River above Grizzle Rapids

Dissolved Oxygen

- Over the deployment period, dissolved oxygen content ranged from 8.66mg/L to 9.85mg/L, with a median value of 9.02mg/L. Saturation of dissolved oxygen ranged from 95.0% saturation to 102.7% saturation, with a median value of 98.0% (Figure 12).
- There is an evident relationship between water temperature and dissolved oxygen. Over the deployment period, dissolved oxygen levels gradually decreased as water temperatures increased through the summer. Dissolved oxygen also follows a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures. Generally, dissolved oxygen levels are higher in a waterbody during cooler temperatures.
- Dissolved oxygen levels were above the CCME's Guideline for the Protection of Early Life Stages for the very beginning of deployment only, after which they fell below the Guideline and remained there for the rest of the deployment period. Dissolved oxygen levels were above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment.

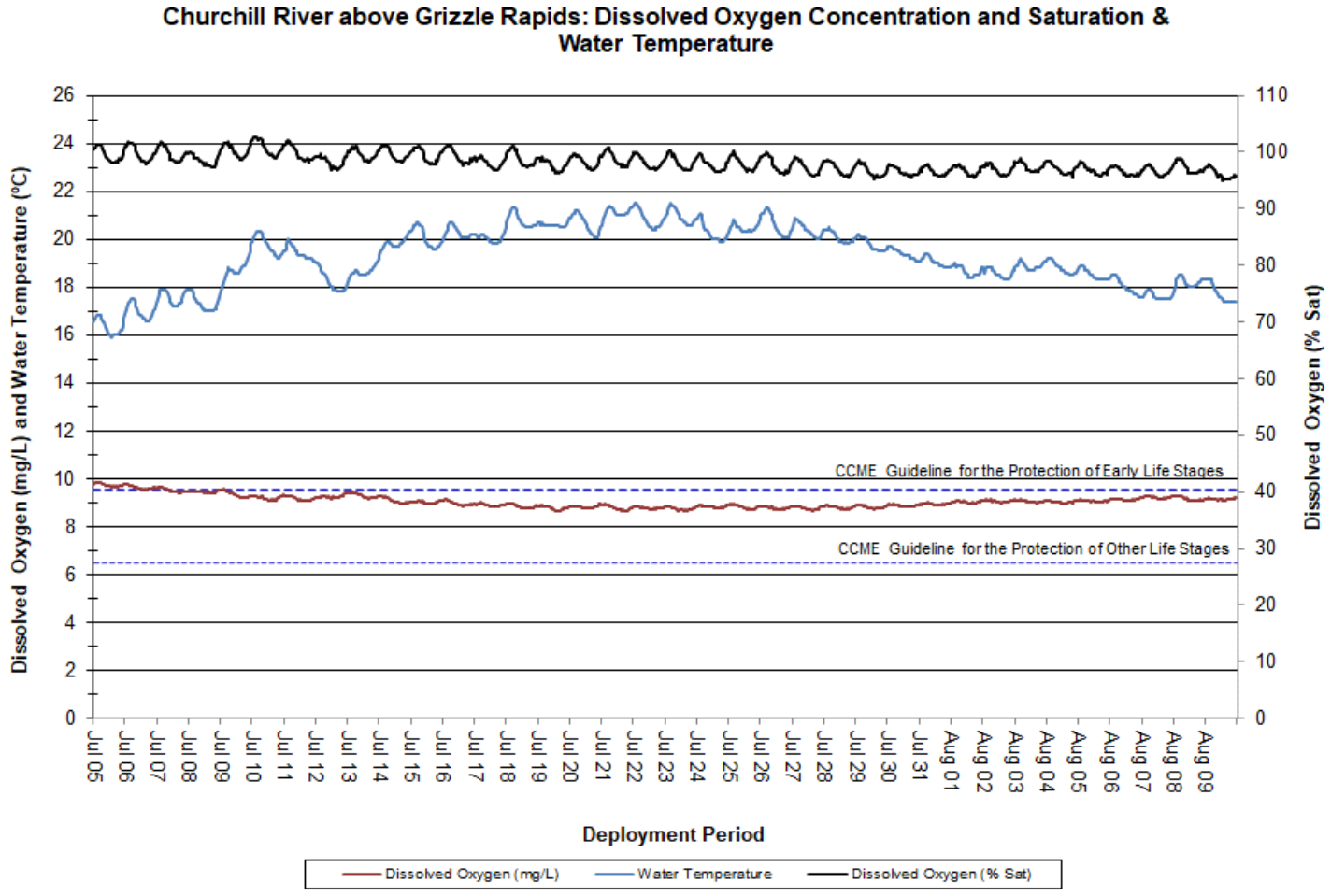

Figure 12: Dissolved Oxygen & Water Temperature at Churchill River above Grizzle Rapids

Turbidity

- Over the deployment period, turbidity remained unchanged at 0 NTU (Figure 13), which indicates a very low level of natural background turbidity in the waterbody. Precipitation data was obtained from the Metchin River at TLH Weather Station.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

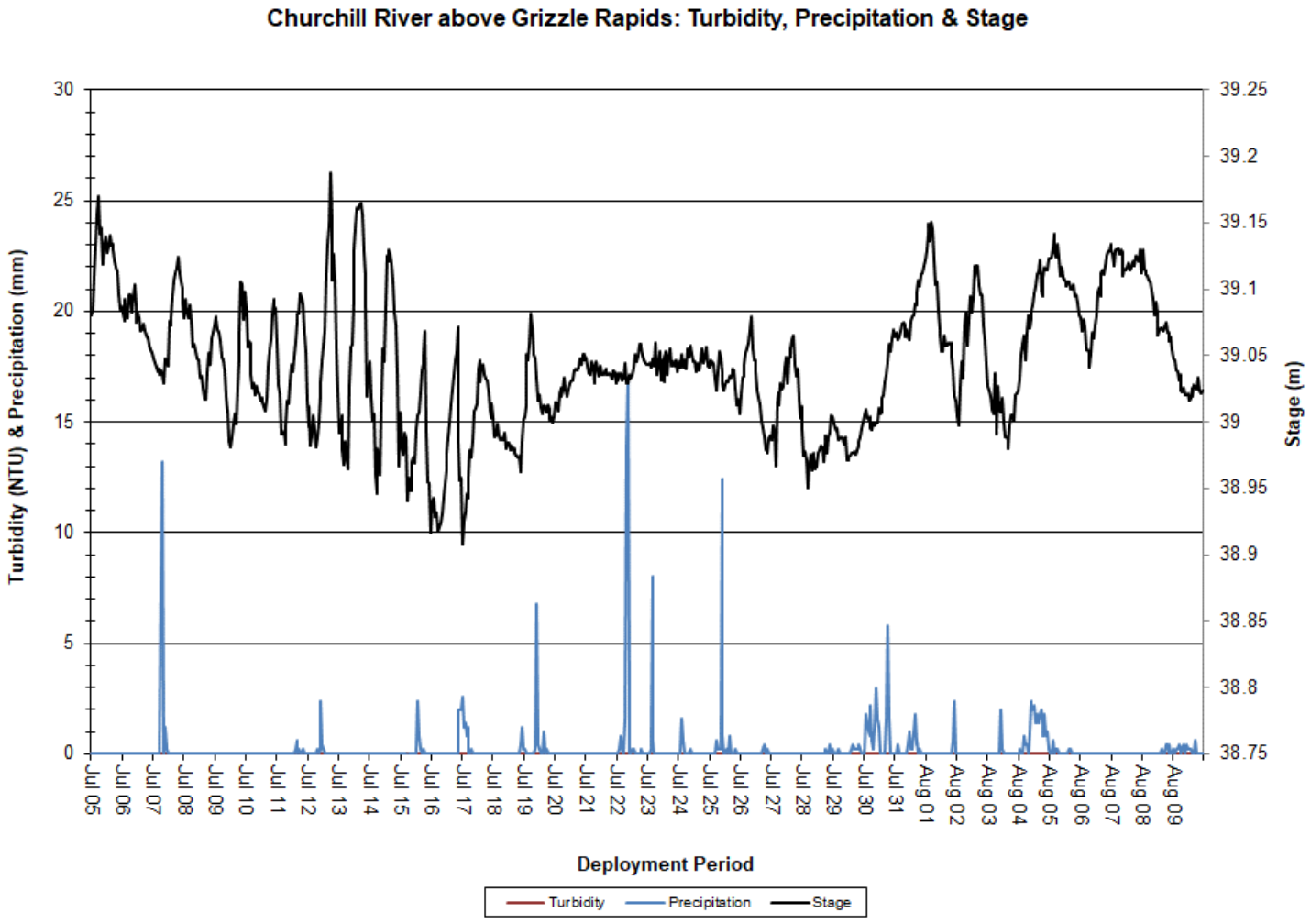

Figure 13: Turbidity, Precipitation & Stage at Churchill River above Grizzle Rapids

Stage

- Over the deployment period, stage ranged from 38.908m to 39.187m, with a median value of 39.042m (Figure 14). Precipitation data was obtained from the Metchin River near TLH Weather Station.
- Stage was somewhat variable across the deployment period, with precipitation events often correlating with increases in stage (Figure 14).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

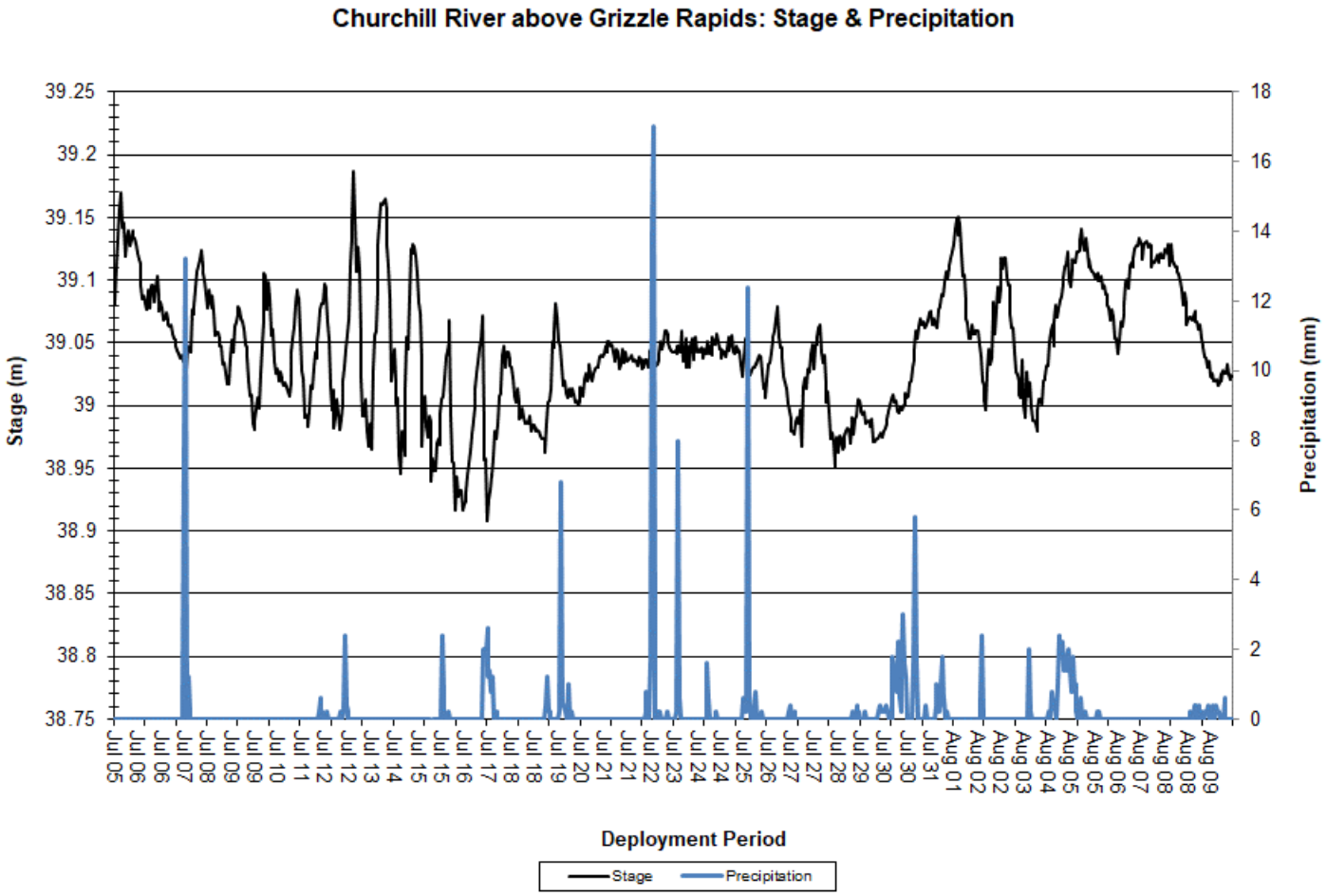

Figure 14: Stage & Precipitation at Churchill River above Grizzle Rapids

Churchill River below Muskrat Falls

Water Temperature

- Over the deployment period, water temperature ranged from 13.5°C to 21.2°C, with a median value of 19.3°C (Figure 15). Air temperature data was obtained from the Metchin River at TLH Weather Station.
- Water temperature increased at the beginning of deployment and then stabilized. This is to be expected as ambient air temperatures followed a similar trend. Water temperatures closely correlate with ambient air temperatures, fluctuating to a much lesser extent.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

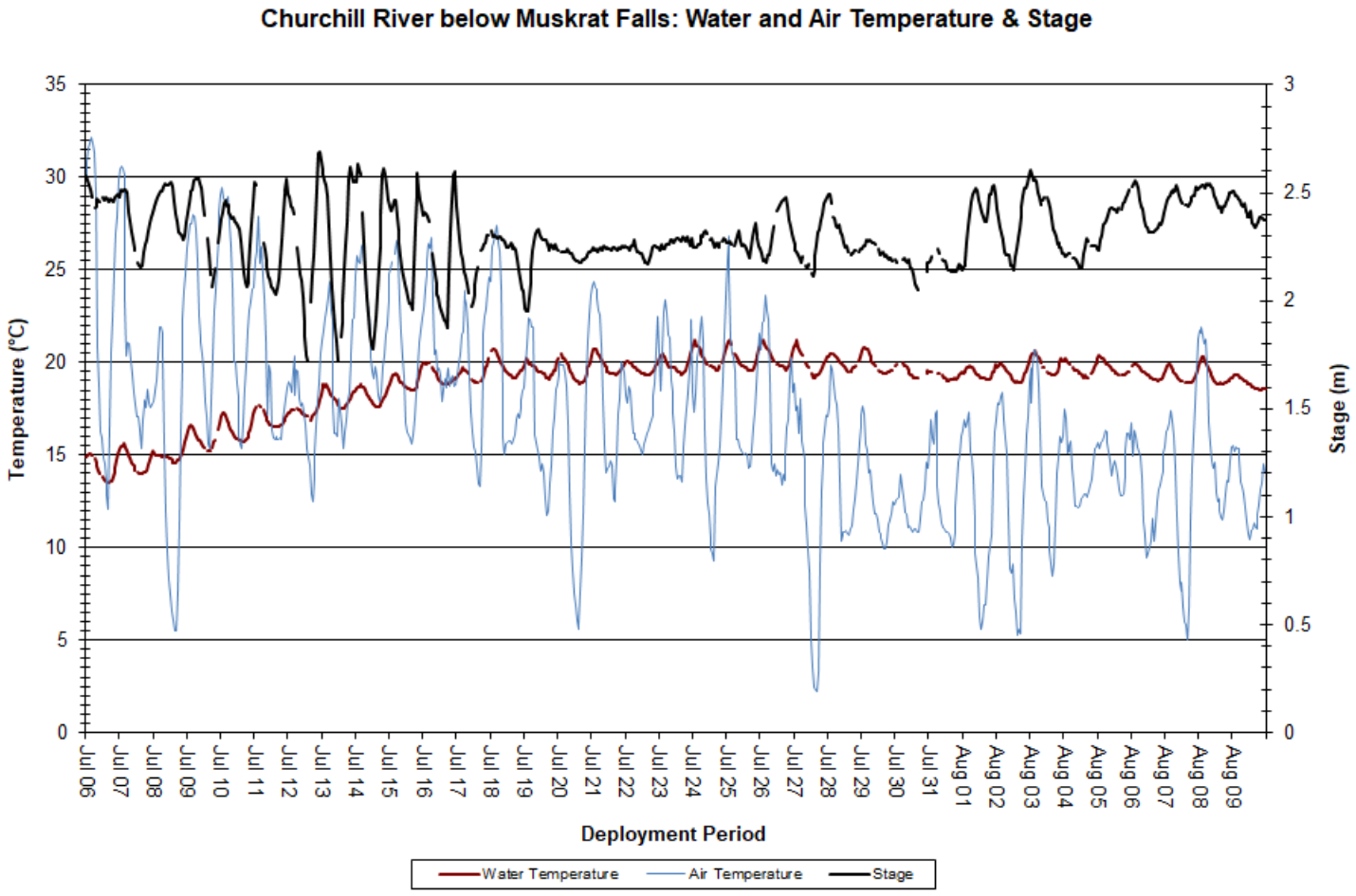

Figure 15: Water and Air Temperature & Stage at Churchill River below Muskrat Falls

pH

- Over the deployment period, pH ranged from 6.65 pH units to 7.08 pH units, with a median value of 6.90 (Figure 16).
- pH values were stable over the course of deployment and remained within the CCME's Guidelines for the Protection of Aquatic Life for the duration of the deployment period (Figure 16).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

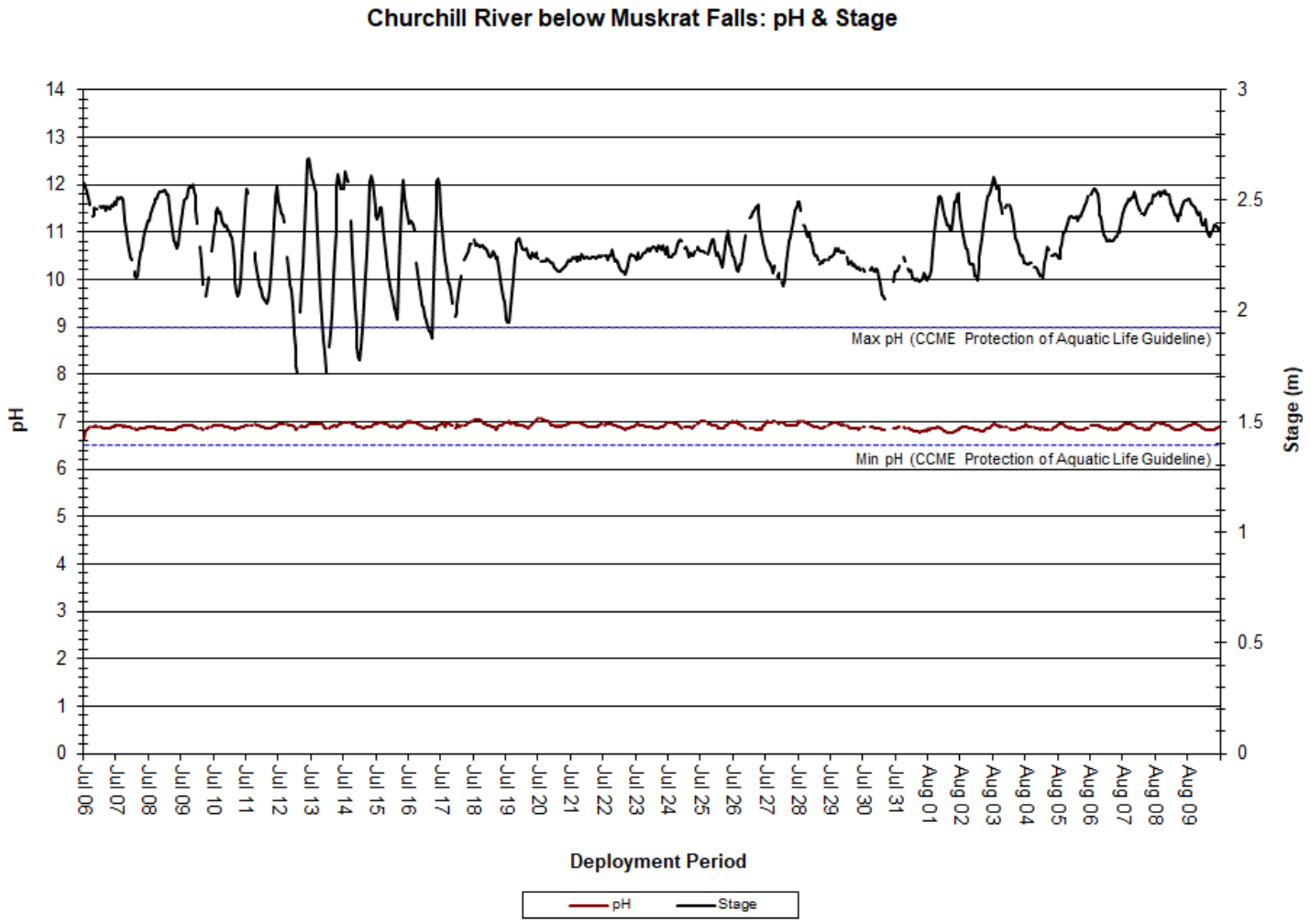

Figure 16: pH & Stage at Churchill River below Muskrat Falls

Specific Conductivity

- Over the deployment period, specific conductivity ranged from 18.0µS/cm to 22.5µS/cm, with a median value of 21.6µS/cm (Figure 17).
- The relationship between conductivity and stage is generally inversed. When stage decreases, specific conductivity increases as the decreased amount of water in the river system concentrates solids that are present, and vice versa. This relationship is only somewhat evident in the graph below, likely because this station is located at a deep and wide section of the Churchill River and other factors in the water column influence conductivity levels (Figure 17).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

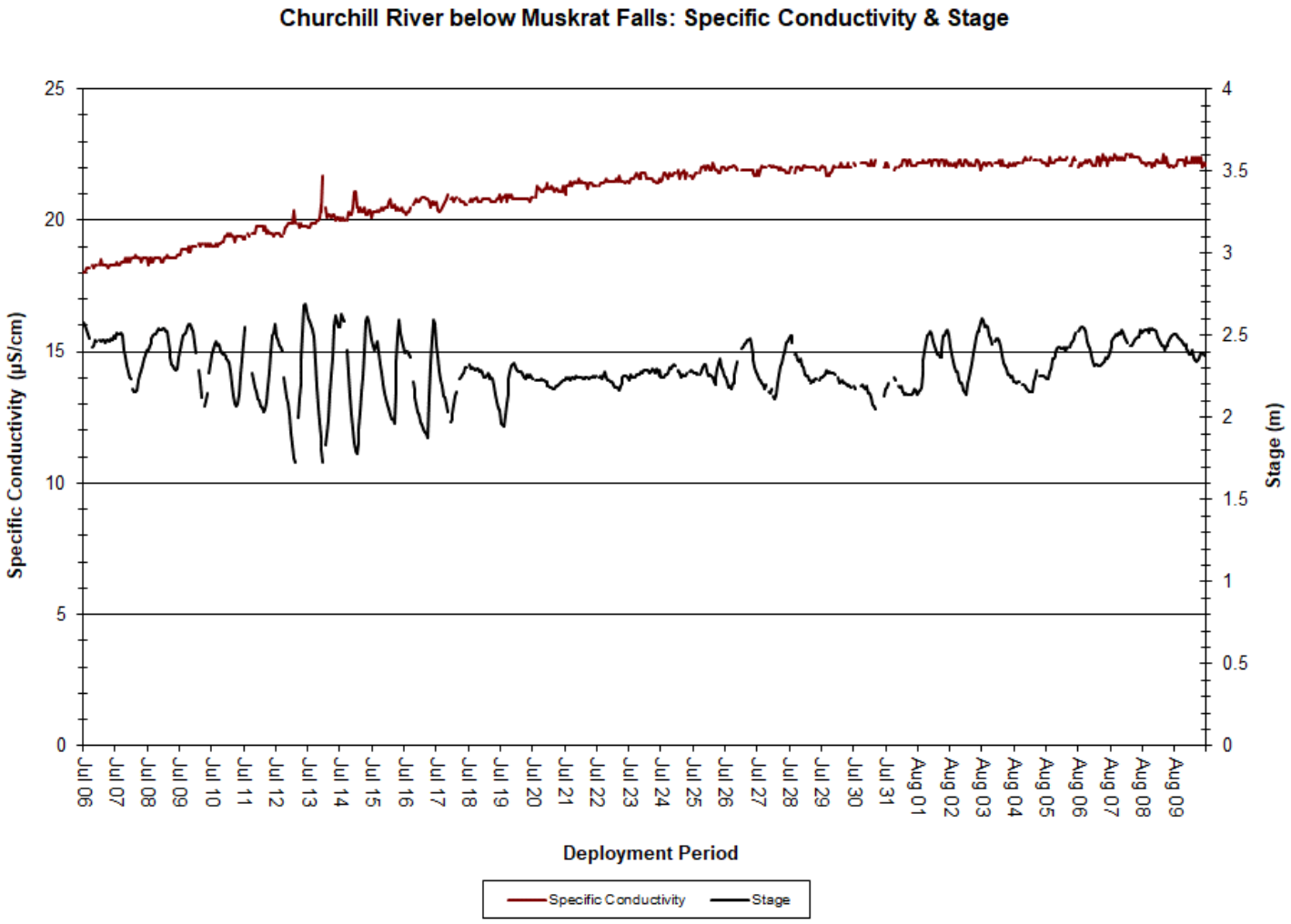

Figure 17: Specific Conductivity & Stage at Churchill River below Muskrat Falls

Dissolved Oxygen

- Over the deployment period, dissolved oxygen concentration ranged from 8.12mg/L to 10.71mg/L, with a median value of 9.095mg/L. Saturation of dissolved oxygen ranged from 87.8% to 110.9%, with a median value of 99.4% (Figure 18).
- Dissolved oxygen and water temperature exhibit an inverse relationship: as one parameter increases, the other decreases, and vice versa. Dissolved oxygen levels slowly decreased over the course of deployment. This is to be expected since water temperatures were increasing over the same period. Dissolved oxygen also follows a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures.
- Dissolved oxygen levels were above the CCME's Guideline for the Protection of Early Life Stages until July 17. Dissolved oxygen levels remained above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment.

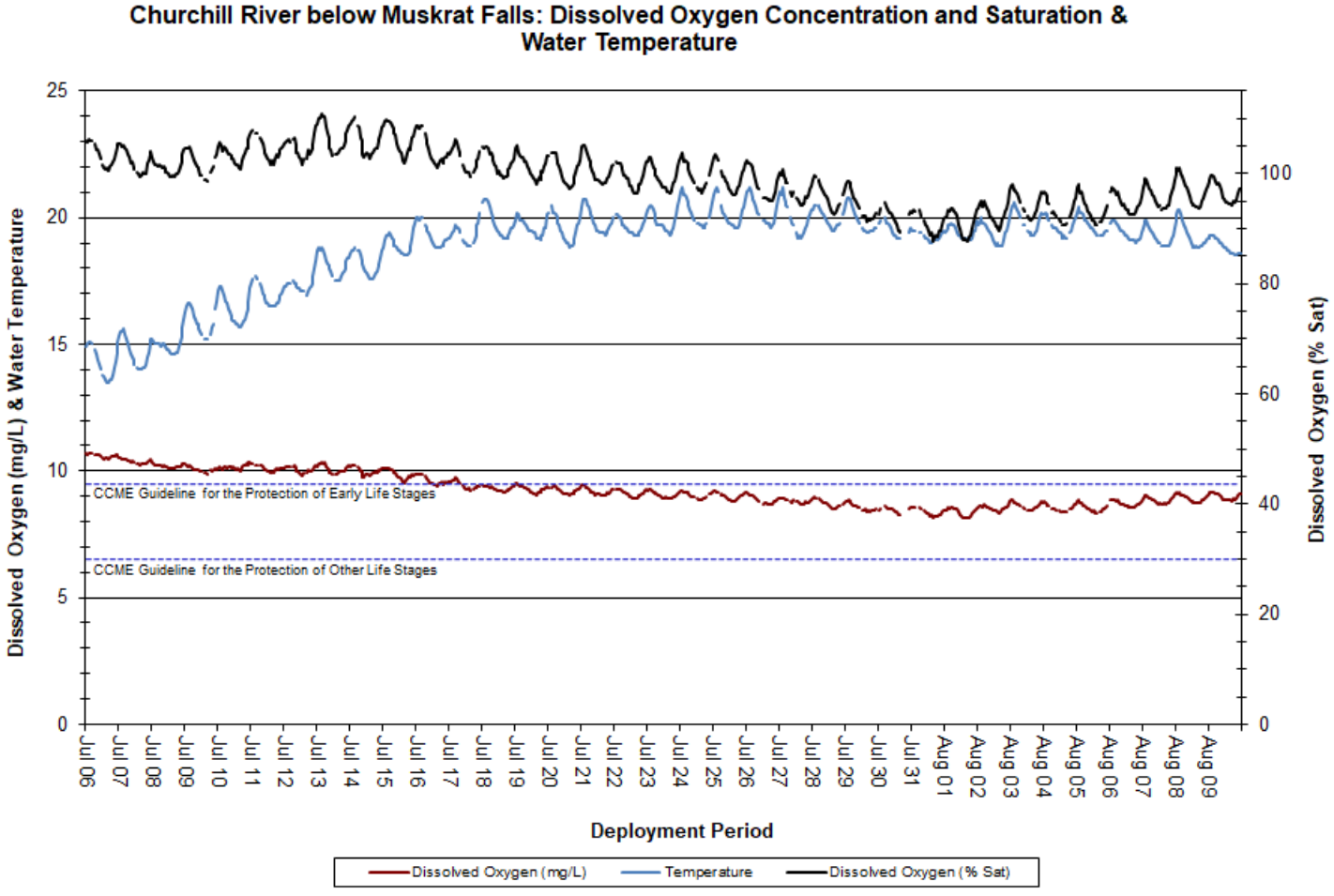

Figure 18: Dissolved Oxygen & Water Temperature at Churchill River below Muskrat Falls

Turbidity

- Over the deployment period, turbidity ranged from 0 NTU to 9.9 NTU, with a median value of 0 NTU. A median value of 0 NTU indicates a very low level of natural background turbidity in the waterbody, which is typical of this station. Precipitation data was obtained from the Metchin River at TLH Weather Station.
- There was some correlation between turbidity events and precipitation events across the deployment period (Figure 19). Turbidity levels are often quite variable at this station, and do not always correlate with precipitation events given that this station is located on a wide and deep section of the Churchill River.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

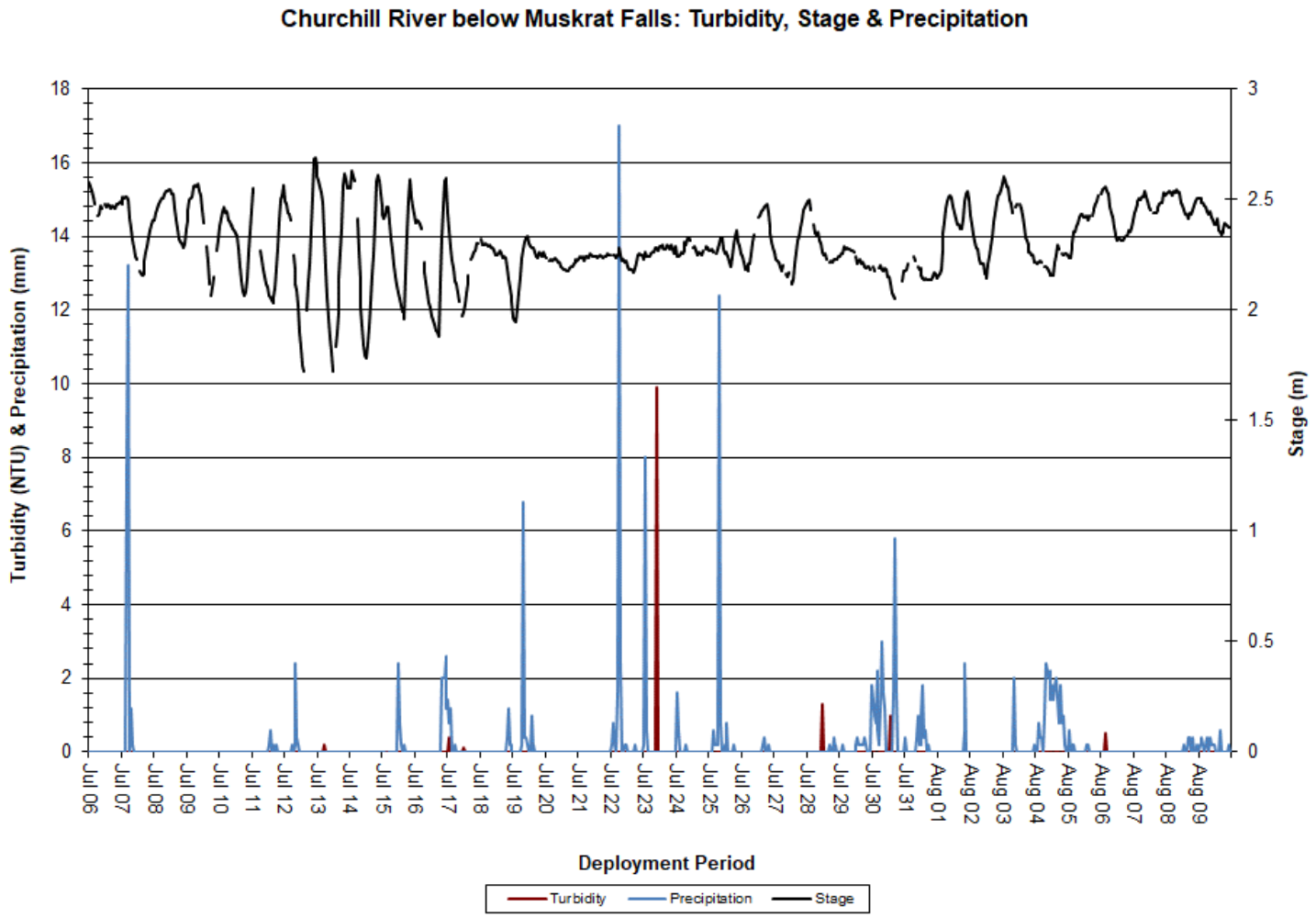

Figure 19: Turbidity, Precipitation & Stage at Churchill River below Muskrat Falls

Stage & Flow

- Over the deployment period, stage ranged from 1.722m to 2.689m, with a median value of 2.282m. Flow ranged from 806.226m^3/s to 1673.304m^3/s, with a median value of 1277.365m^3/s (Figure 20). Precipitation data was obtained from the Metchin River at TLH Weather Station.
- Stage and flow were variable over the course of deployment, and somewhat correlated with precipitation events. This is partly related to the fact that this station is located on a very wide section of the Churchill River and therefore not as easily influenced by smaller precipitation events. Stage and flow at this station are also influenced by upstream activities at the Muskrat Falls hydroelectric project.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

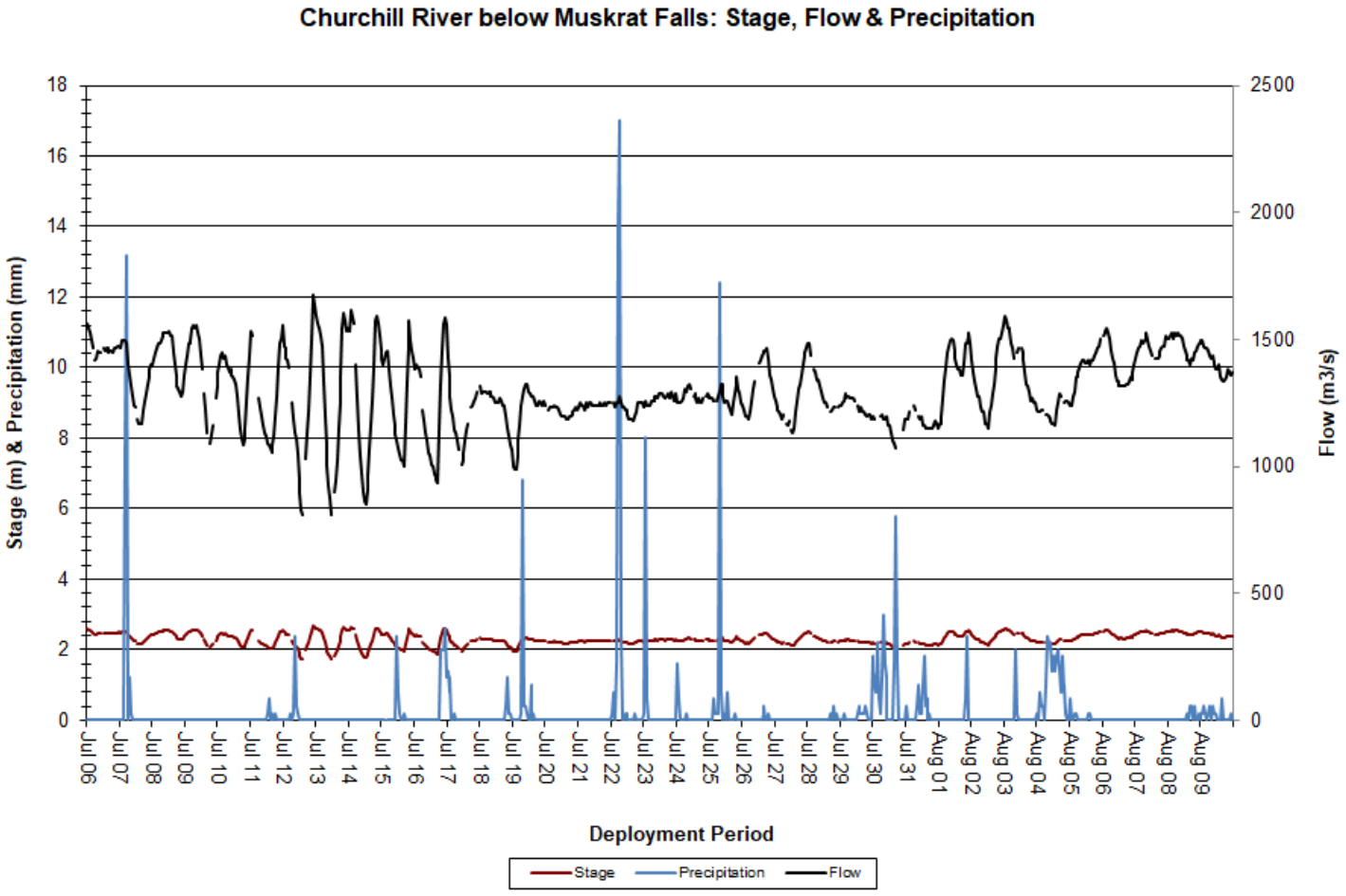

Figure 20: Stage, Flow & Precipitation at Churchill River below Muskrat Falls

Chlorophyll

- Over the deployment period, chlorophyll ranged from 1.36ug/L to 3.41ug/L, with a median value of 2.25ug/L (Figure 21).
- Chlorophyll is found within living cells of photosynthetic organisms like phytoplankton and cyanobacteria. The amount of chlorophyll found in water can be used to understand the general biological health of an ecosystem. Chlorophyll can also be used to identify algal bloom events and is an indicator of nutrient loading in ecosystems.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

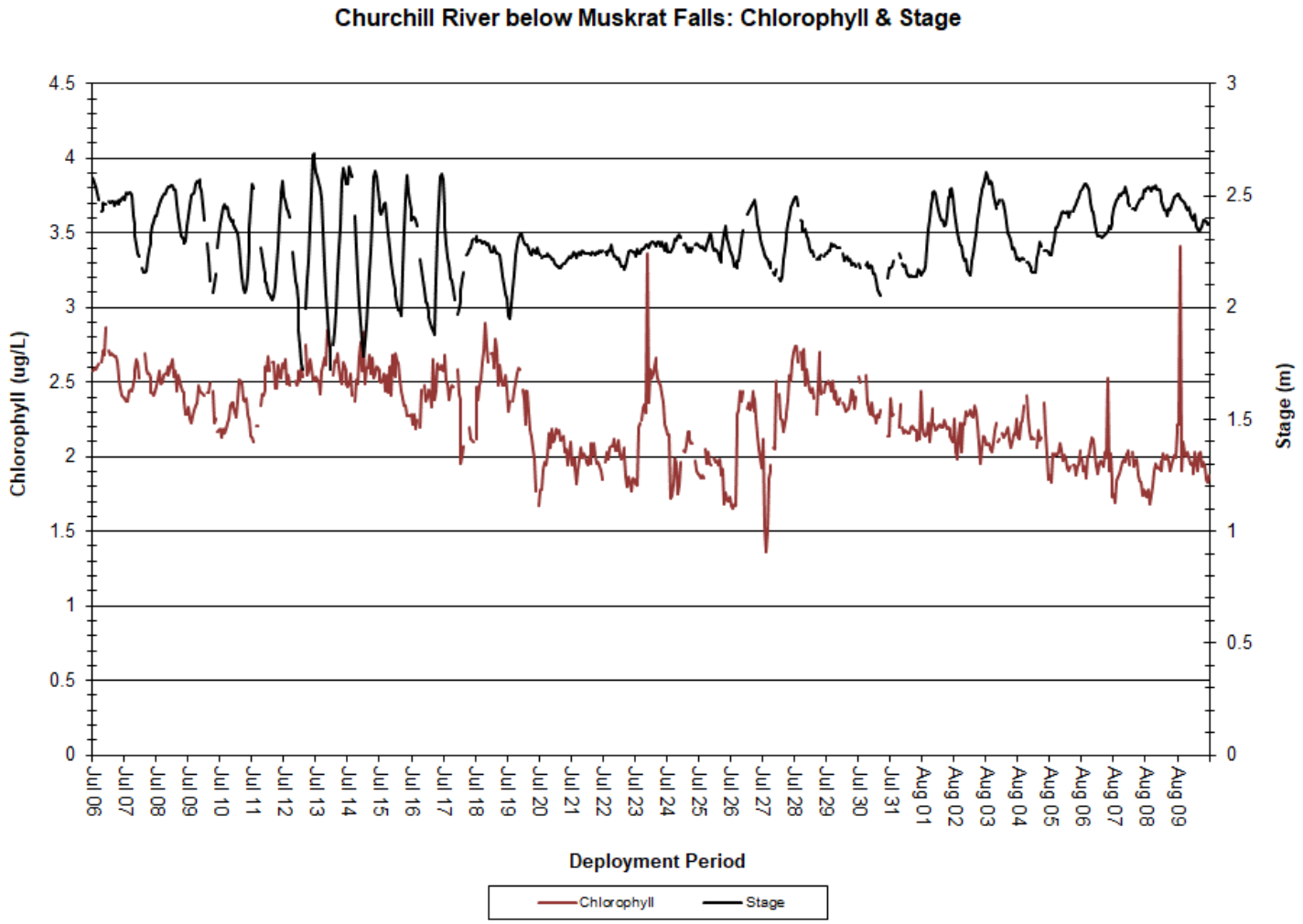

Figure 21: Chlorophyll & Stage at Churchill River below Muskrat Falls

Churchill River at English Point

Water Temperature

- Water temperature ranged from 15.3°C to 24.1°C, with a median value of 20.1°C (Figure 22). Air temperature data was obtained from the Metchin River at TLH Weather Station.
- Water temperature increased through July, after which it stabilized for the remainder of deployment. Water temperatures closely correlated with ambient air temperatures, which followed a similar trend across the same period.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

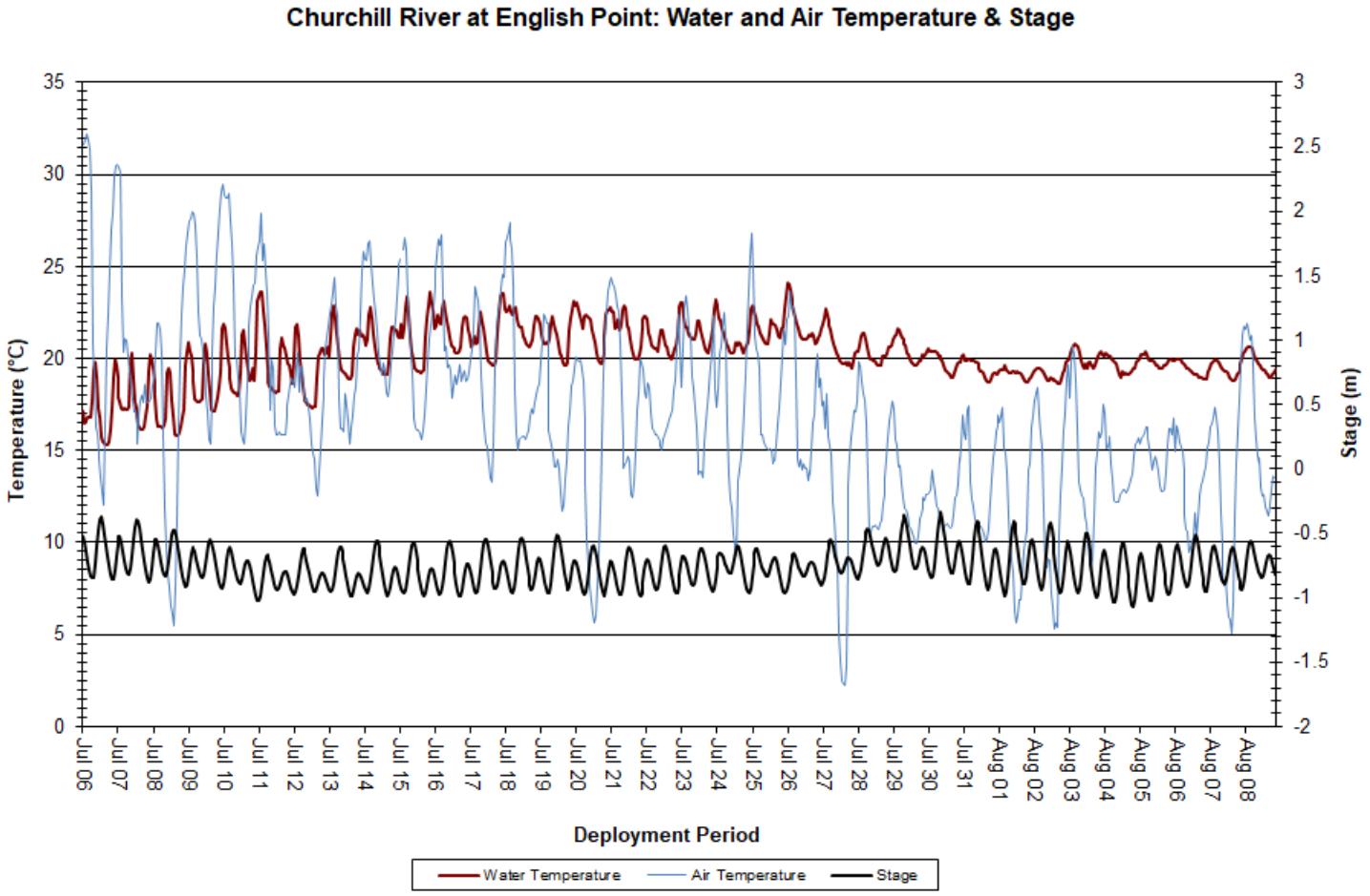

Figure 22: Water and Air Temperature & Stage at Churchill River at English Point

pH

- Over the deployment period, pH ranged from 6.26 pH units to 6.91 pH units, with a median value of 6.46 (Figure 23).
- pH values were relatively stable over the course of deployment, fluctuating above and below the CCME's Minimum Guideline for the Protection of Aquatic Life for the duration of deployment.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

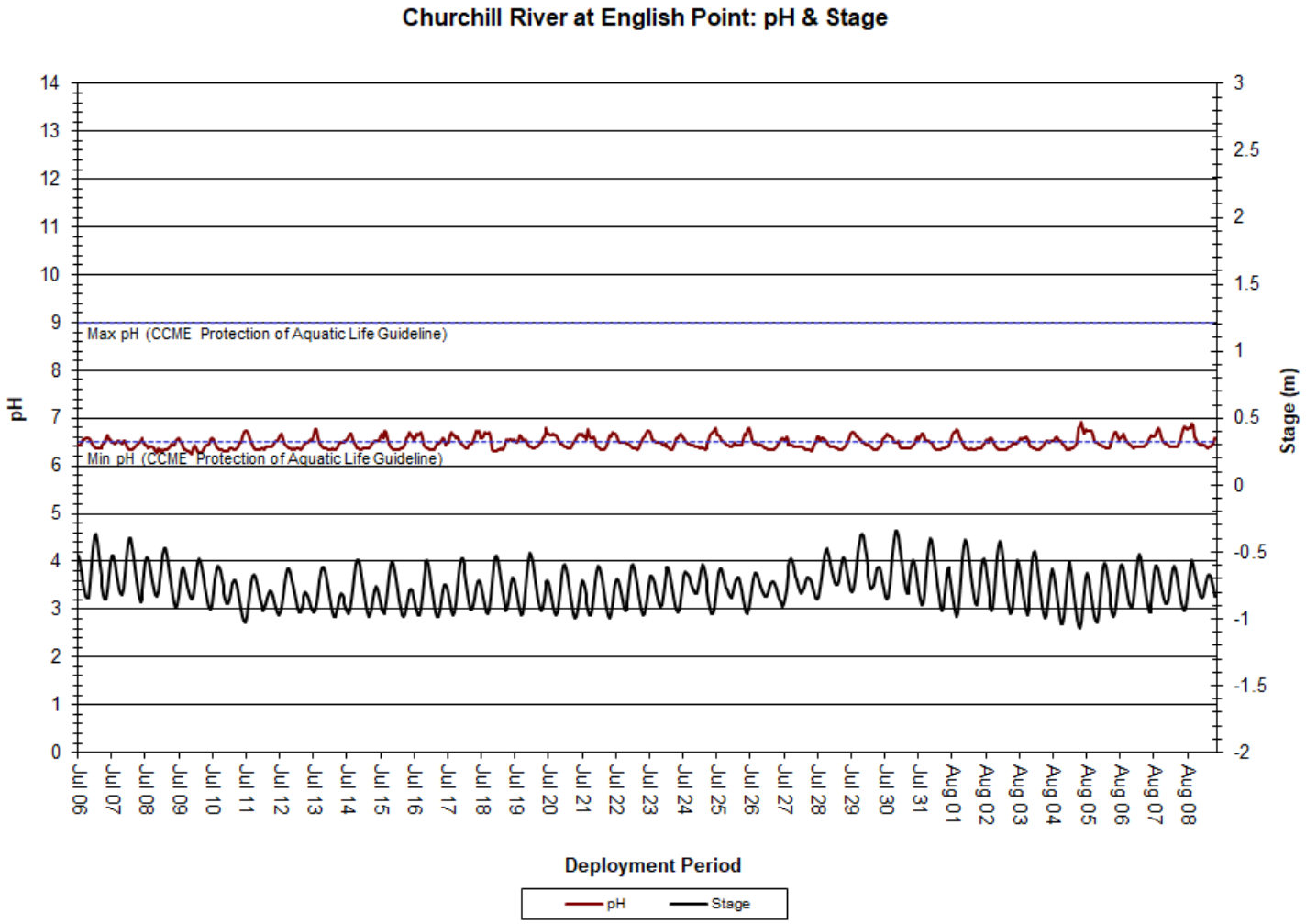

Figure 23: pH & Stage at Churchill River at English Point

Specific Conductivity

- Over the deployment period, specific conductivity ranged from 20.5µS/cm to 51.2µs/cm, with a median value of 31.1µS/cm (Figure 24).
- Specific conductivity fluctuates considerably at this location due to the tidal influences of the Atlantic Ocean on Lake Melville. As the tide comes in, specific conductivity increases as dissolved solids and salinity increase, and vice versa as the tide goes out. This increase and decrease in specific conductivity and stage occurs twice daily. This pattern is generally consistent throughout the deployment period (Figure 23).
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

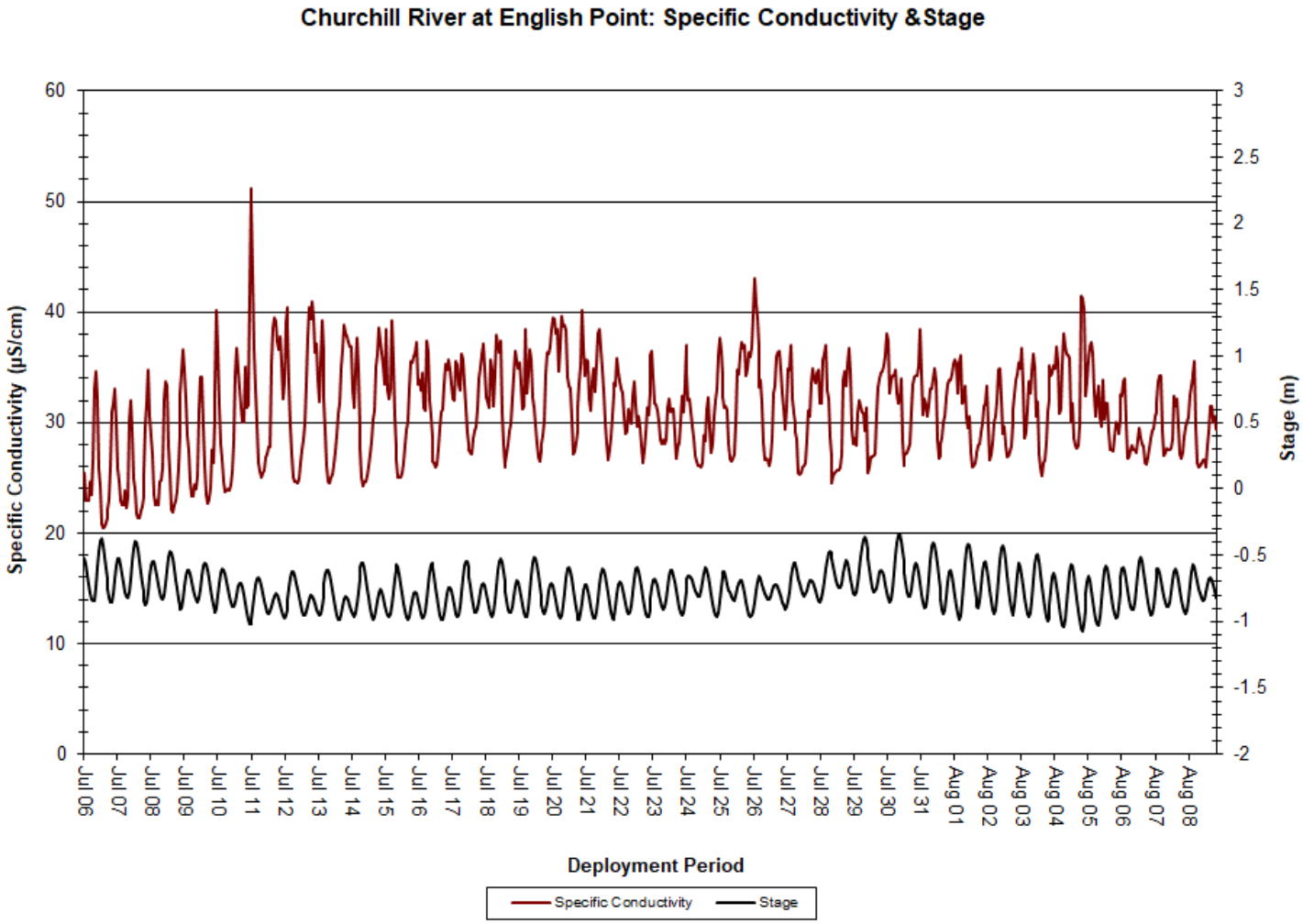

Figure 24: Specific Conductivity & Stage at Churchill River at English Point

Dissolved Oxygen

- Over the deployment period, dissolved oxygen concentration ranged from 8.27mg/L to 10.47mg/L, with a median value of 9.06mg/L. Saturation of dissolved oxygen ranged from 90.4% to 112.1% saturation, with a median value of 100.8% (Figure 25).
- There is an evident relationship between water temperature and dissolved oxygen. As water temperatures increased over the deployment period, dissolved oxygen levels decreased. Dissolved oxygen levels also follow a diurnal pattern as water temperatures rise and fall under the influence of ambient air temperatures. Generally, dissolved oxygen levels are higher in a waterbody during cooler temperatures.
- Dissolved oxygen levels were above the CCME's Guideline for the Protection of Early Life Stages for the very beginning of deployment, after which they hovered around and then fell below that Guideline. Dissolved oxygen levels were above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment (Figure 25).

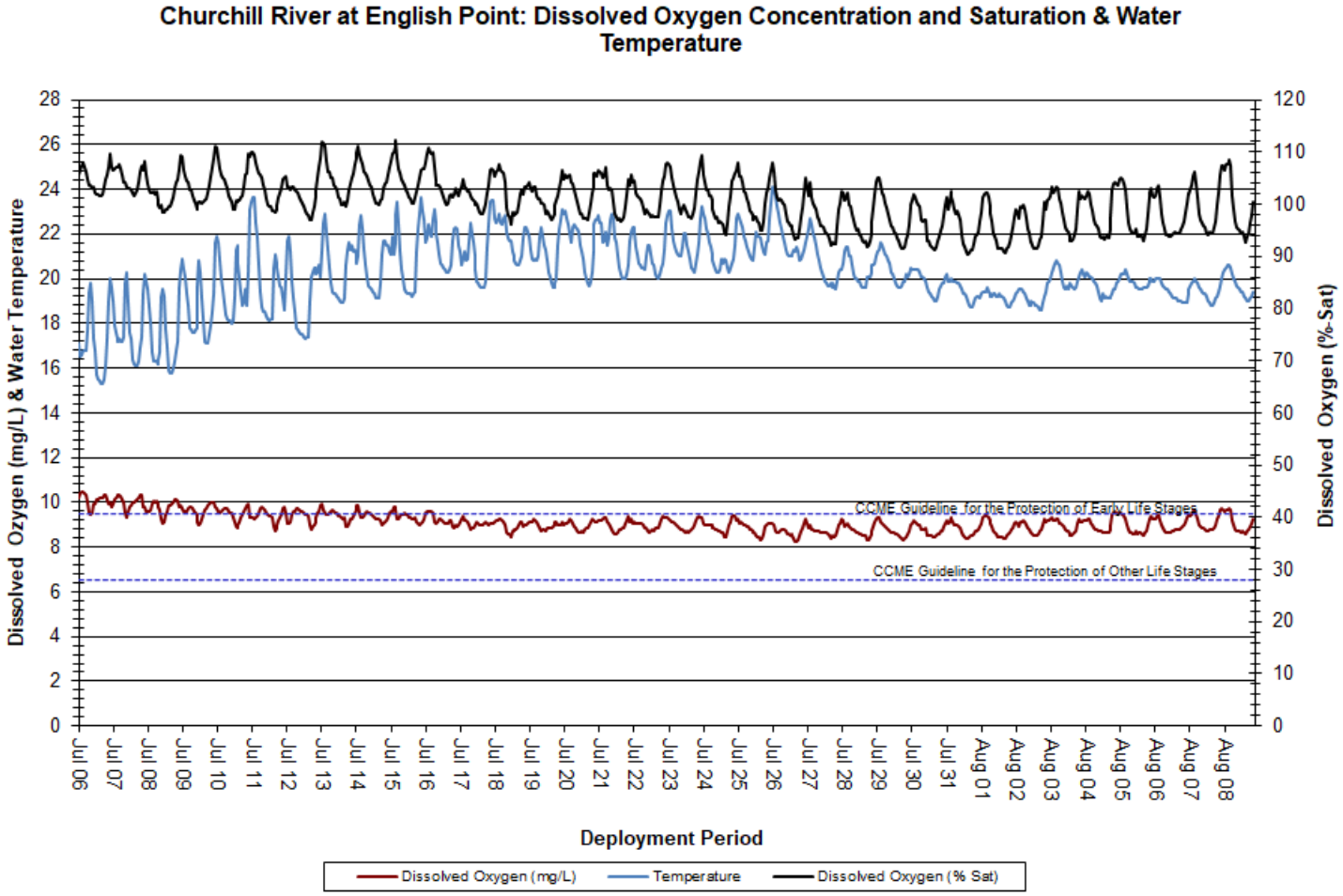

Figure 25: Dissolved Oxygen & Water Temperature at Churchill River at English Point

Turbidity

- Over the deployment period, turbidity ranged from 0 NTU to 32.1 NTU, with a median value of 0 NTU (Figure 26). A median value of 0 NTU indicates a low level of background turbidity. Precipitation data was obtained from the Metchin River at TLH Weather Station.
- Turbidity events generally correlate with precipitation events, as these can increase the presence of suspended material in water. High winds and tidal influences can also contribute to turbidity events at this station by disturbing sediment from the riverbed (Figure 26). Wind speed data was also obtained from the Metchin River at TLH Weather Station.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

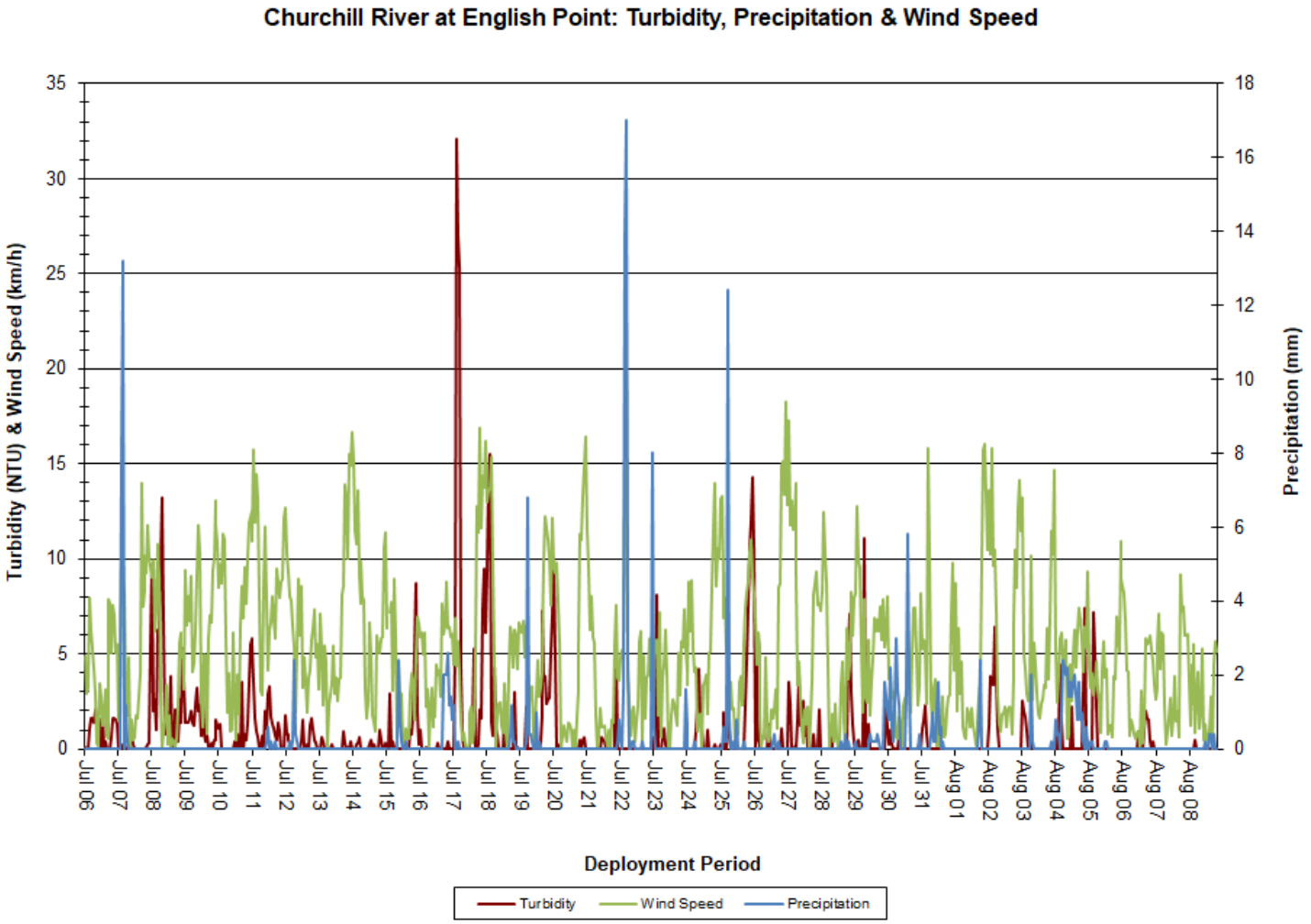

Figure 26: Turbidity, Precipitation & Wind Speed at Churchill River at English Point

Stage

- Over the deployment period, stage ranged from -1.071m to -0.34m, with a median value of -0.77m (Figure 27). Precipitation data was obtained from the Metchin River at TLH Weather Station.
- Stage fluctuates considerably at this location due to the tidal influences of the Atlantic Ocean. This pattern is consistent over the deployment period. Increases in stage often correlate with precipitation events.
- Water Survey of Canada (Environment and Climate Change Canada) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

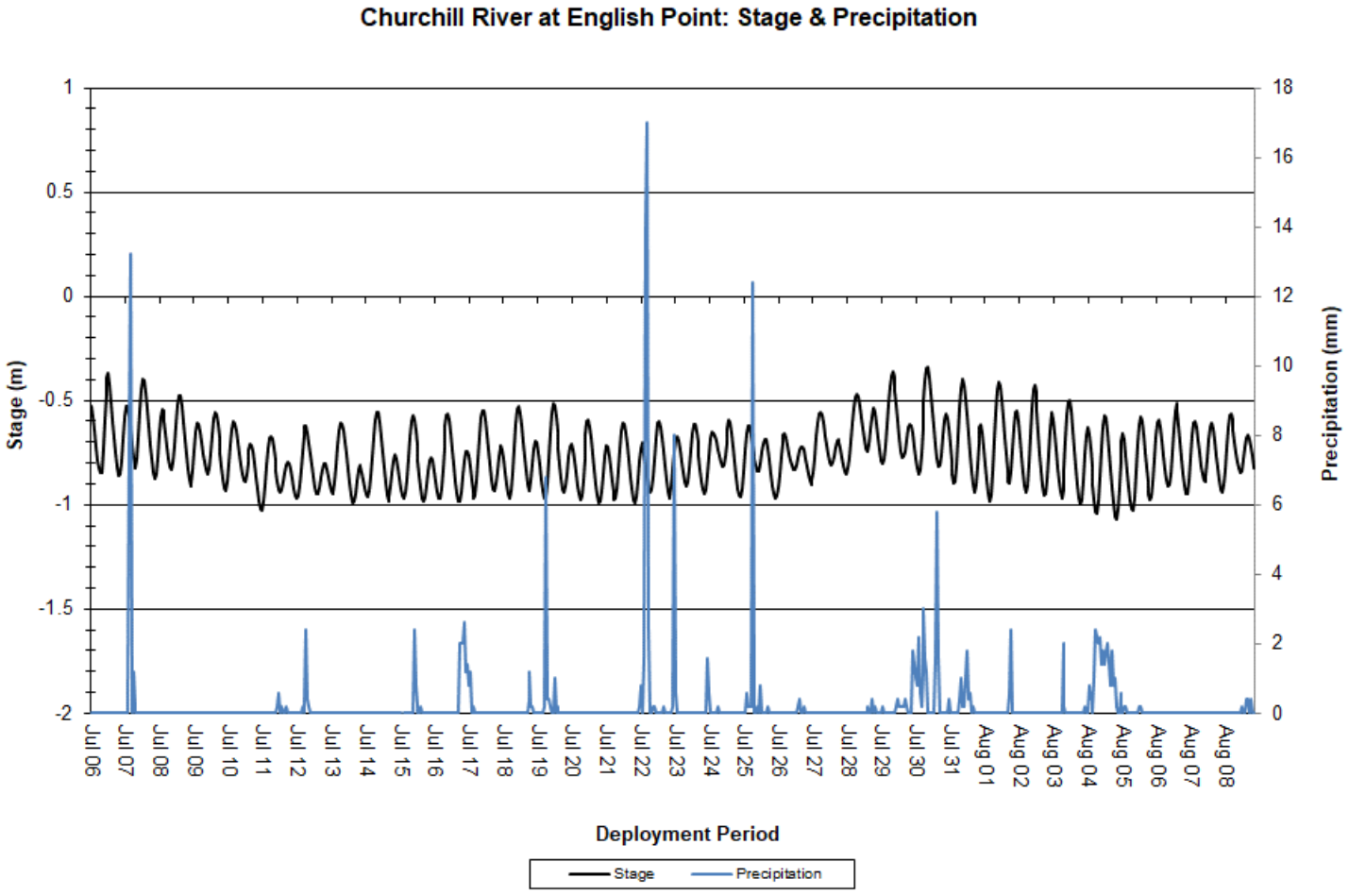

Figure 27: Stage & Precipitation at Churchill River at English Point

Conclusions

- Instruments at four water quality monitoring stations on the Lower Churchill River were deployed from July 5/6/14 through August 9/10, 2023.
- Water temperature increased at all stations over the course of deployment. This is to be expected based on ambient air temperature trends during the same period through July and early August.
- pH was relatively stable at all stations over the course of deployment. pH was within the CCME's Guidelines for the Protection of Aquatic Life for the duration of deployment at Churchill River below Metchin River, above Grizzle Rapids, and below Muskrat Falls. pH fluctuated above and below the Minimum Guideline at Churchill River at English Point.
- Specific conductivity was generally stable or increasing over the course of deployment at all stations. Since English Point is influenced by tides in Lake Melville, specific conductivity values at the Churchill River at English Point station had a much wider range, which is comparable to other deployments at this location.
- Dissolved oxygen levels slowly decreased over the course of deployment at all stations as water temperatures increased through the summer. Dissolved oxygen levels are generally higher in water at cooler temperatures. Dissolved oxygen levels fell below the CCME's Guideline for the Protection of Early Life Stages at some point during deployment at all stations. Dissolved oxygen levels were above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment at all stations.
- Turbidity events occurred at all stations and were generally related to precipitation, wind or tidal events. In most cases, turbidity values returned to background levels following each observed event.

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. Available at: http://st-ts.ccme.ca/en/index.html?chems=154,162&chapters=1 [Accessed January 18, 2024].

Fondriest Environmental Inc. (2016a). Fundamentals of Environmental Measurements [Online]. Available at: http://www.fondriest.com/environmental-measurements/parameters/water-quality/conductivity-salinity-tds/#cond15 [Accessed January 18, 2024].

Fondriest Environmental Inc. (2016b). Fundamentals of Environmental Measurements [Online]. Available at: http://www.fondriest.com/environmental-measurements/parameters/water-quality/water-temperature/#watertemp1 [Accessed January 18, 2024].

Swenson, H.A., and Baldwin, H.L. (1965). A Primer on Water Quality, U.S. Geological Survey. Available at: https://pubs.usgs.gov/gip/7000057/report.pdf [Accessed January 18, 2024].

United States Geological Survey. (2017). Water properties: Dissolved oxygen [Online]. Available at: https://water.usgs.gov/edu/dissolvedoxygen.html [Accessed January 18, 2024].

APPENDIX A

Water Parameter Description

Water Parameter Description

Dissolved Oxygen - The amount of Dissolved Oxygen (DO) (mg/l or % saturation) in the water is vital to aquatic organisms for their survival. The concentration of DO is affected by such things as water temperature, water depth and flow (e.g., aeration by rapids, riffles etc.), consumption by aerobic organisms, consumption by inorganic chemical reactions, consumption by plants during darkness, and production by plants during the daylight (USGS, 2017).

Flow - Flow (m3/s) is a measure of how quickly a volume of water is displaced in streams, rivers, and other channels.

pH - pH is a measure of the relative amount of free hydrogen and hydroxyl ions in water. pH is an important indicator of chemically changing water, and determines the solubility and biological availability of nutrients and heavy metals in the water (USGS, 2017).

Specific conductivity - Specific conductivity (µs/cm) is a measure of water's ability to conduct electricity, with values normalized to a water temperature of 25°C. Specific conductance indicates the concentration of dissolved solids (such as salts) in the water, which can affect the growth and reproduction of aquatic life. Specific conductivity is affected by rainfall events, the composition of inflowing tributaries and their associated geology, saline inflow (e.g., road salt), agricultural run-off and industrial inputs (Fondriest Environmental Inc, 2016).

Stage - Stage (m) is the elevation of the water surface and is often used as a surrogate for the more difficult to measure flow.

Temperature - Essential to the measurement of most water quality parameters, temperature (°C) controls most aquatic processes. Water temperature is influenced by such things as ambient air temperature, solar radiation, meteorological events, industrial effluence, wastewater, inflowing tributaries, as well as water body size and depth. In turn, water temperature has an influence on the metabolic rates and biological activity of aquatic organisms (Fondriest Environmental Inc, 2016b).

Total Dissolved Solids - Total Dissolved Solids (TDS) (g/l) is a measure of alkaline salts dissolved in water or in fine suspension and can affect the growth and reproduction of aquatic life. It is affected by rainfall events, the composition of inflowing tributaries and their associated geology, saline inflow (e.g., road salt), agricultural run-off and industrial inputs (Swenson and Baldwin, 1965).

Turbidity - Turbidity (NTU) is a measure of the translucence of water and indicates the amount of suspended material in the water. Turbidity is caused by any substance that makes water cloudy (e.g., soil erosion, micro-organisms, vegetation, chemicals, etc.) and can correspond to precipitation events, high stage, and floating debris near the sensor (Swenson and Baldwin 1965).

APPENDIX B

Grab Sample Results

Bureau Veritas Job #: C3L3902
Report Date: 2023/08/09

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU545 CR BELOW MR								
Sampling Date 2023/07/14 14:15								
Matrix W								
Sample # 2023-6311-00-SI-SP								
Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	11	1.0	mg/L	N/A	2023/08/09		8797883
Nitrate (N)	-	ND	0.050	mg/L	N/A	2023/08/04		8797888
Total dissolved solids (calc., EC)	-	14	1.0	mg/L	N/A	2023/08/04		8797896
Inorganics								
Conductivity	-	25	1.0	uS/cm	N/A	2023/08/04	LJV	8832113
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Sulphate (SO4)	-	1.1	1.0	mg/L	N/A	2023/07/24	LKH	8805594
Total Alkalinity (Total as CaCO3)	-	2.4	2.0	mg/L	N/A	2023/08/04	LJV	8832118
Colour	-	15	5.0	TCU	N/A	2023/08/04	MCN	8831846
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/08/04	LJV	8832121
Total Kjeldahl Nitrogen (TKN)	-	0.13	0.10	mg/L	2023/07/21	2023/07/24	RTY	8804787
Dup.Total Kjeldahl Nitrogen (TKN)	-	ND	0.10	mg/L	2023/07/21	2023/07/24	RTY	8804787
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2023/08/04	MCN	8831861
Nitrite (N)	-	ND	0.010	mg/L	N/A	2023/08/03	MCN	8831867
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/08/01	MCN	8825494
Dissolved Organic Carbon (C)	-	3.2	0.50	mg/L	N/A	2023/08/05	CPP	8834211
Total Organic Carbon (C)	-	3.3	0.50	mg/L	N/A	2023/07/27	CPP	8816589
pH	-	7.26		pH	N/A	2023/08/04	LJV	8832103
Total Phosphorus	-	0.008	0.004	mg/L	2023/07/21	2023/07/22	MUM	8804799
Total Suspended Solids	-	1.6	1.0	mg/L	2023/07/20	2023/07/20	RMK	8800716
Turbidity	-	0.49	0.10	NTU	N/A	2023/08/04	LJV	8833723
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/27	2023/07/28	SGK	8815475
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.031	0.0050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Barium (Ba)	-	0.0080	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Boron (B)	-	ND	0.050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Calcium (Ca)	-	2.9	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Copper (Cu)	-	0.00057	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Iron (Fe)	-	0.086	0.050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Lead (Pb)	-	ND	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Magnesium (Mg)	-	0.99	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 220028978-9
Sampler Initials: MM

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WKU545 CR BELOW MR Sampling Date 2023/07/14 14:15 Matrix W Sample # 2023-6311-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.015	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Potassium (K)	-	0.31	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Sodium (Na)	-	0.70	0.10	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Strontium (Sr)	-	0.013	0.0020	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Uranium (U)	-	ND	0.00010	mg/L	2023/08/08	2023/08/09	JHY	8838136
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/08/08	2023/08/09	JHY	8838136

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Bureau Veritas Job #: C3K3267
Report Date: 2023/07/31

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 220028978-9

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WIO742 CR ABOVE GR Sampling Date 2023/07/05 11:10 Matrix W Sample # 2023-6308-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	9.9	1.0	mg/L	N/A	2023/07/28		8780487
Nitrate (N)	-	ND	0.050	mg/L	N/A	2023/07/28		8780493
Total dissolved solids (calc., EC)	-	13	1.0	mg/L	N/A	2023/07/31		8780806
Inorganics								
Conductivity	-	23	1.0	uS/cm	N/A	2023/07/28	LJV	8818266
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Total Alkalinity (Total as CaCO3)	-	9.4	2.0	mg/L	N/A	2023/07/28	LJV	8818267
Colour	-	28	5.0	TCU	N/A	2023/07/28	MCN	8816736
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/07/28	LJV	8818268
Total Kjeldahl Nitrogen (TKN)	-	0.15	0.10	mg/L	2023/07/14	2023/07/17	KJP	8790069
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2023/07/28	MCN	8816715
Nitrite (N)	-	ND	0.010	mg/L	N/A	2023/07/27	MCN	8816429
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/07/24	TGO	8804128
Dissolved Organic Carbon (C)	-	3.8	0.50	mg/L	N/A	2023/07/27	CPP	8816664
Total Organic Carbon (C)	-	4.0	0.50	mg/L	N/A	2023/07/24	CPP	8808496
pH	-	7.23		pH	N/A	2023/07/28	LJV	8818265
Total Phosphorus	-	ND	0.004	mg/L	2023/07/14	2023/07/16	MUM	8789527
Total Suspended Solids	-	ND	1.0	mg/L	2023/07/12	2023/07/18	RDM	8784275
Turbidity	-	0.21	0.10	NTU	N/A	2023/07/28	LJV	8818385
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/20	2023/07/24	SGK	8801316
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.041	0.0050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Barium (Ba)	-	0.0078	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Boron (B)	-	ND	0.050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Calcium (Ca)	-	2.6	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Copper (Cu)	-	ND	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Iron (Fe)	-	0.10	0.050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Lead (Pb)	-	0.0028	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Magnesium (Mg)	-	0.82	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Manganese (Mn)	-	0.0079	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Bureau Veritas Job #: C3K3267
Report Date: 2023/07/31

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 220028978-9

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WIO742 CR ABOVE GR Sampling Date 2023/07/05 11:10 Matrix W Sample # 2023-6308-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Potassium (K)	-	0.29	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Sodium (Na)	-	0.62	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Strontium (Sr)	-	0.013	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Uranium (U)	-	ND	0.00010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/07/26	2023/07/27	JHY	8812804

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WIO744 CR BELOW MF Sampling Date 2023/07/06 14:00 Matrix W Sample # 2023-6309-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	8.2	1.0	mg/L	N/A	2023/07/28		8780487
Nitrate (N)	-	ND	0.050	mg/L	N/A	2023/07/28		8780493
Total dissolved solids (calc., EC)	-	11	1.0	mg/L	N/A	2023/07/31		8780806
Inorganics								
Conductivity	-	20	1.0	uS/cm	N/A	2023/07/28	LJV	8818266
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Total Alkalinity (Total as CaCO3)	-	5.1	2.0	mg/L	N/A	2023/07/28	LJV	8818267
Colour	-	31	5.0	TCU	N/A	2023/07/28	MCN	8816736
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/07/28	LJV	8818268
Total Kjeldahl Nitrogen (TKN)	-	0.15	0.10	mg/L	2023/07/14	2023/07/17	KJP	8790069
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2023/07/28	MCN	8816715
Nitrite (N)	-	ND	0.010	mg/L	N/A	2023/07/27	MCN	8816429
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/07/24	TGO	8804115
Dissolved Organic Carbon (C)	-	4.2	0.50	mg/L	N/A	2023/07/27	CPP	8816664
Total Organic Carbon (C)	-	4.2	0.50	mg/L	N/A	2023/07/25	CPP	8810076
pH	-	7.05		pH	N/A	2023/07/28	LJV	8818265
Total Phosphorus	-	0.008	0.004	mg/L	2023/07/14	2023/07/16	MUM	8789527
Total Suspended Solids	-	2.2	1.0	mg/L	2023/07/13	2023/07/14	RDM	8787106
Turbidity	-	2.8	0.10	NTU	N/A	2023/07/27	KMC	8816765
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/20	2023/07/24	SGK	8801316
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.11	0.0050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Barium (Ba)	-	0.0075	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Boron (B)	-	ND	0.050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Calcium (Ca)	-	2.2	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Copper (Cu)	-	ND	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Iron (Fe)	-	0.15	0.050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Lead (Pb)	-	0.0015	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Magnesium (Mg)	-	0.68	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Manganese (Mn)	-	0.0061	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WIO744 CR BELOW MF Sampling Date 2023/07/06 14:00 Matrix W Sample # 2023-6309-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Potassium (K)	-	0.29	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Sodium (Na)	-	0.61	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Strontium (Sr)	-	0.012	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Uranium (U)	-	ND	0.00010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/07/26	2023/07/27	JHY	8812804

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WIO750 CR @ EP Sampling Date 2023/07/06 15:00 Matrix W Sample # 2023-6310-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	9.3	1.0	mg/L	N/A	2023/07/28		8780487
Nitrate (N)	-	ND	0.050	mg/L	N/A	2023/07/28		8780493
Total dissolved solids (calc., EC)	-	18	1.0	mg/L	N/A	2023/07/31		8780806
Inorganics								
Conductivity	-	32	1.0	uS/cm	N/A	2023/07/28	LJV	8818266
Chloride (Cl-)	-	3.6	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2023/07/14	SUR	8788421
Total Alkalinity (Total as CaCO3)	-	7.8	2.0	mg/L	N/A	2023/07/28	LJV	8818267
Colour	-	65	25	TCU	N/A	2023/07/28	MCN	8816736
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2023/07/28	LJV	8818268
Total Kjeldahl Nitrogen (TKN)	-	0.16	0.10	mg/L	2023/07/14	2023/07/17	KJP	8790069
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2023/07/28	MCN	8816715
Nitrite (N)	-	ND	0.010	mg/L	N/A	2023/07/27	MCN	8816429
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2023/07/24	TGO	8804136
Dissolved Organic Carbon (C)	-	5.6	0.50	mg/L	N/A	2023/07/27	CPP	8816664
Total Organic Carbon (C)	-	5.8	0.50	mg/L	N/A	2023/07/24	CPP	8808496
pH	-	7.06		pH	N/A	2023/07/28	LJV	8818265
Total Phosphorus	-	0.017	0.004	mg/L	2023/07/14	2023/07/16	MUM	8789527
Total Suspended Solids	-	3.6	1.0	mg/L	2023/07/13	2023/07/14	RDM	8787106
Turbidity	-	3.7	0.10	NTU	N/A	2023/07/27	KMC	8816765
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2023/07/20	2023/07/24	SGK	8801316
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.27	0.0050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Antimony (Sb)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Arsenic (As)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Barium (Ba)	-	0.0092	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Boron (B)	-	ND	0.050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Calcium (Ca)	-	2.2	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Chromium (Cr)	-	ND	0.0010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Copper (Cu)	-	0.00091	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Iron (Fe)	-	0.45	0.050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Lead (Pb)	-	ND	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Magnesium (Mg)	-	0.95	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Manganese (Mn)	-	0.013	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Bureau Veritas Job #: C3K3267
Report Date: 2023/07/31

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 220028978-9

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
WIO750 CR @ EP Sampling Date 2023/07/06 15:00 Matrix W Sample # 2023-6310-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Nickel (Ni)	-	ND	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Phosphorus (P)	-	ND	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Potassium (K)	-	0.48	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Selenium (Se)	-	ND	0.00050	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Sodium (Na)	-	2.9	0.10	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Strontium (Sr)	-	0.016	0.0020	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Uranium (U)	-	ND	0.00010	mg/L	2023/07/26	2023/07/27	JHY	8812804
Total Zinc (Zn)	-	ND	0.0050	mg/L	2023/07/26	2023/07/27	JHY	8812804

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com