Real-Time Water Quality Deployment Report

Lower Churchill River Network

May 31 to July 10/11, 2024

Newfoundland Labrador

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

Contents

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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 two stations on the Lower Churchill River: Churchill River below Muskrat Falls and Churchill River at English Point.
- Real-time water quality monitoring instruments were deployed at Churchill River below Muskrat Falls and Churchill River at English Point on May 31st.
- An instrument was not deployed at Churchill River above Grizzle Rapids due to the presence of an ice wall, which prohibited access to that site.
- An instrument was not deployed at Churchill River below Metchin River due to the unavailability of a helicopter to access this site.
- The instrument at Churchill River below Muskrat Falls was removed on July 10th, for a deployment period of 40 days.
- The instrument at Churchill River at English Point was removed on July 11th, for a deployment period of 41 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 May 31 to July 10/11, 2024 are summarized in Table 2.

Table 2: Comparison rankings for Lower Churchill River stations May 31 to July 10/11, 2024

Churchill River Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Below Metchin River	N/A	Deployment	N/A	N/A	N/A	N/A	N/A
	N/A	Removal	N/A	N/A	N/A	N/A	N/A
Above Grizzle Rapids	N/A	Deployment	N/A	N/A	N/A	N/A	N/A
	N/A	Removal	N/A	N/A	N/A	N/A	N/A
Below Muskrat Falls	May 31, 2024	Deployment	Good	Good	Excellent	Good	Excellent
	July 10, 2024	Removal	Good	Good	Excellent	Excellent	Good
At English Point	May 31, 2024	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	July 11, 2024	Removal	Excellent	Good	Excellent	Excellent	Good

- **Churchill River below Metchin River**
  - An instrument could not be deployed at this station due to a lack of site access.
- **Churchill River above Grizzle Rapids**
  - An instrument could not be deployed at this station due to unfavourable site conditions.
- **Churchill River below Muskrat Falls**
  - At deployment, all parameters ranked as either ‘excellent’ or ‘good’.
  - At removal, all parameters again ranked as either ‘excellent’ or ‘good’.
- **Churchill River at English Point**
  - At deployment, all parameters ranked as either ‘excellent’ or ‘good’.
  - At removal, all parameters ranked as either ‘excellent’ or ‘good’.

Data Interpretation

- The following graphs and discussion illustrate water quality related events occurring from May 31 to July 10/11, 2024 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.

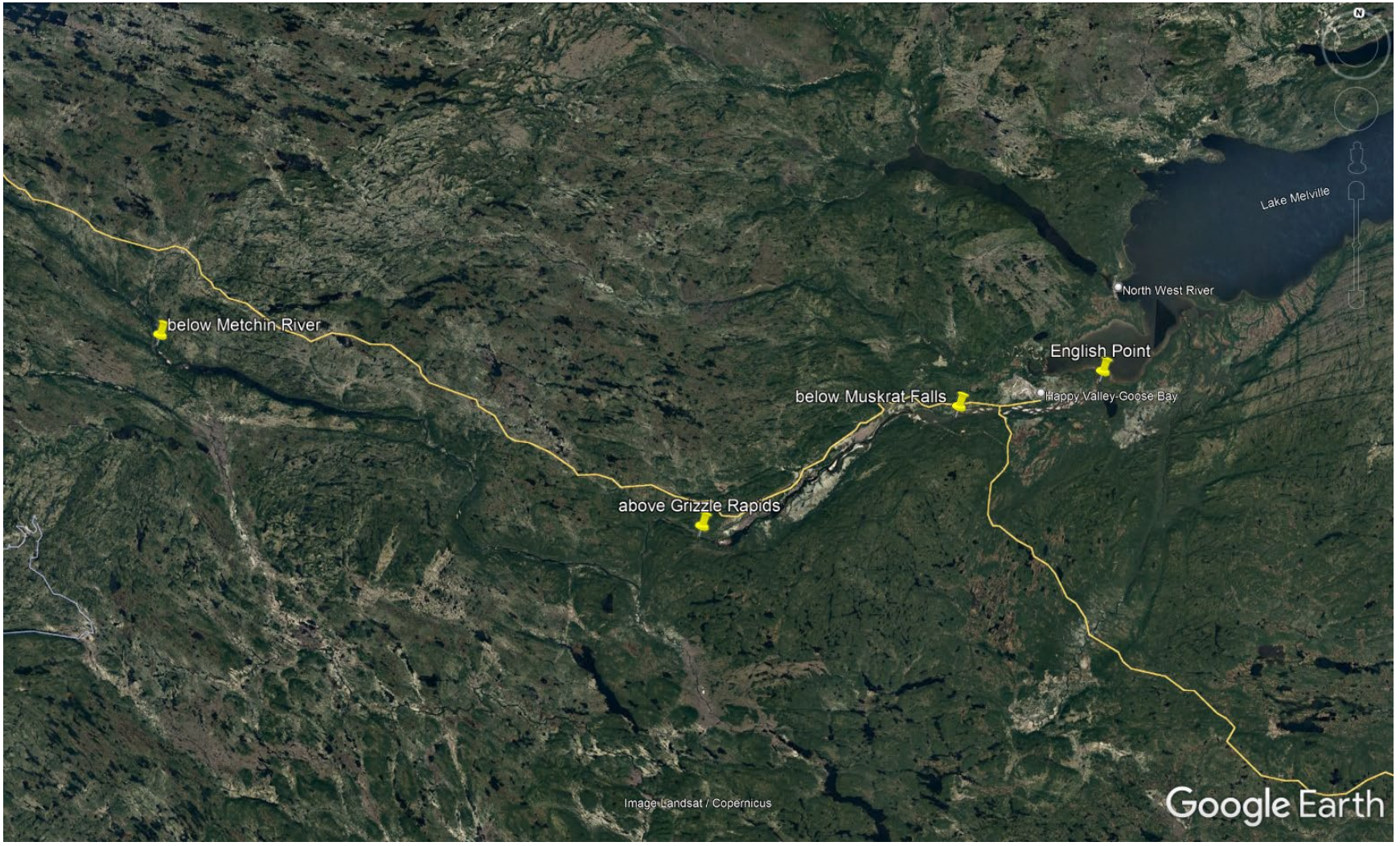

Figure 1: Lower Churchill Network of Real-Time Water Quality Stations

Churchill River below Muskrat Falls

Water Temperature

- Over the deployment period, water temperature ranged from 3.9°C to 28.8°C, with a median value of 12.2°C (Figure 2). Air temperature data was obtained from the Muskrat Falls Weather Station.
- Water temperature steadily increased over the course of the deployment period. This is to be expected as ambient air temperatures also increased over the same period. Water temperatures closely correlate with ambient air temperatures. The period from June 26-28 where water temperatures equal air temperature corresponds to low stage levels, and so the instrument was very likely out of water.
- 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.

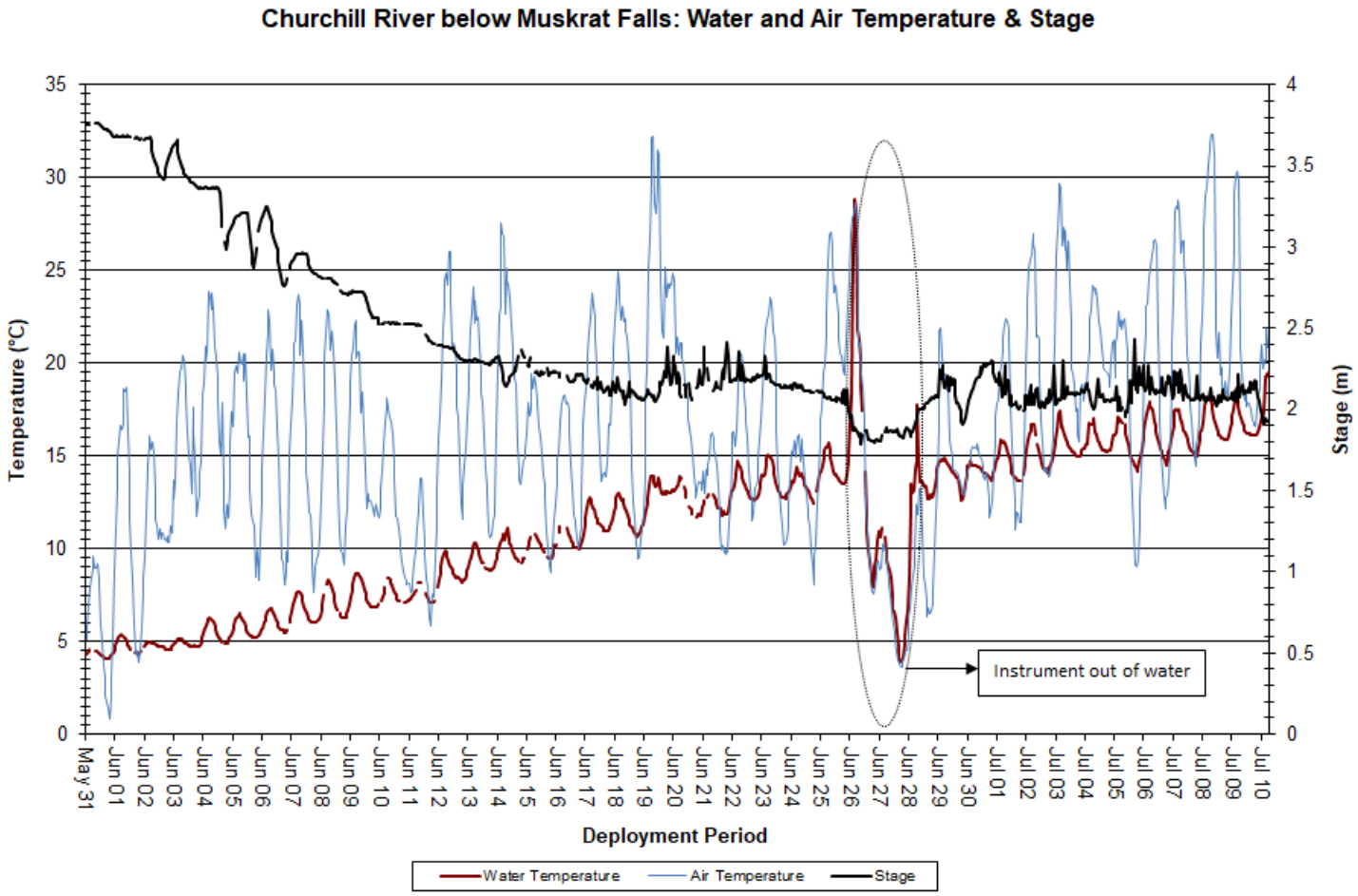

Figure 2: Water and Air Temperature & Stage at Churchill River below Muskrat Falls

pH

- Over the deployment period, pH ranged from 0 pH units to 10.79 pH units, with a median value of 6.80 (Figure 3).
- pH values were quite stable over the course of deployment, staying mostly within the CCME's Minimum Guideline for the Protection of Aquatic Life for the duration of deployment (Figure 3). Instances where pH levels fell below the CCME's Minimum Guideline are likely attributable to the instrument being at the edge, or completely out, of the water.
- 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.

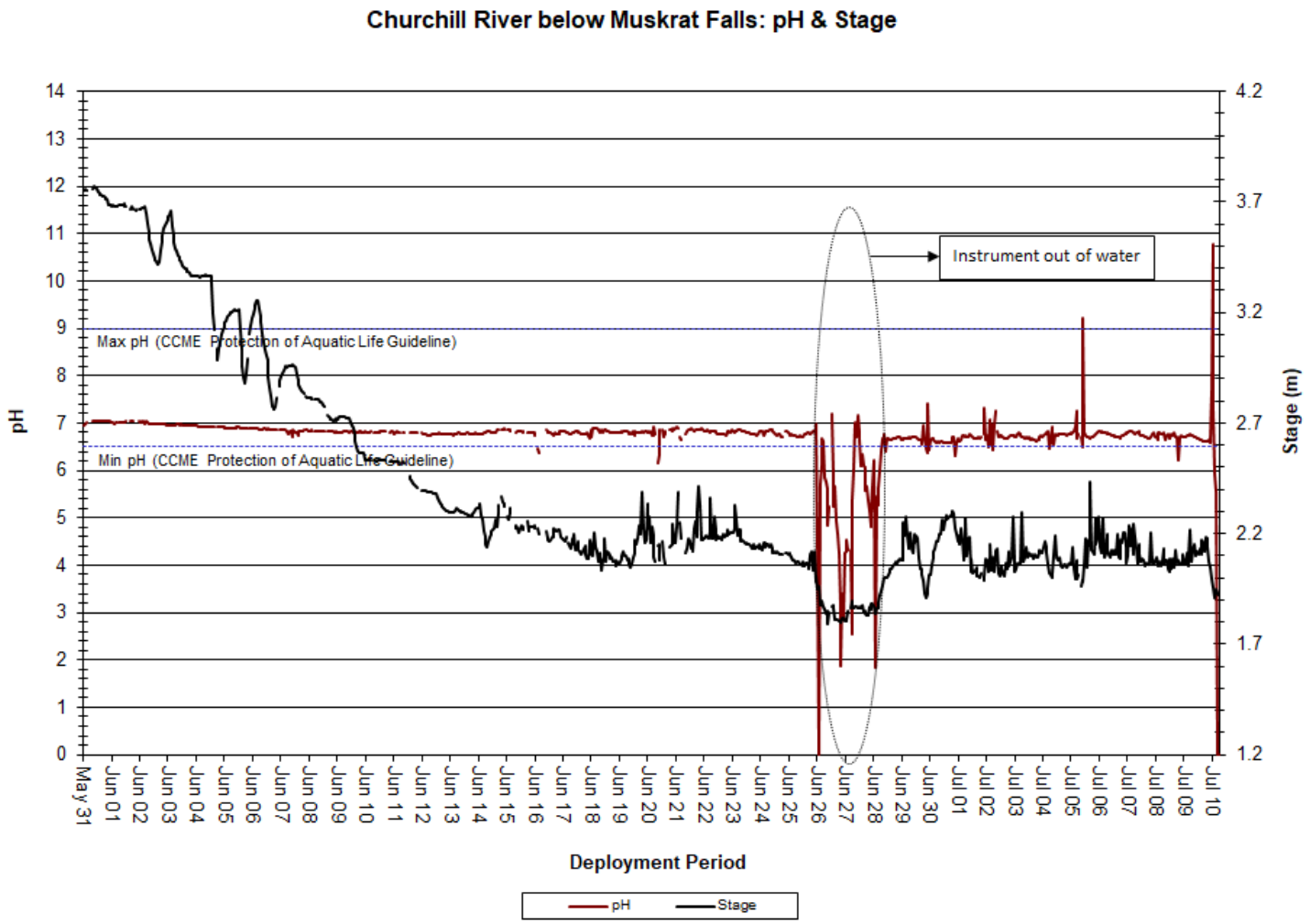

Figure 3: pH & Stage at Churchill River below Muskrat Falls

Specific Conductivity

- Over the deployment period, specific conductivity ranged from 0µS/cm to 20.2µS/cm, with a median value of 15.0µS/cm (Figure 4).
- 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 4). Instances where specific conductivity dropped to or near 0µS/cm are likely attributable to the instrument being at the edge, or completely out, of the water.
- 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.

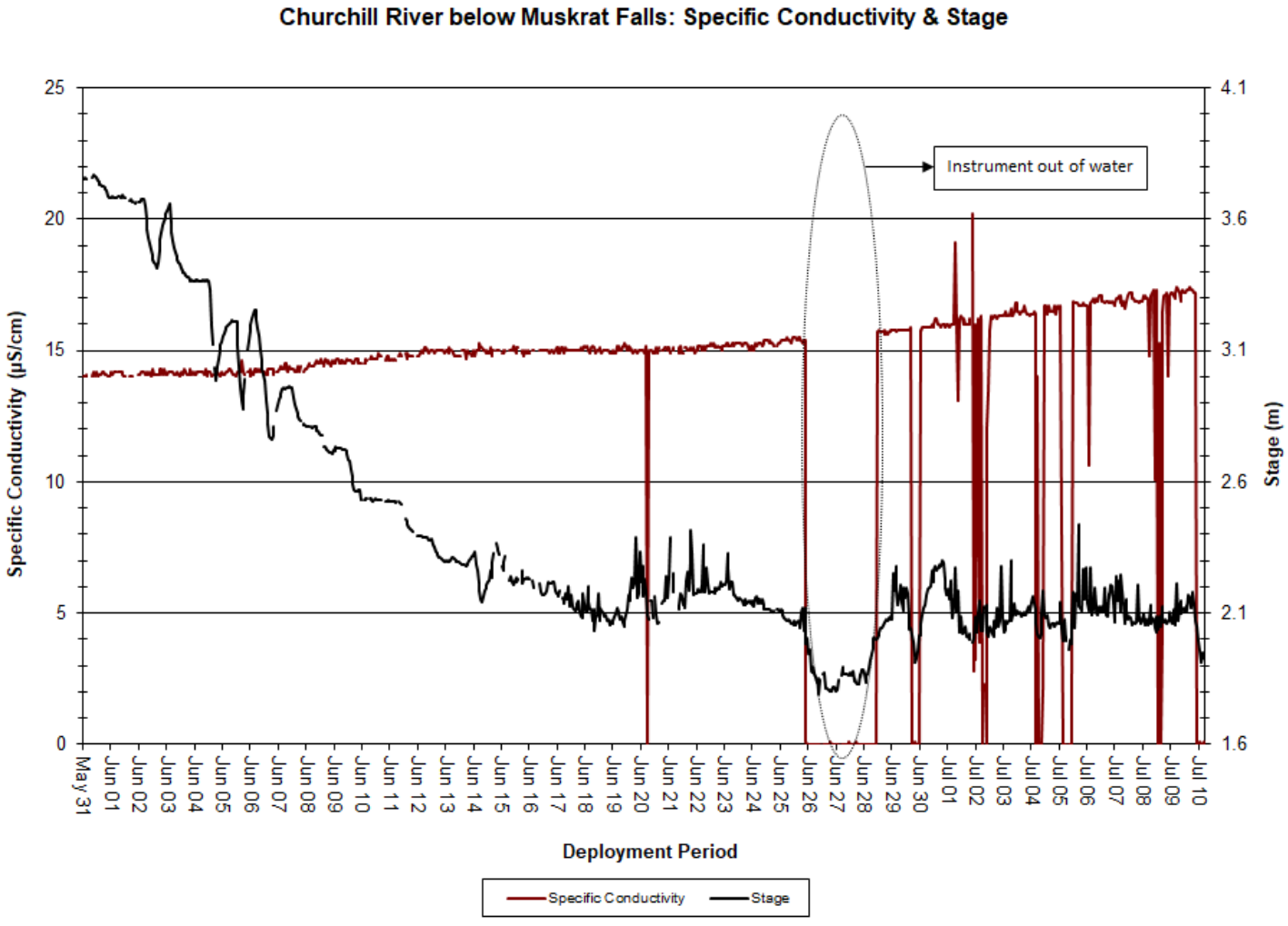

Figure 4: Specific Conductivity & Stage at Churchill River below Muskrat Falls

Dissolved Oxygen

- Over the deployment period, dissolved oxygen concentration ranged from 8.1mg/L to 13.4mg/L, with a median value of 10.82mg/L. Saturation of dissolved oxygen ranged from 94.6% to 111.3%, with a median value of 100.5% (Figure 5).
- 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 slowly 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.
- The period of high fluctuations in dissolved oxygen levels from June 26-28 is likely attributable to the instrument being out of the water (Figure 5).
- Dissolved oxygen levels were above the CCME's Guideline for the Protection of Early Life Stages for most of the deployment period, and above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment.

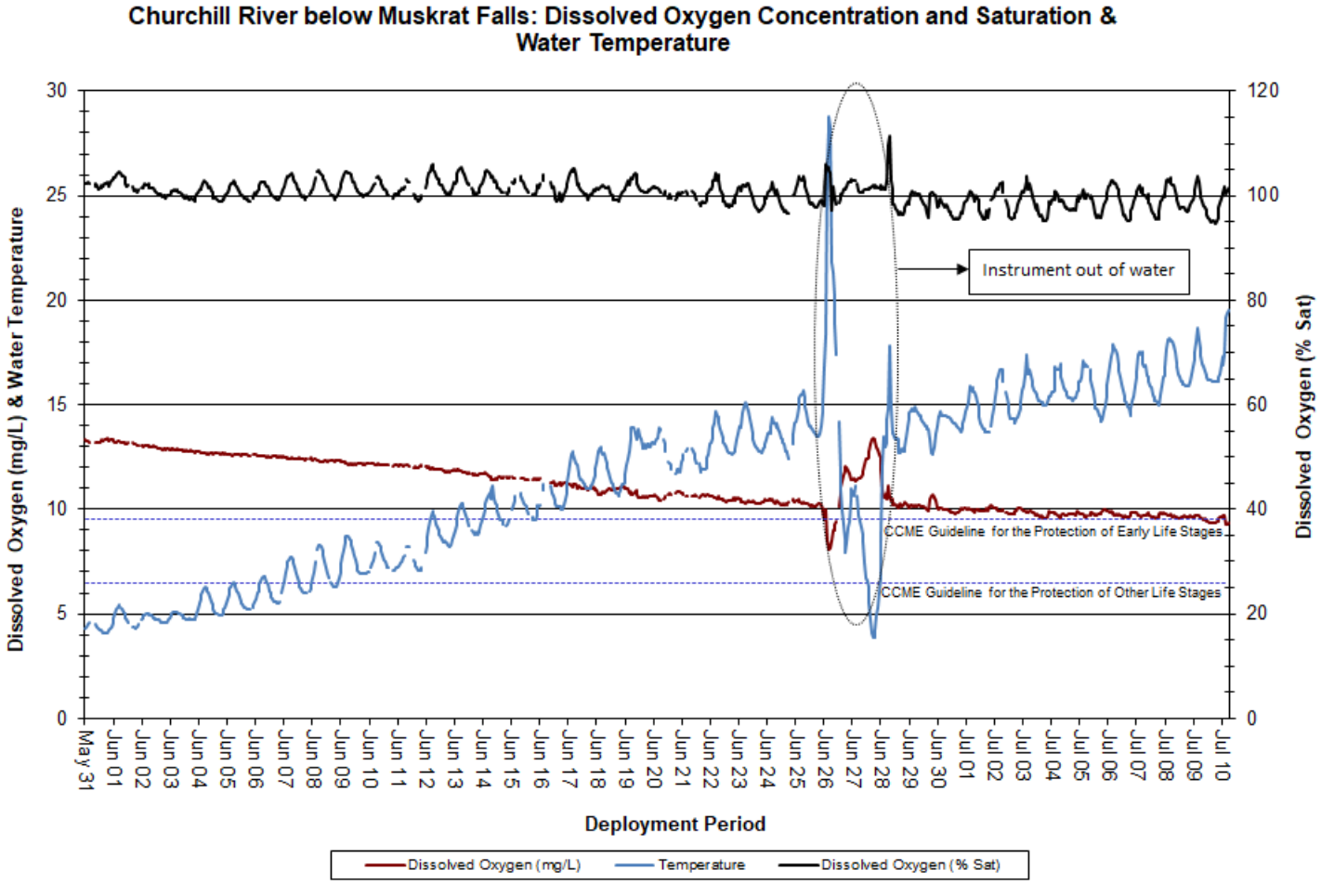

Figure 5: Dissolved Oxygen & Water Temperature at Churchill River below Muskrat Falls

Turbidity

- Over the deployment period, turbidity ranged from 0 NTU to 945 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. Precipitation data was obtained from the Muskrat Falls Weather Station.
- There was some correlation between turbidity events and precipitation events across the deployment period (Figure 6).
- 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.

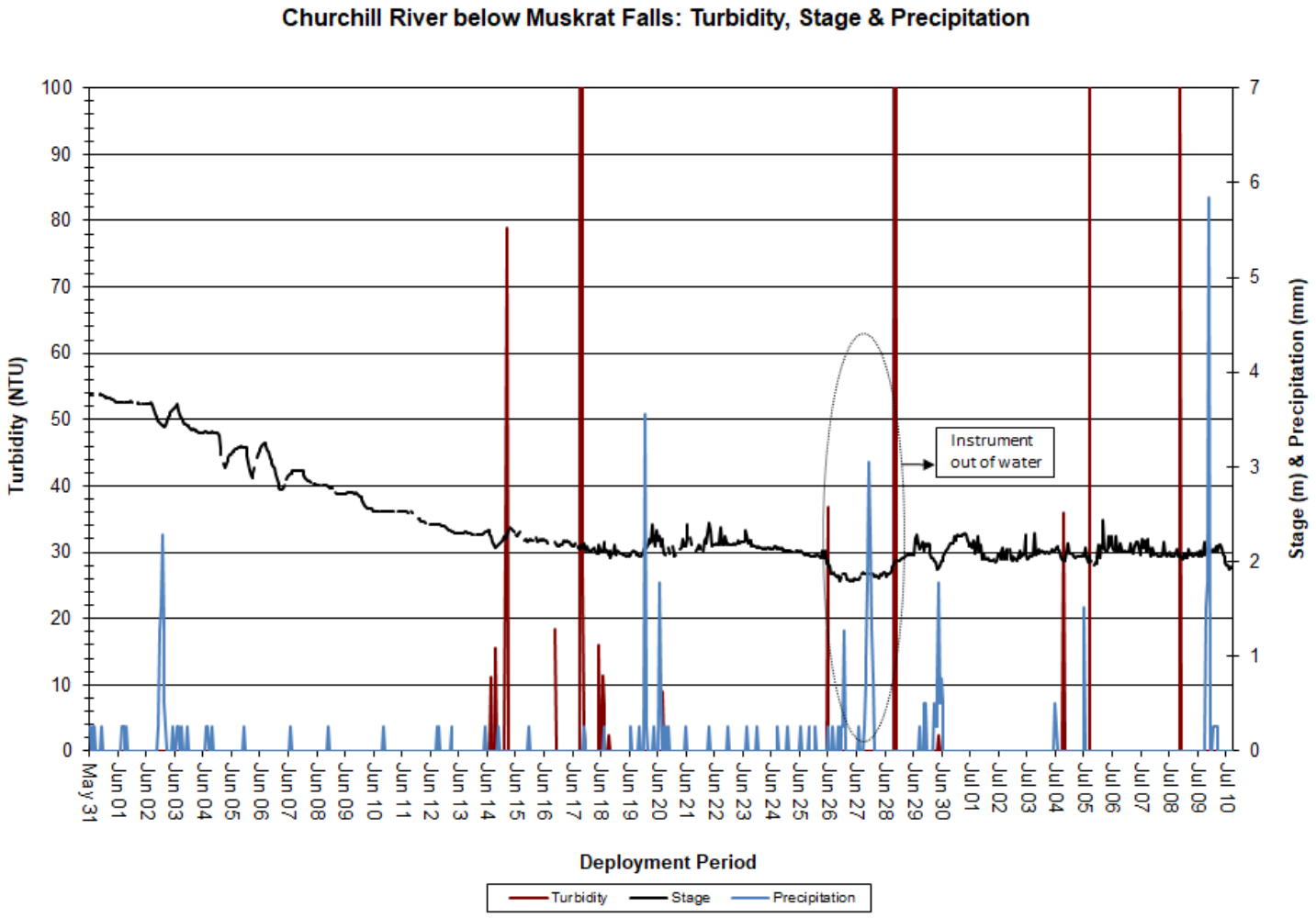

Figure 6: Turbidity, Precipitation & Stage at Churchill River below Muskrat Falls

Stage & Flow

- Over the deployment period, stage ranged from 1.791m to 3.769m, with a median value of 2.1805m. Flow ranged from 860.485m^3/s to 2903.47m^3/s, with a median value of 1187.167m^3/s (Figure 7). Precipitation data was obtained from the Muskrat Falls Weather Station.
- Stage and flow were variable over the course of deployment and correlated somewhat 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.

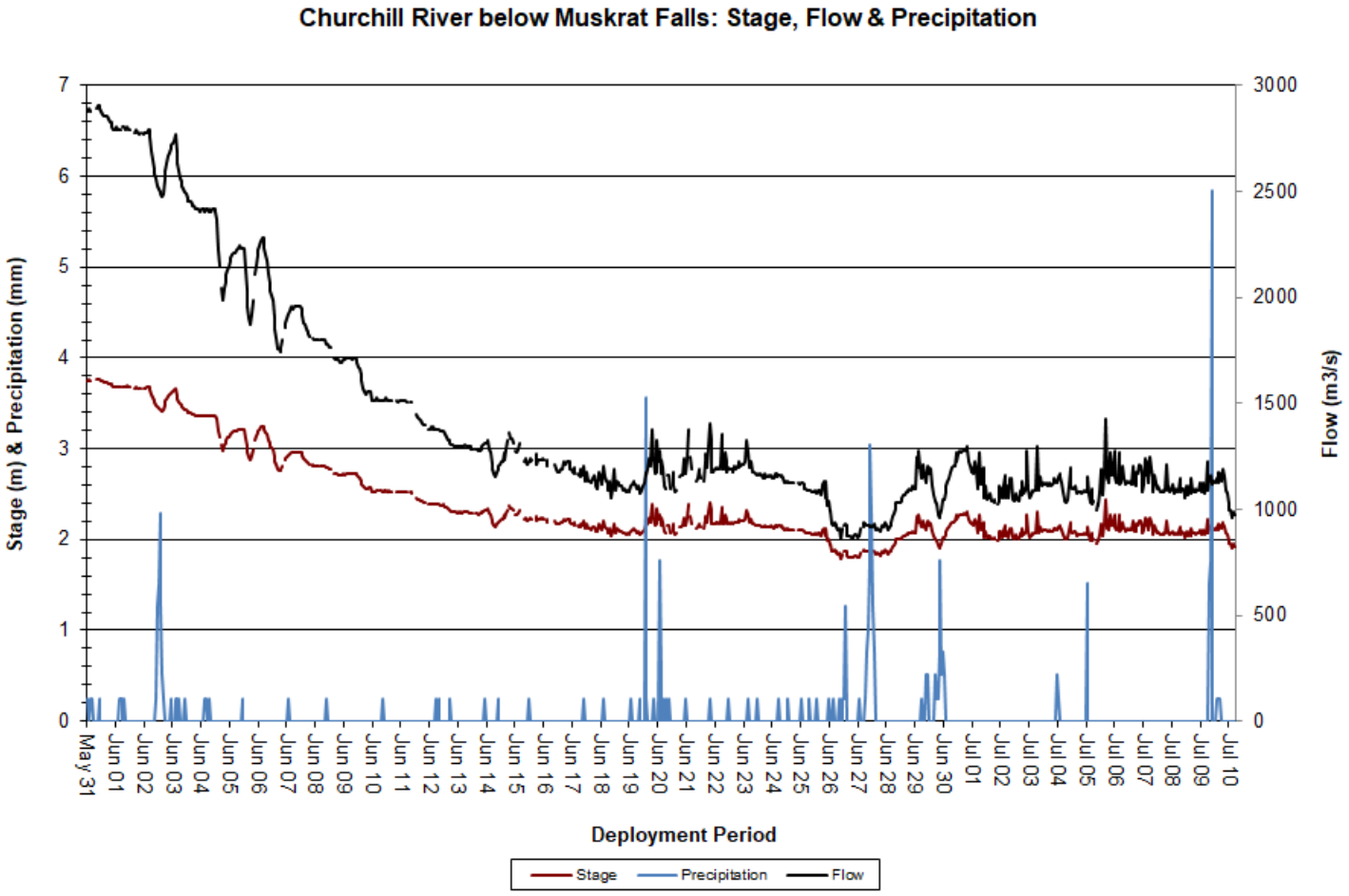

Figure 7: Stage, Flow & Precipitation at Churchill River below Muskrat Falls

Churchill River at English Point

Water Temperature

- Water temperature ranged from 5.4°C to 20.8°C, with a median value of 14.6°C (Figure 8). Air temperature data was obtained from the Mud Lake Road Weather Station.
- Water temperature increased steadily across the deployment period. 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.

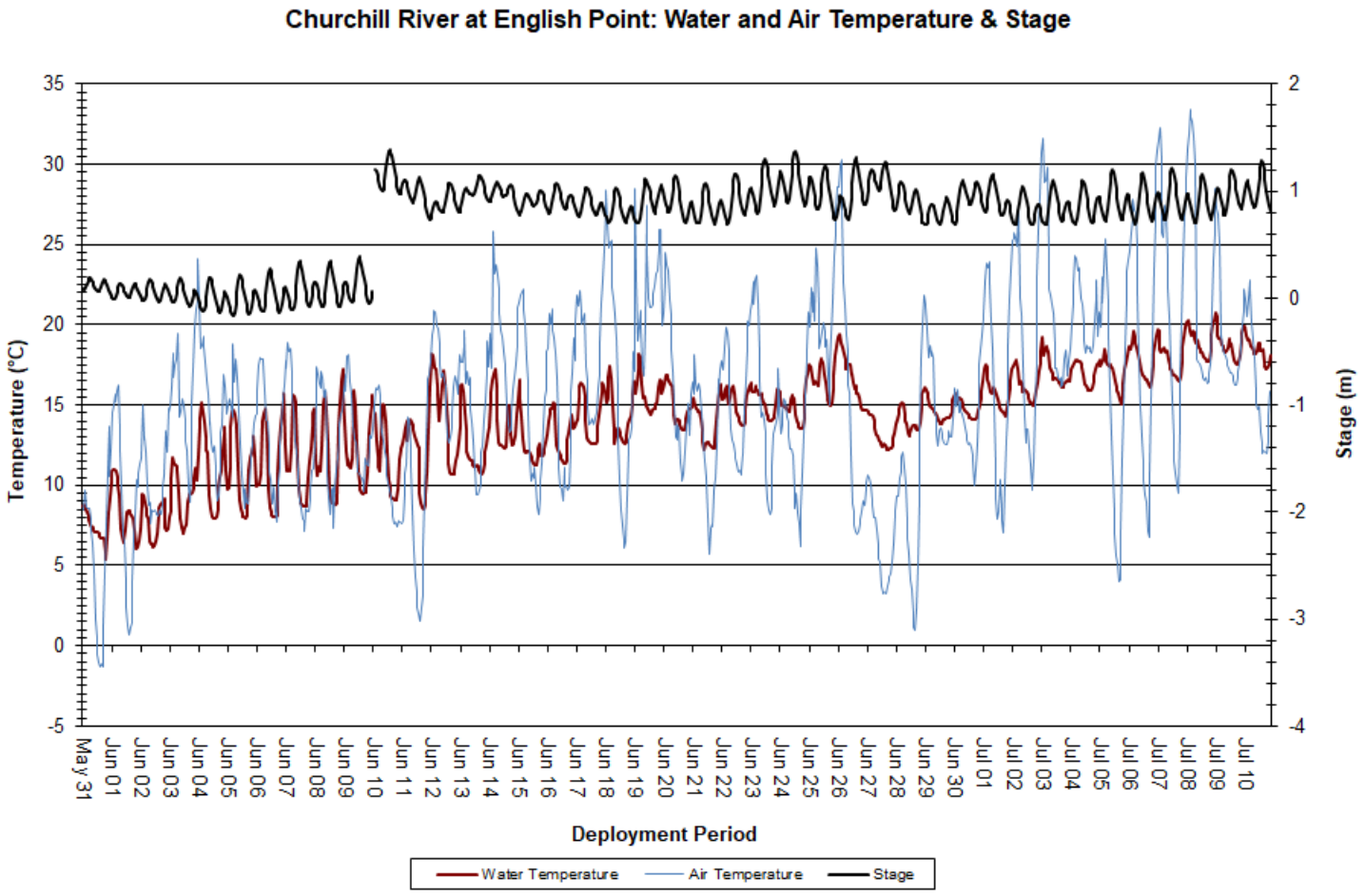

Figure 8: Water and Air Temperature & Stage at Churchill River at English Point

pH

- Over the deployment period, pH ranged from 6.65 pH units to 7.56 pH units, with a median value of 6.98 (Figure 9).
- pH values were consistent across the deployment period and remained within the CCME's Guidelines 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.

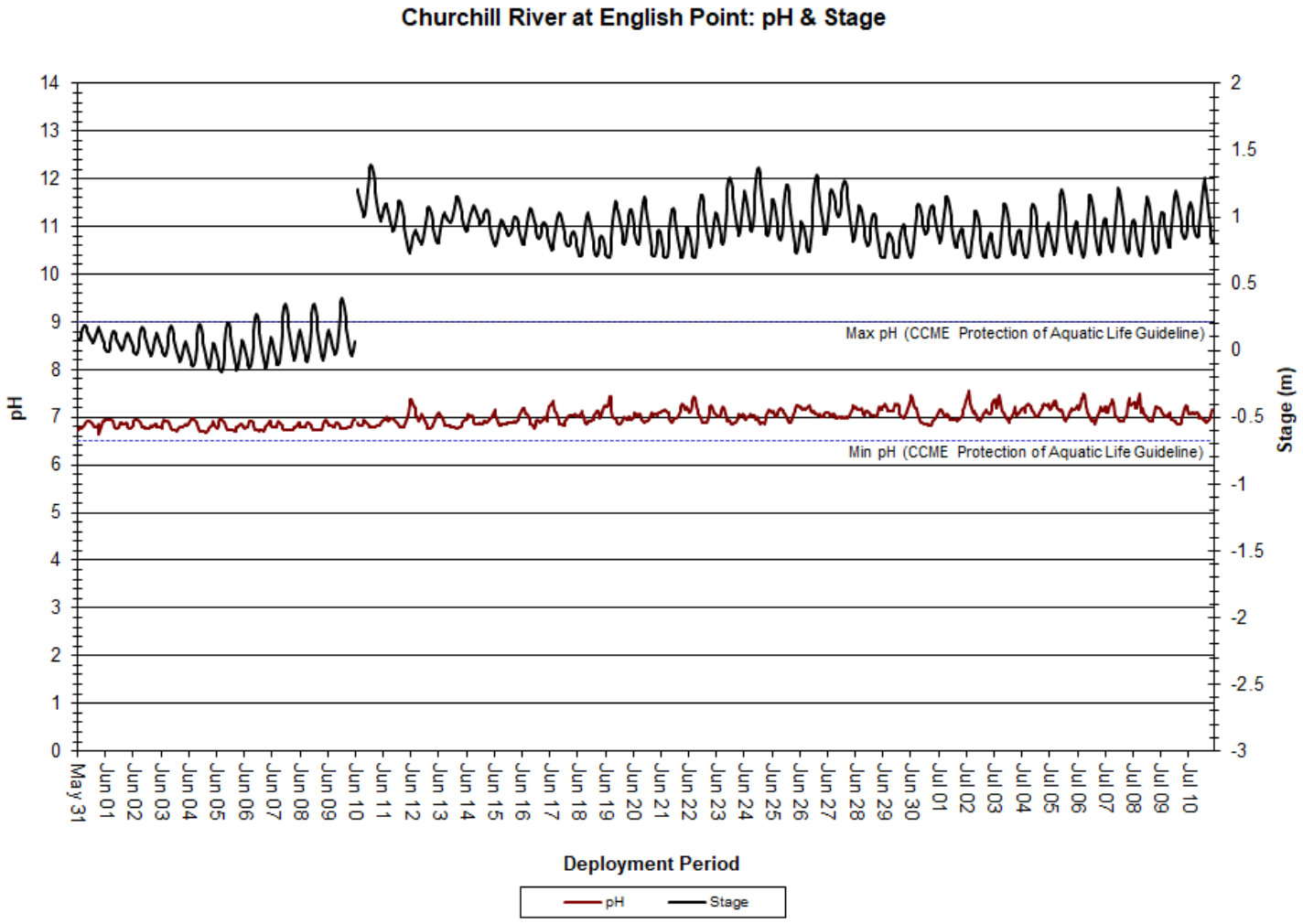

Figure 9: pH & Stage at Churchill River at English Point

Specific Conductivity

- Over the deployment period, specific conductivity ranged from 16.93µS/cm to 77.55µs/cm, with a median value of 30.84µS/cm (Figure 10).
- 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 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.

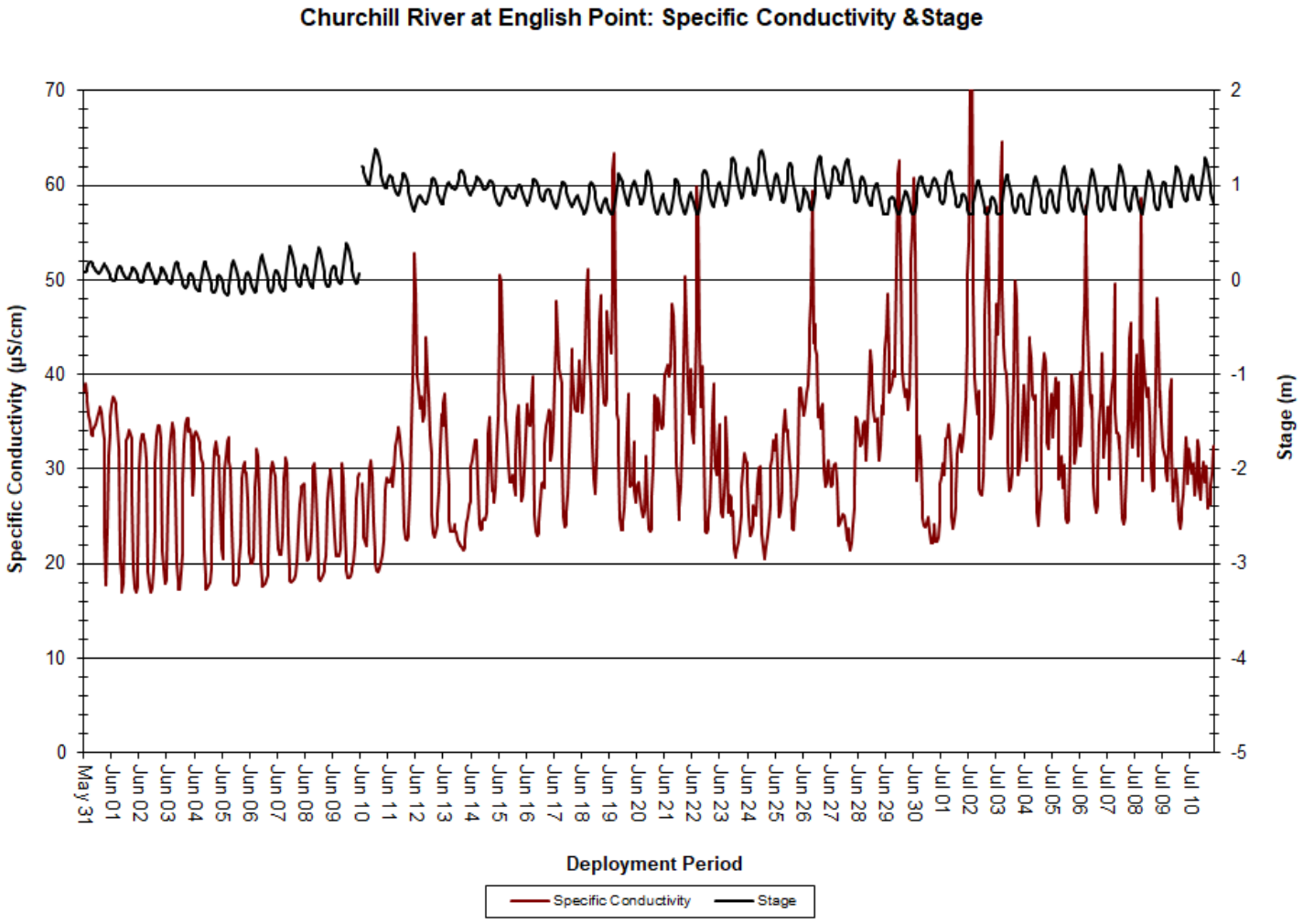

Figure 10: Specific Conductivity & Stage at Churchill River at English Point

Dissolved Oxygen

- Over the deployment period, dissolved oxygen concentration ranged from 9.08mg/L to 12.59mg/L, with a median value of 10.42mg/L. Saturation of dissolved oxygen ranged from 94.2% to 119.4% saturation, with a median value of 101.9% (Figure 11).
- 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 remained above the CCME's Guideline for the Protection of Early Life Stages for most 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 11).

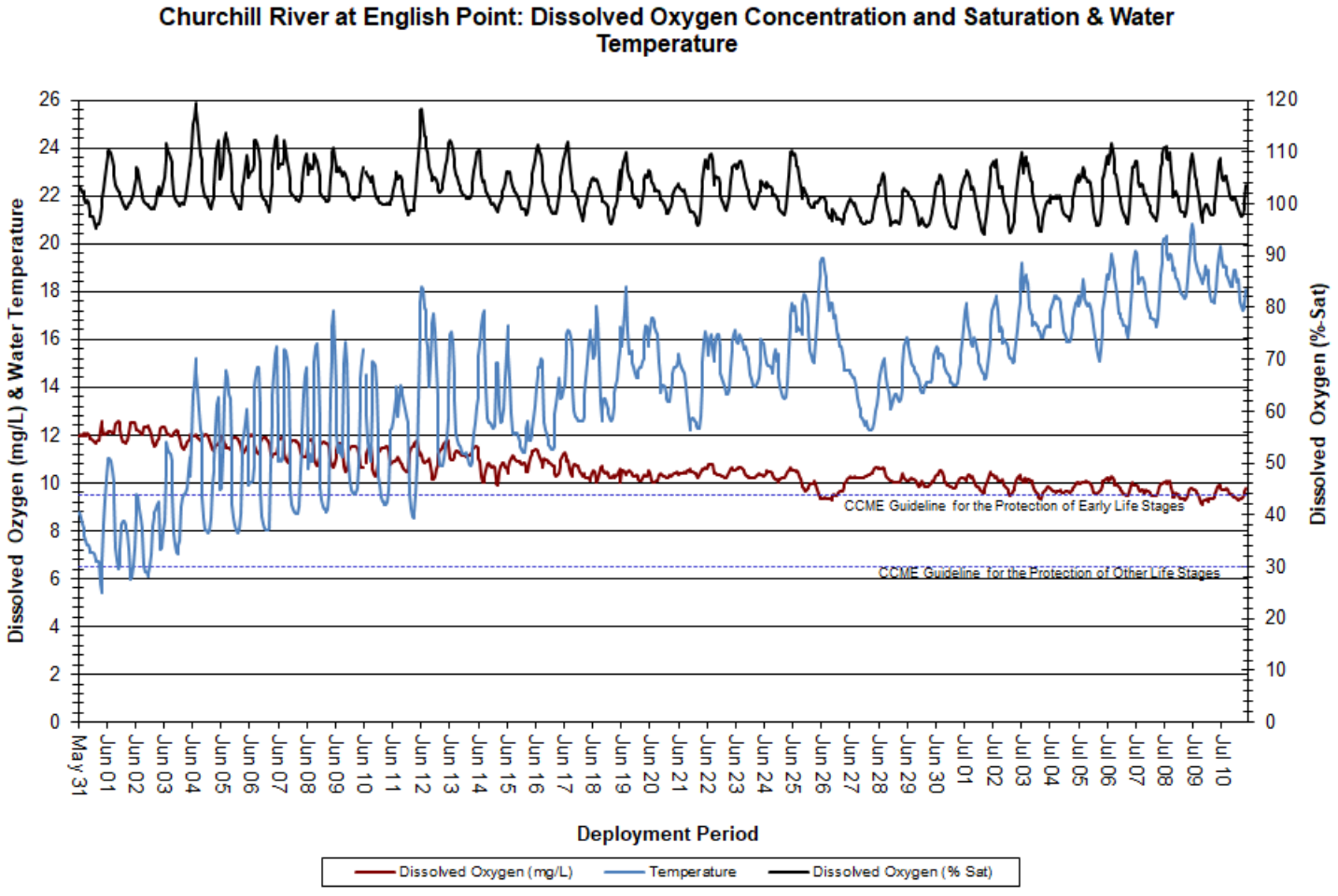

Figure 11: Dissolved Oxygen & Water Temperature at Churchill River at English Point

Turbidity

- Over the deployment period, turbidity ranged from -1.1 NTU to 158.7 NTU, with a median value of 3.7 NTU (Figure 12). A median value of 3.7 NTU indicates a low level of background turbidity; this is to be expected considering the sandy riverbed and tidal influences present at this station. Precipitation data was obtained from the Muskrat Falls Weather Station.
- Negative turbidity levels are theoretically impossible and therefore not shown on the graph below. Such readings can be caused by natural variations in measurements, sonde/sensor error, or calibration error.
- 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 12). Wind speed data was obtained from the Mud Lake Road 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.

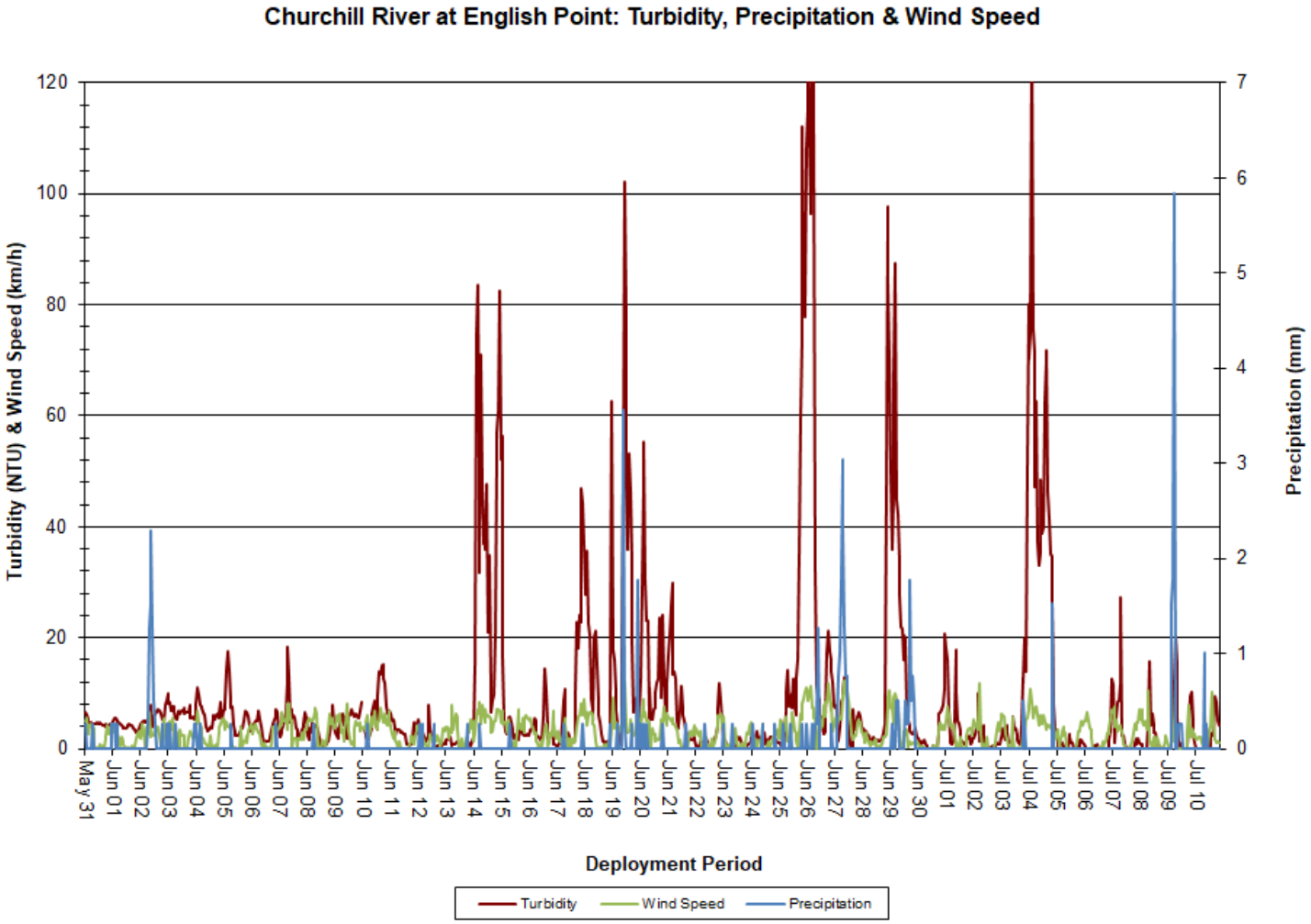

Figure 12: Turbidity, Precipitation & Wind Speed at Churchill River at English Point

Stage

- Over the deployment period, stage ranged from -0.16m to 1.39m, with a median value of 0.855m (Figure 13). Precipitation data was obtained from the Muskrat Falls 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.

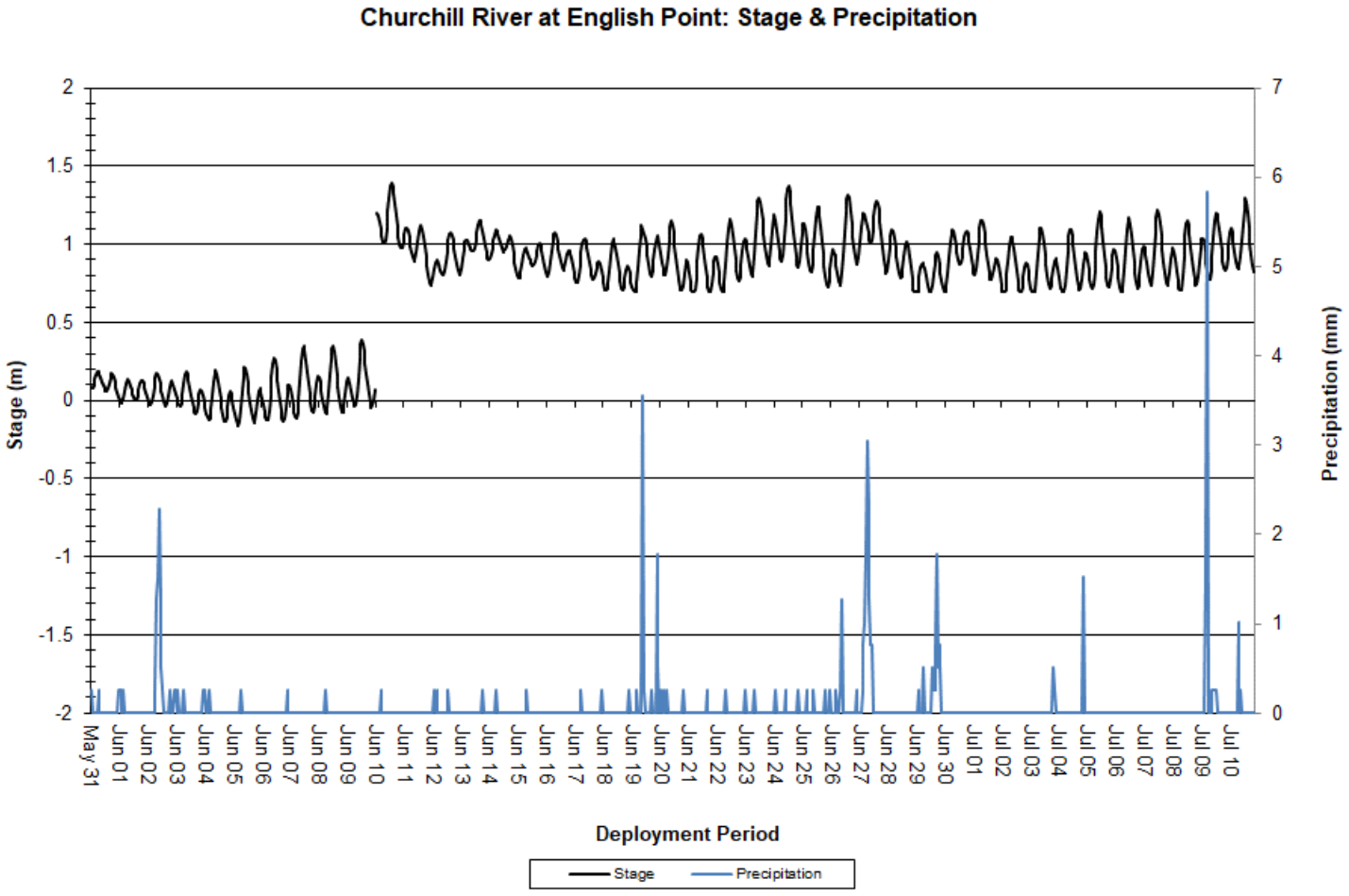

Figure 13: Stage & Precipitation at Churchill River at English Point

Conclusions

- Instruments at two water quality monitoring stations on the Lower Churchill River were deployed from May 31 through July 10/11, 2024.
- Water temperature increased steadily at both stations over the course of deployment. This is to be expected based on ambient air temperature trends during the same period through June and July.
- pH was relatively stable at Churchill River below Muskrat Falls and Churchill River at English Point, staying within the CCME's Guidelines for the Protection of Aquatic Life for the majority of the deployment period.
- Specific conductivity generally increased over the course of deployment at both 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 both stations as water temperatures increased through the summer. Dissolved oxygen levels are generally higher in water at cooler temperatures. Dissolved oxygen levels were above the CCME's Guideline for the Protection of Early Life Stages at the beginning of the deployment period, falling below the Guideline towards the end of deployment. Dissolved oxygen levels were above the CCME's Guideline for the Protection of Other Life Stages for the duration of deployment at both stations.
- Turbidity events occurred at both stations and were generally related to precipitation, wind or tidal events. Turbidity values returned to background levels following each observed event.

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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 #: C4G8751
Report Date: 2024/06/14

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 220028978-13

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ZJA746 CR BELOW MF								
Sampling Date 2024/05/31 10:00								
Matrix W								
Sample # 2024-6300-00-SI-SP								
Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	7.6	1.0	mg/L	N/A	2024/06/11		9435909
Nitrate (N)	-	0.051	0.050	mg/L	N/A	2024/06/11		9435911
Total dissolved solids (calc., EC)	-	9.7	1.0	mg/L	N/A	2024/06/12		9434908
Inorganics								
Conductivity	-	17	1.0	uS/cm	N/A	2024/06/11	LJV	9446287
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Dup.Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Dup.Bromide (Br-)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Dup.Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Total Alkalinity (Total as CaCO3)	-	5.8	2.0	mg/L	N/A	2024/06/11	LJV	9446289
Colour	-	41	5.0	TCU	N/A	2024/06/11	EMT	9446250
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2024/06/11	LJV	9446290
Total Kjeldahl Nitrogen (TKN)	-	ND	0.10	mg/L	2024/06/12	2024/06/13	RTY	9450210
Nitrate + Nitrite (N)	-	0.051	0.050	mg/L	N/A	2024/06/11	EMT	9446252
Nitrite (N)	-	ND	0.010	mg/L	N/A	2024/06/11	EMT	9446253
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2024/06/10	MCN	9444245
Dissolved Organic Carbon (C)	-	5.0	0.50	mg/L	N/A	2024/06/12	MKY	9446401
Dup.Dissolved Organic Carbon (C)	-	5.1	0.50	mg/L	N/A	2024/06/12	MKY	9446401
Total Organic Carbon (C)	-	5.1	0.50	mg/L	N/A	2024/06/10	MKY	9444408
pH	-	6.81		pH	N/A	2024/06/11	LJV	9446285
Total Phosphorus	-	0.011	0.004	mg/L	2024/06/12	2024/06/13	SPC	9450805
Total Suspended Solids	-	4.2	1.0	mg/L	2024/06/07	2024/06/10	DME	9440114
Turbidity	-	3.3	0.10	NTU	N/A	2024/06/13	LJV	9452211
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2024/06/11	2024/06/12	SPY	9446674
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.27	0.0050	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Antimony (Sb)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Arsenic (As)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Barium (Ba)	-	0.0091	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Boron (B)	-	ND	0.050	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Calcium (Ca)	-	1.9	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Chromium (Cr)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Copper (Cu)	-	0.00076	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444434

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Bureau Veritas Job #: C4G8751
Report Date: 2024/06/14

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 220028978-13

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ZJA746 CR BELOW MF Sampling Date 2024/05/31 10:00 Matrix W Sample # 2024-6300-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Iron (Fe)	-	0.39	0.050	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Lead (Pb)	-	ND	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Magnesium (Mg)	-	0.69	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Manganese (Mn)	-	0.014	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Nickel (Ni)	-	ND	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Phosphorus (P)	-	ND	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Potassium (K)	-	0.33	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Selenium (Se)	-	ND	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Sodium (Na)	-	0.62	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Strontium (Sr)	-	0.012	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Uranium (U)	-	ND	0.00010	mg/L	2024/06/10	2024/06/10	MTZ	9444434
Total Zinc (Zn)	-	ND	0.0050	mg/L	2024/06/10	2024/06/10	MTZ	9444434

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Bureau Veritas Job #: C4G8751
Report Date: 2024/06/14

NL Department of Environment, Climate Change and Municipalities
Site Location: LABRADOR
Your P.O. #: 220028978-13

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ZJA750 CR @ EP								
Sampling Date 2024/05/31 14:30								
Matrix W								
Sample # 2024-6301-00-SI-SP								
Registration # SA-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	9.5	1.0	mg/L	N/A	2024/06/11		9435909
Nitrate (N)	-	ND	0.050	mg/L	N/A	2024/06/11		9435911
Total dissolved solids (calc., EC)	-	22	1.0	mg/L	N/A	2024/06/12		9434908
Inorganics								
Conductivity	-	39	1.0	uS/cm	N/A	2024/06/11	LJV	9446287
Chloride (Cl-)	-	5.2	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Sulphate (SO4)	-	ND	1.0	mg/L	N/A	2024/06/10	LKH	9442432
Total Alkalinity (Total as CaCO3)	-	7.6	2.0	mg/L	N/A	2024/06/11	LJV	9446289
Colour	-	69	25	TCU	N/A	2024/06/11	EMT	9446250
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2024/06/11	LJV	9446290
Total Kjeldahl Nitrogen (TKN)	-	0.11	0.10	mg/L	2024/06/12	2024/06/13	RTY	9450210
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2024/06/11	EMT	9446252
Nitrite (N)	-	ND	0.010	mg/L	N/A	2024/06/11	EMT	9446253
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2024/06/10	MCN	9444252
Dissolved Organic Carbon (C)	-	6.8	0.50	mg/L	N/A	2024/06/11	MKY	9444828
Total Organic Carbon (C)	-	6.5	0.50	mg/L	N/A	2024/06/07	MKY	9440379
Dup.Total Organic Carbon (C)	-	6.3	0.50	mg/L	N/A	2024/06/07	MKY	9440379
pH	-	6.90		pH	N/A	2024/06/11	LJV	9446285
Total Phosphorus	-	0.019	0.004	mg/L	2024/06/12	2024/06/13	SPC	9450805
Total Suspended Solids	-	9.2	2.0	mg/L	2024/06/11	2024/06/13	DME	9446507
Turbidity	-	12	0.10	NTU	N/A	2024/06/13	LJV	9452216
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2024/06/11	2024/06/12	SPY	9446674
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.47	0.0050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Aluminum (Al)	-	0.50	0.0050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Antimony (Sb)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Antimony (Sb)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Arsenic (As)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Arsenic (As)	-	ND	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Barium (Ba)	-	0.011	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Barium (Ba)	-	0.012	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Boron (B)	-	ND	0.050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Boron (B)	-	ND	0.050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Cadmium (Cd)	-	0.000022	0.000010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Cadmium (Cd)	-	ND	0.000010	mg/L	2024/06/10	2024/06/10	MTZ	9444577

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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
ZJA750 CR @ EP Sampling Date 2024/05/31 14:30 Matrix W Sample # 2024-6301-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Calcium (Ca)	-	2.0	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Calcium (Ca)	-	2.0	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Chromium (Cr)	-	0.0010	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Chromium (Cr)	-	0.0011	0.0010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Copper (Cu)	-	0.0012	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Copper (Cu)	-	0.0011	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Iron (Fe)	-	0.77	0.050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Iron (Fe)	-	0.79	0.050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Lead (Pb)	-	ND	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Lead (Pb)	-	ND	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Magnesium (Mg)	-	1.1	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Magnesium (Mg)	-	1.1	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Manganese (Mn)	-	0.031	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Manganese (Mn)	-	0.031	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Nickel (Ni)	-	ND	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Nickel (Ni)	-	ND	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Phosphorus (P)	-	ND	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Phosphorus (P)	-	ND	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Potassium (K)	-	0.51	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Potassium (K)	-	0.55	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Selenium (Se)	-	ND	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Selenium (Se)	-	ND	0.00050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Sodium (Na)	-	3.9	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Sodium (Na)	-	4.0	0.10	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Strontium (Sr)	-	0.017	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Strontium (Sr)	-	0.015	0.0020	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Uranium (U)	-	ND	0.00010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Uranium (U)	-	ND	0.00010	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Total Zinc (Zn)	-	ND	0.0050	mg/L	2024/06/10	2024/06/10	MTZ	9444577
Dup.Total Zinc (Zn)	-	ND	0.0050	mg/L	2024/06/10	2024/06/10	MTZ	9444577

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