



Real-Time Water Quality Deployment Report

Iron Ore Company of Canada
Labrador West Network

June 7 to
July 21, 2022



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

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General

- The Water Resources Management Division, in partnership with the Iron Ore Company of Canada (IOC) and Environment and Climate Change Canada (ECCC), maintain two real-time water quality (RTWQ) and water quantity stations at Wabush Lake.
- The official name of each station is *Wabush Lake at Dolomite Road* and *Wabush Lake at Lake Outlet*, hereafter referred to as the Dolomite Road station and the Julienne Narrows station.
- These stations are situated upstream (Dolomite Road) and downstream (Julienne Narrows) of the IOC tailings disposal area in Wabush Lake.
- On June 8th, 2016, an additional station was commissioned under this agreement. This station is located at *Dumbell Stream above Dumbell Lake*, hereafter referred to as Dumbell Stream.
- On June 12th, 2017 a new station was commissioned under this agreement. This station is located at *Pumphouse Stream above Drum Lake*, hereafter referred to as Pumphouse Stream.
- Water Resources Management Division staff monitor the real-time graphs regularly. They will inform IOC of any significant water quality events by email notification and by monthly deployment reports.
- Between June 7th and 8th, real-time water quality monitoring instruments were deployed at the four IOC stations. The instruments were deployed for a period of 43-44 days at each station. The instruments were removed between July 20th and 21st. This was the first deployment of 2022 for these stations.



Figure 1: RTWQ Monitoring Stations in Labrador West

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 each deployment period. The procedure is based on the approach used by the United States Geological Survey.

At deployment and removal, a QA/QC Sonde is temporarily deployed adjacent to the Field Sonde. 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 Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

Table 1: Ranking classifications for deployment and removal

Parameter	Rank				
	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

- It should be noted that the temperature sensor on any sonde 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 sonde, the entire sonde 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 IOC water quality stations deployed between June 07-08 and July 20-21 are summarized in Table 2.

Table 2: QA/QC comparison rankings for IOC stations between June 07-08 and July 20-21, 2022.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Dolomite Road	June 7, 2022	Deployment	Good	Excellent	Excellent	Good	Excellent
	July 20, 2022	Removal	Good	N/A	Excellent	Excellent	Excellent
Julienne Narrows	June 7, 2022	Deployment	Excellent	Marginal	Excellent	Excellent	Poor
	July 20, 2022	Removal	Excellent	Good	Excellent	Excellent	Excellent
Dumbell Stream	June 7, 2022	Deployment	Good	N/A	Excellent	Excellent	Excellent
	July 21, 2022	Removal	Good	Good	Excellent	Excellent	Poor
Pumphouse Stream	June 8, 2022	Deployment	Excellent	Excellent	Excellent	Excellent	Good
	July 21, 2022	Removal	Excellent	Good	Good	Excellent	Excellent

▪ **Dolomite Road**

At deployment and removal, all parameters besides pH ranked either ‘excellent’ or ‘good’. pH could not be ranked at removal due to an issue with the QA/QC sonde. When the field sonde is compared to a QA/QC grab sample, the ranking is ‘excellent’.

▪ **Julienne Narrows**

At deployment, temperature, conductivity and dissolved oxygen ranked ‘excellent’. pH ranked ‘marginal’, with the field sonde reading a value of 7.40 and the QA/QC sonde recording a value of 8.40. When the field sonde is compared to the QA/QC grab sample, the ranking is ‘good’. Turbidity ranked ‘poor’. The field sonde read a value of 1.9 NTU, while the QA/QC sonde read a value of 29.5 NTU. When the field sonde is compared to the QA/QC grab sample, the ranking is ‘good’. It is likely there was an issue with the QA/QC sonde.

At removal, all parameters ranked either ‘excellent’ or ‘good’.

▪ **Dumbell Stream**

At deployment, all parameters besides pH ranked either ‘excellent’ or ‘good’. pH could not be ranked due to an issue with the QA/QC sonde. When compared to the QA/QC grab sample, pH ranked ‘good’.

At removal, all parameters besides turbidity ranked either ‘good’ or ‘excellent’. Turbidity ranked ‘poor’. The field instrument read a value 10.8 NTU, while the QA/QC grab sample read a value of 0.0 NTU.

▪ **Pumphouse Stream**

At deployment and removal, all parameters ranked either ‘excellent’ or ‘good’.

- There are a few circumstances which may cause less than ideal QA/QC rankings to be obtained. These include: the placement of the QA/QC sonde in relation to the field sonde; the amount of time each sonde was given to stabilize before readings were recorded; and deteriorating performance of one or more of the sensors.

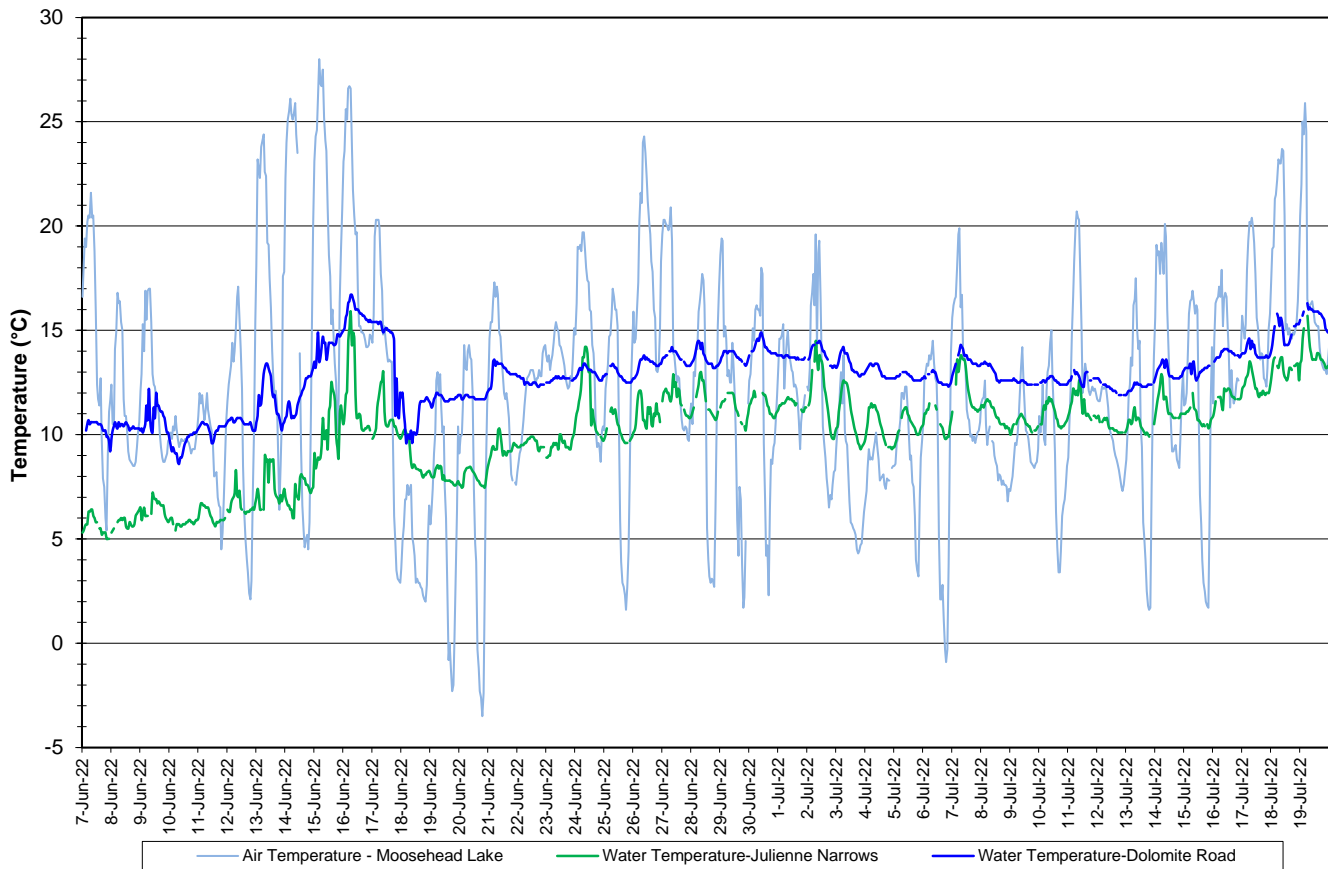
Data Interpretation

- The following graphs and discussion illustrate water quality-related events from June 7-8 to July 20-21, 2022 at the IOC RTWQ monitoring stations in Labrador West.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Wabush Lake Network

- Water temperature ranged from 8.60 to 16.70°C at Dolomite Road and 5.00 to 15.90°C at Julienne Narrows during this deployment period (Figure 2).
- Water temperature at both stations increased until the middle of June. It then decreased slightly before gradually increasing for the remainder of the deployment period. Water temperature corresponded to increases/decreases in ambient air temperature trends (Figure 2).

**Water and Air Temperature : Wabush Lake Network
June 7 to July 20, 2022**



**Figure 2: Water and Air Temperature - Wabush Lake network
(Weather data collected from climate station near Moosehead Lake)**

- pH ranges from 7.19 to 7.89 pH units at Dolomite Road, and from 7.40 to 8.15 pH units at Julienne Narrows throughout the deployment period (Figure 3). The median pH is 7.53 and 7.93 units respectively.
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). pH fluctuates slightly throughout the day and night.
- At Dolomite Road, there is a rise in pH during the first week of deployment. This could be due to spring runoff. pH at Julienne Narrows was stable throughout deployment.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Water pH and Stage: Wabush Lake Network
June 7 to July 20, 2022**

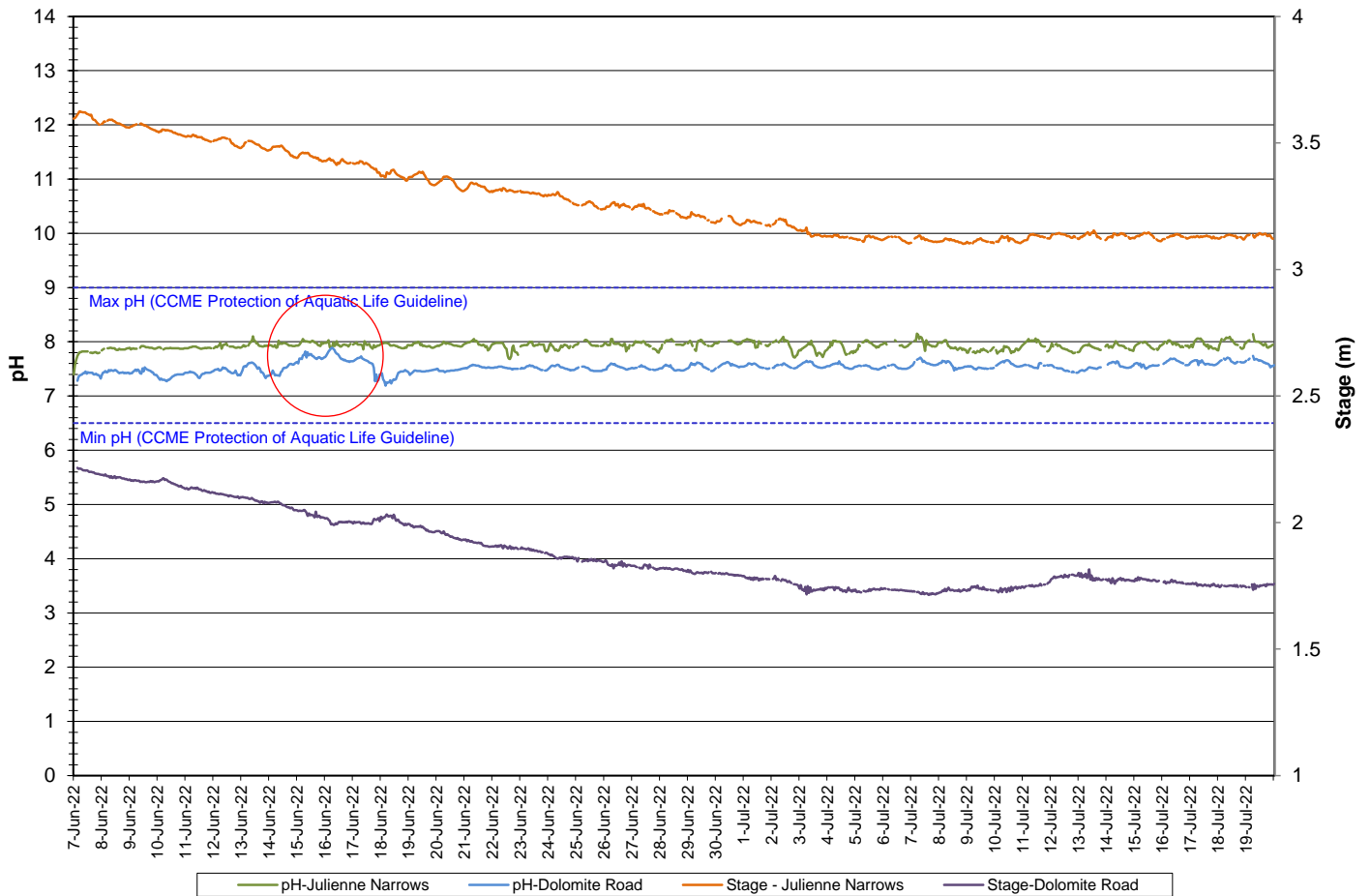


Figure 3: Water pH and Stage– Wabush Lake network

- Specific conductivity ranged from 43.6 to 63.9 $\mu\text{S}/\text{cm}$ at Dolomite Road and from 69.8 to 118.10 $\mu\text{S}/\text{cm}$ at Julienne Narrows throughout the deployment period (Figure 4).
- Daily fluctuations are evident at the Julienne Narrows station. This can be attributed to varying contributions of iron ore tailings deposited into Wabush Lake upstream of Julienne Narrows and downstream of Dolomite Road. This can also explain the difference in specific conductivity levels between the two stations as conductance values are generally higher at Julienne Narrows.
- At Dolomite Road, conductivity decreases on the 18th of June, corresponding to a rise in stage during the same time.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Specific Conductivity and Stage: Wabush Lake Network
June 7 to July 20, 2022**

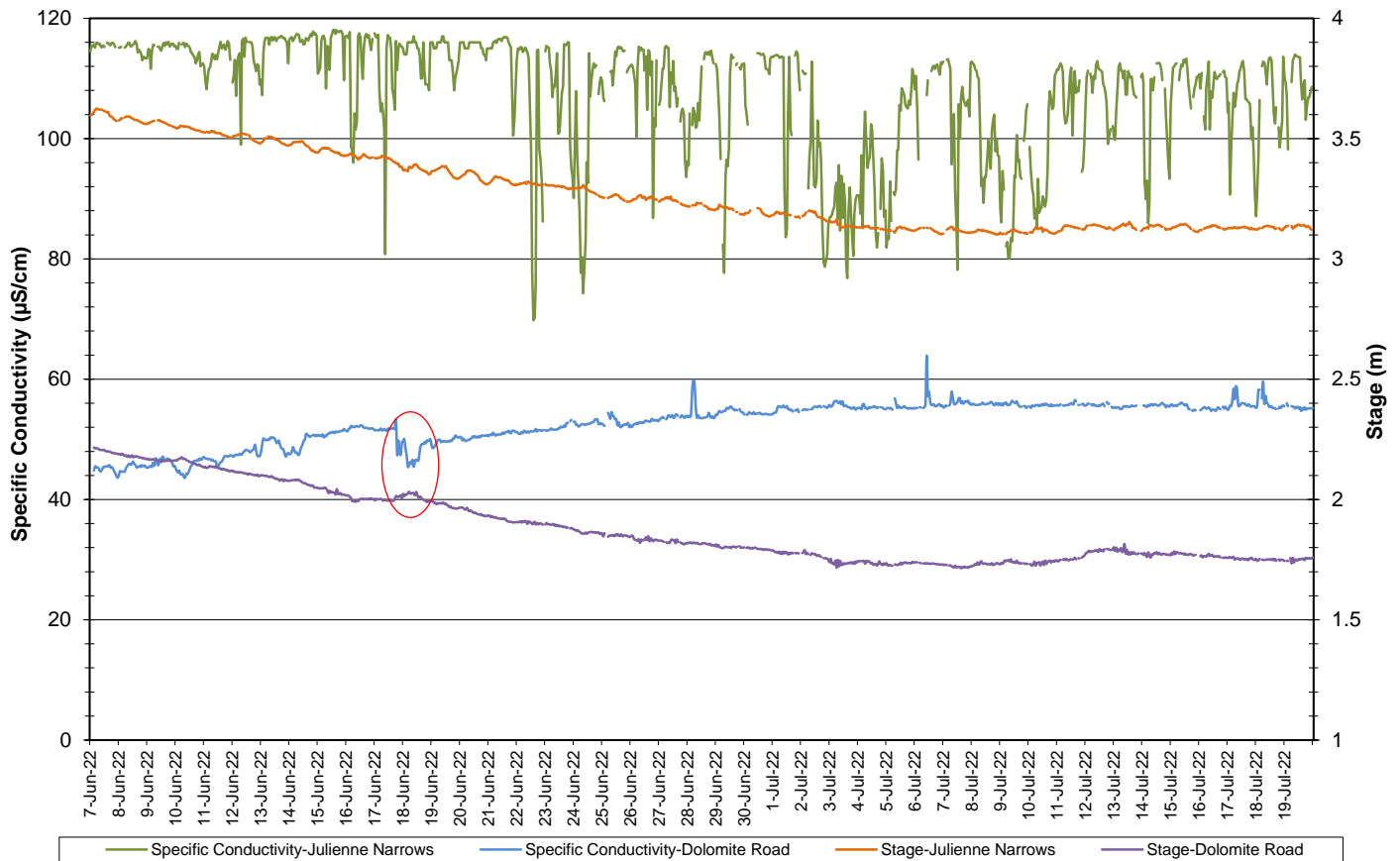


Figure 4: Specific Conductivity and Stage – Wabush Lake network

- At the Dolomite Road station, the saturation of dissolved oxygen ranged from 87.7 to 106.6% while the dissolved oxygen content ranged from 9.43 to 11.49 mg/l with a median value of 9.79 mg/l (Figure 5).
- At the Julienne Narrows station, the saturation of dissolved oxygen ranged from 86.9 to 103.0% while the dissolved oxygen content ranged from 9.37 to 11.92 mg/l with a median value of 10.57 mg/l (Figure 5).
- All values recorded at Julienne Narrows and Dolomite Road were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Other Life Stages of 6.5 mg/l. The majority of the values at Dolomite Road and Julienne Narrows, were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/l. The guidelines are indicated in blue on Figure 5.
- Dissolved oxygen decreased at both stations over the course of this deployment period, as water temperature increased. Dissolved oxygen fluctuated daily with decreases observed at night.

**Dissolved Oxygen and Percent Saturation : Wabush Lake Network
June 7 to July 20, 2022**

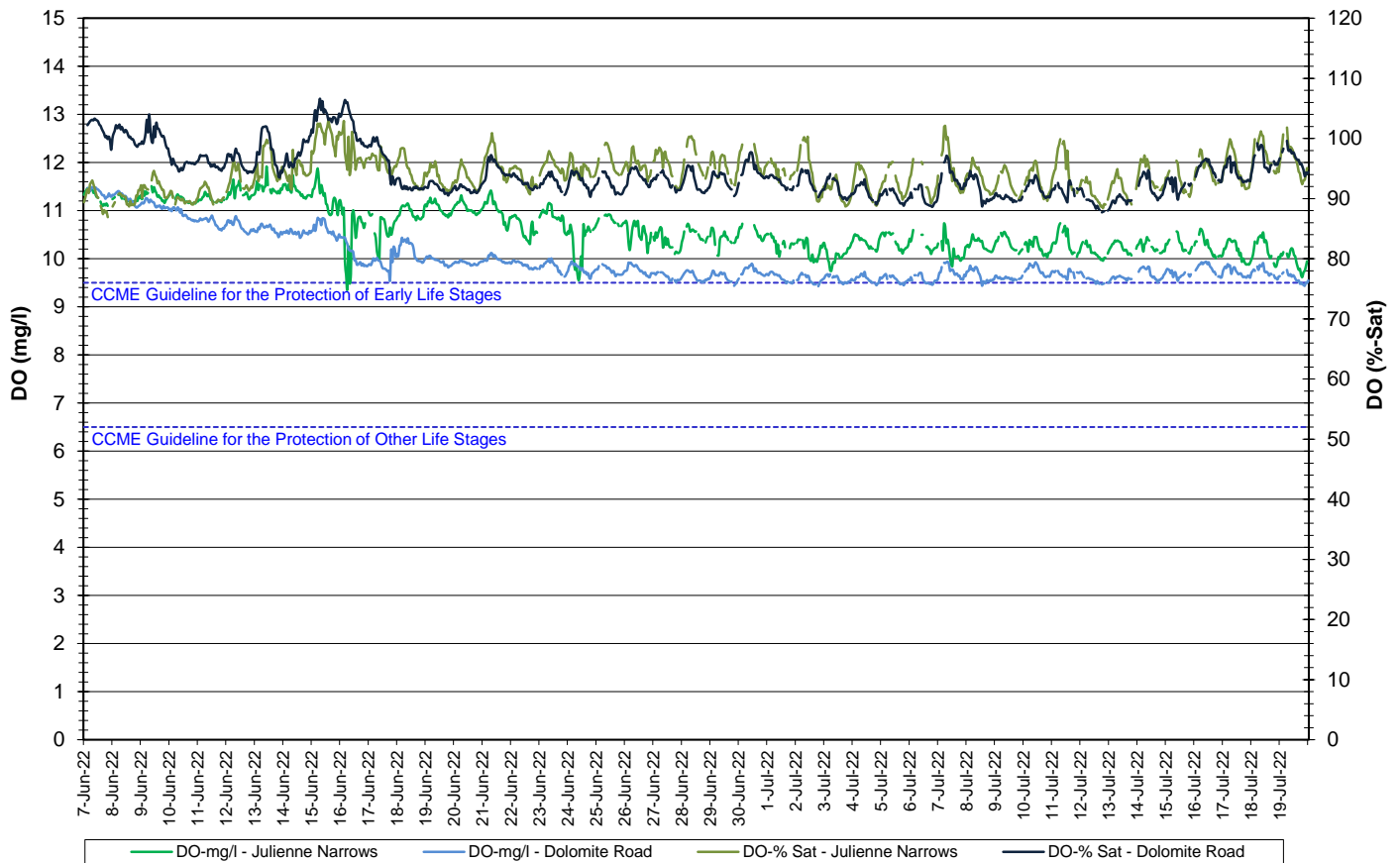
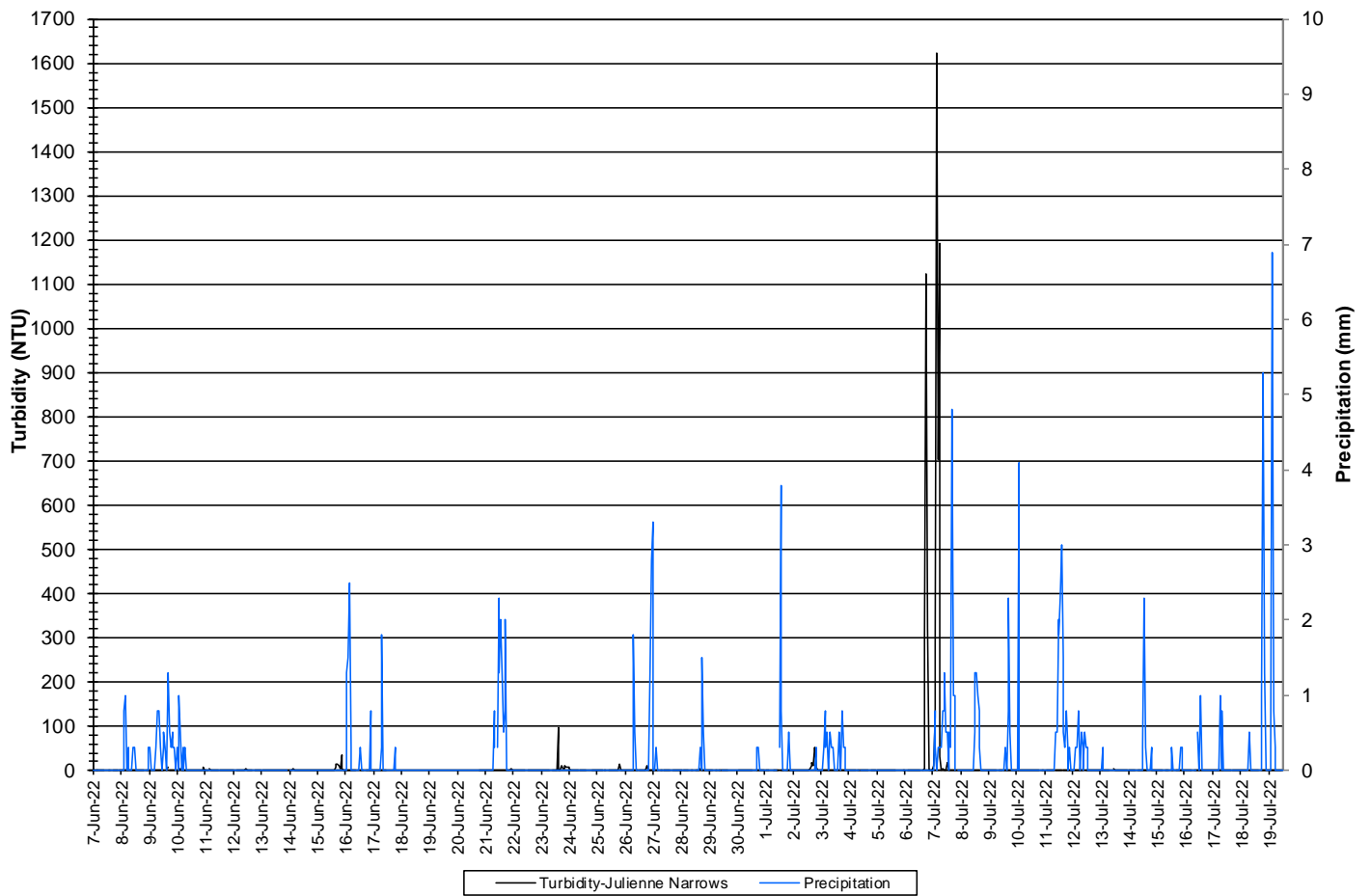


Figure 5: Dissolved Oxygen and Percent Saturation – Wabush Lake Network

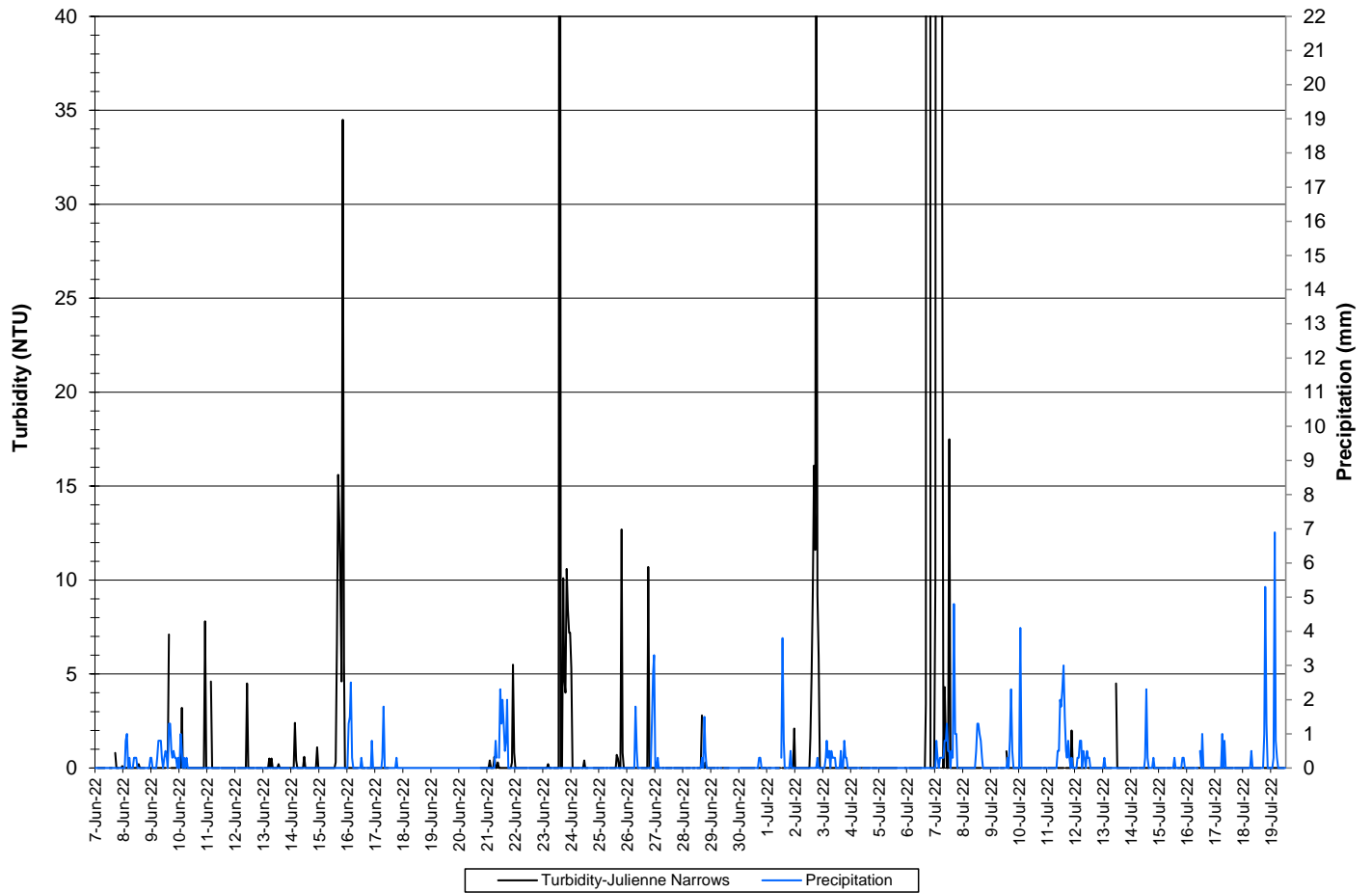
- At the Julienne Narrows station, turbidity values range from 0.0 to 1624.0 NTU throughout the deployment period (Figure 6a). The median value was 0.0 NTU, indicating low background turbidity levels.
- In some instances, turbidity spikes can be attributed to precipitation events. Others may be the result of wave action near the instrument. Large spikes were infrequent and for short periods of time.

**Water Turbidity and Precipitation: Julienne Narrows
June 7 to July 20, 2022**



**Figure 6a: Turbidity and Precipitation – Julienne Narrows
(Weather data collected from climate station near Moosehead Lake)**

**Water Turbidity <40 NTU and Precipitation: Julienne Narrows
June 7 to July 20, 2022**



**Figure 6b: Turbidity <40 NTU and Precipitation – Julienne Narrows
(Weather data collected from climate station near Moosehead Lake)**

- At the Dolomite Road station, turbidity values range from 0.0 NTU to 13.2 NTU throughout the deployment period (Figure 7). The median value was 0.0 NTU.

Turbidity and Precipitation : Dolomite Road
June 7 to July 20, 2022

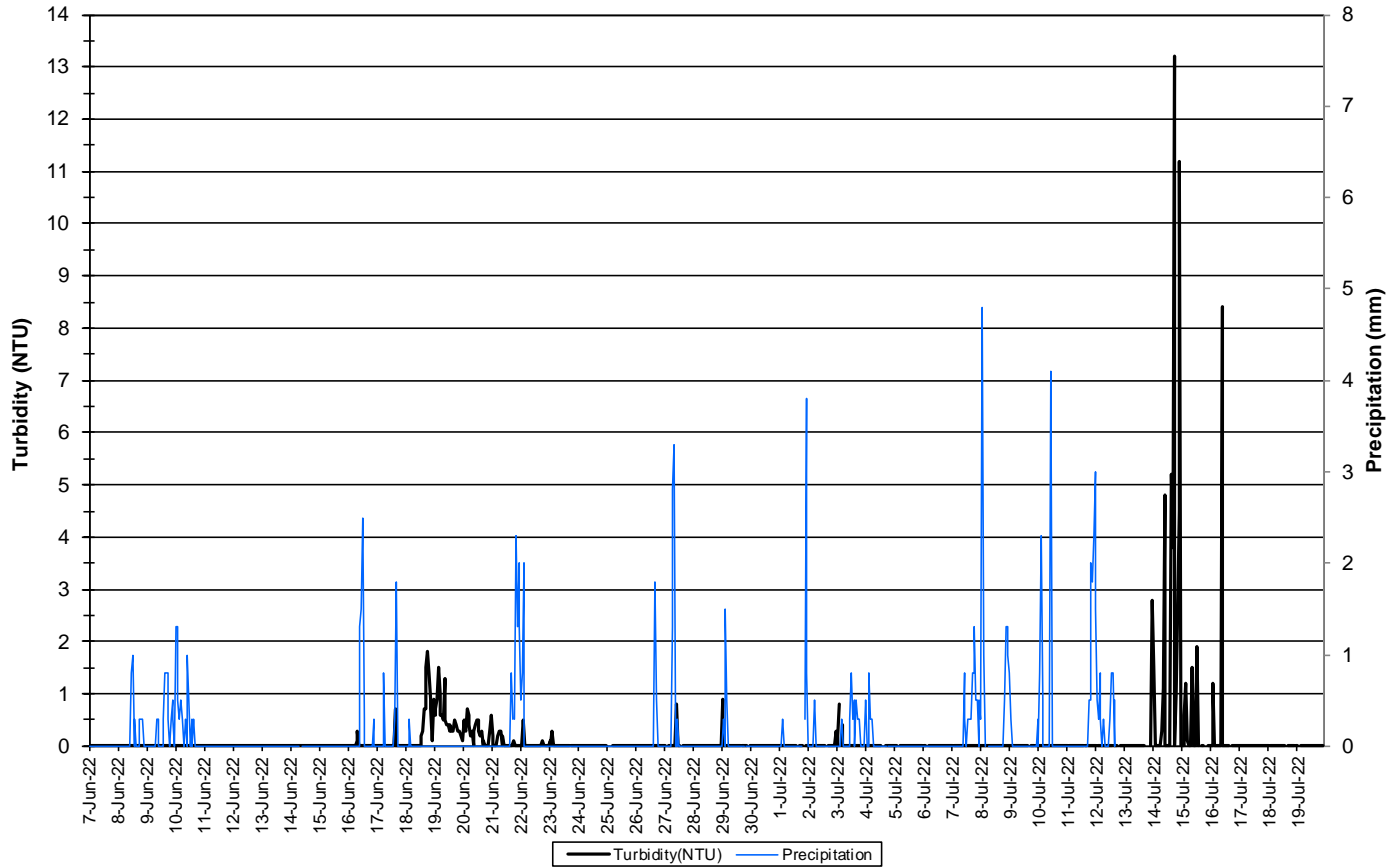
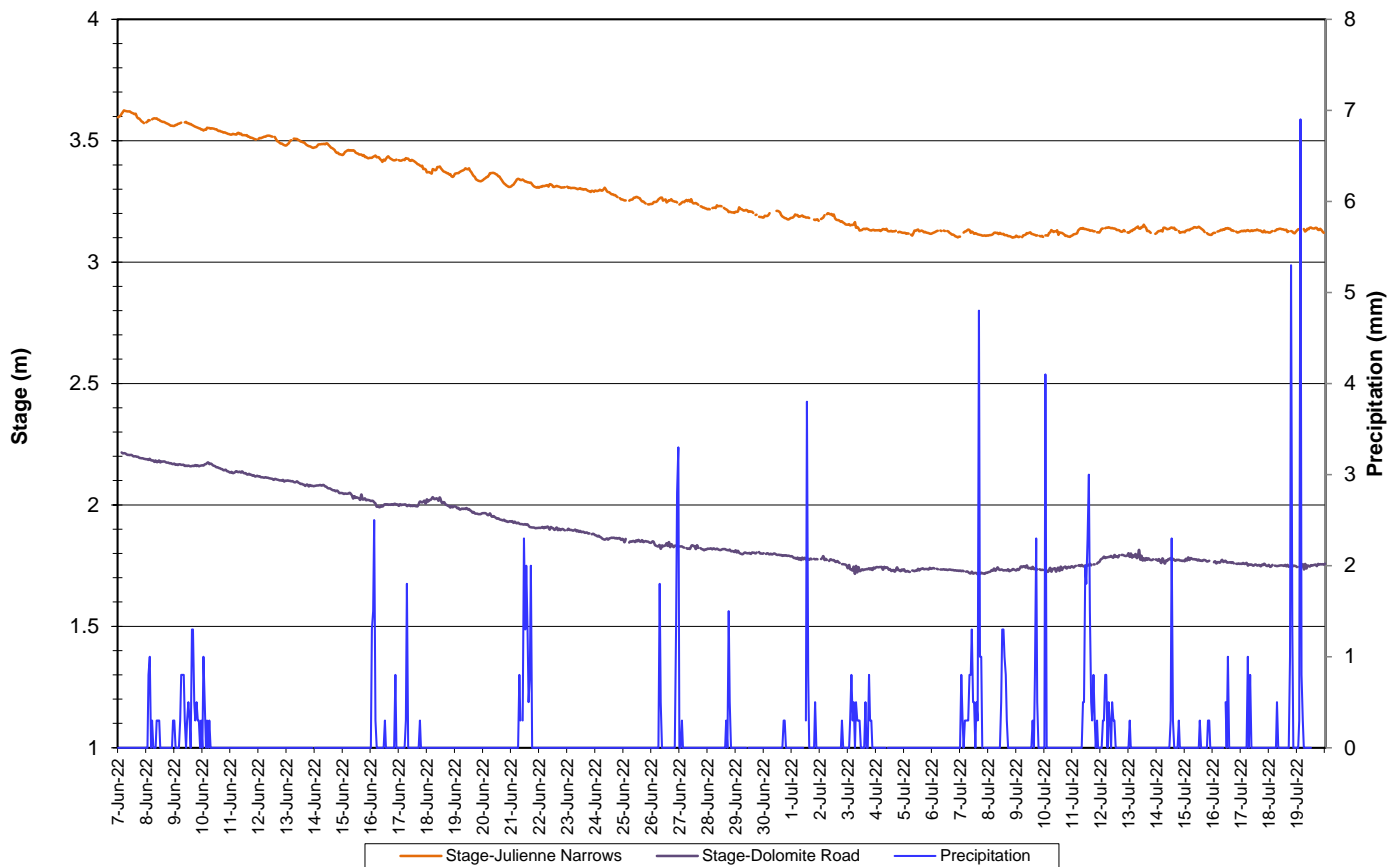


Figure 7: Turbidity and Precipitation – Dolomite Road
(Weather data collected from climate station near Moosehead Lake)

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Dolomite Road and Julienne Narrows (Figure 8).
- Stage decreased at both Julienne Narrows and Dolomite Road. At Dolomite Road, there were small increases noted after some precipitation events.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Stage and Precipitation: Wabush Lake Network
June 7 to July 20, 2022**

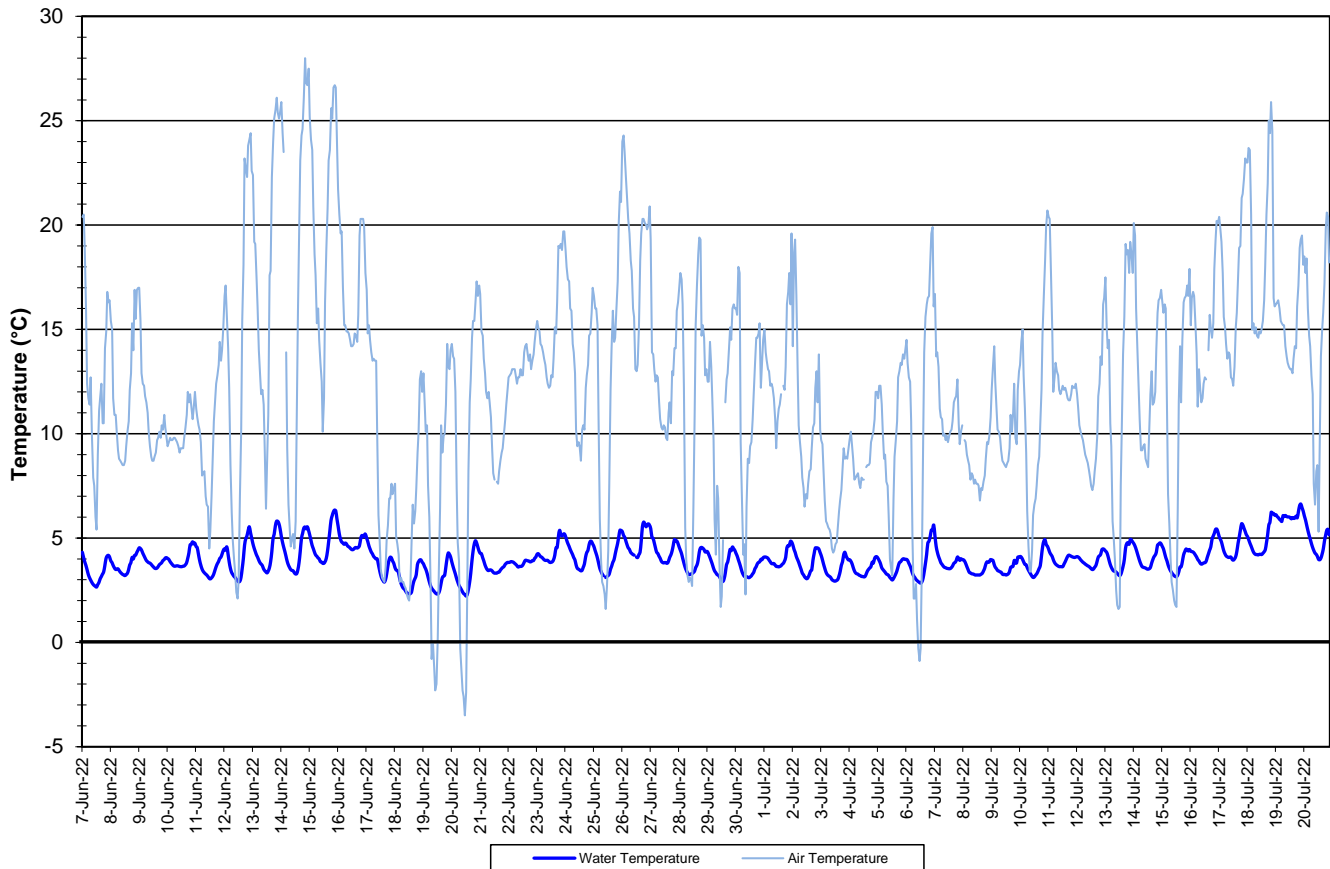


**Figure 8: Stage and Precipitation – Wabush Lake Network
(Weather data collected at climate station located near Moosehead Lake)**

Dumbell Stream

- Water temperature ranged from 2.22 to 6.63°C during this deployment period (Figure 9).
- Water temperature fluctuated within a small range during this deployment period. Water temperature at Dumbell Stream is typically much lower than other stations (Figure 9).

**Water and Air Temperature : Dumbell Stream above Dumbell Lake
June 7 to July 21, 2022**



**Figure 9: Water and Air Temperature – Dumbell Stream
(Weather data collected from climate station near Moosehead Lake)**

- pH ranged from 7.36 to 7.83 pH units (Figure 10). The median pH was 7.70.
- The pH sensor started to drift on June 25th. The erroneous data has been removed from the dataset and statistics. It is included on the graph for display purposes only.
- All valid values are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). pH fluctuates slightly throughout the day and night.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Water pH and Stage : Dumbell Stream above Dumbell Lake
June 7 to July 21, 2022

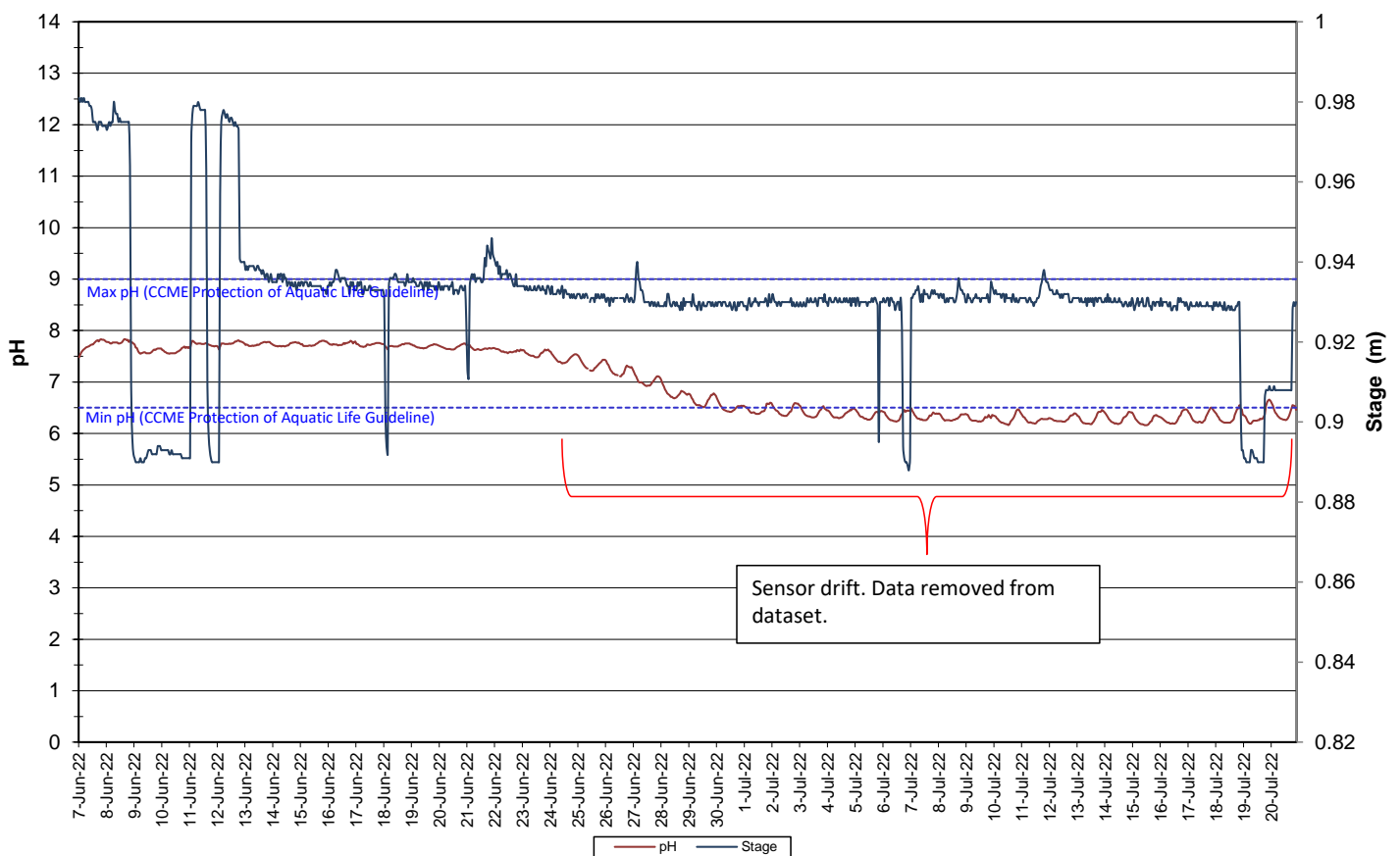


Figure 10: Water pH and Stage – Dumbell Stream

- Specific conductivity ranged from 76.6 to 301.0 $\mu\text{S}/\text{cm}$, throughout the deployment period (Figure 11).
- Specific conductivity is relatively stable over the course of the deployment period, with periodic decreases noted during or after precipitation events as the system is temporarily diluted.
- There is a large increase in conductivity at the end of the deployment period, this is likely due to runoff.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Specific Conductivity of Water and Precipitation: Dumbell Stream above Dumbell Lake
June 7 to July 21, 2022**

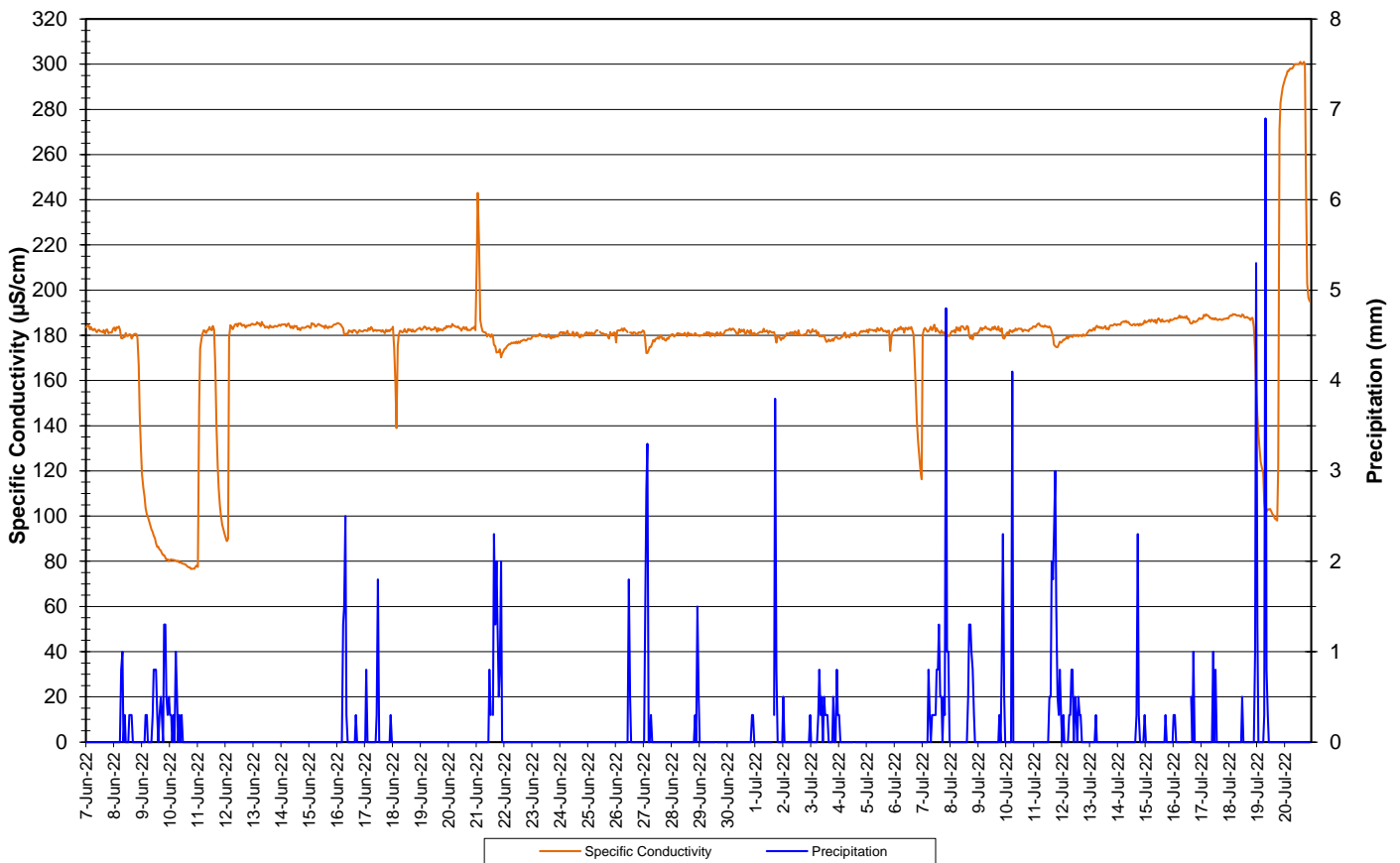


Figure 11: Specific conductivity and stage – Dumbell Stream

- The saturation of dissolved oxygen ranged from 86.3 to 92.4% while the dissolved oxygen content ranged from 10.76 to 12.51 mg/l with a median value of 11.79 mg/l (Figure 12).
- All values recorded at Dumbell Stream were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Other Life Stages of 6.5 mg/l and the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/l. The guidelines are indicated in blue on Figure 12.
- Dissolved oxygen was relatively stable during this deployment period. Dissolved oxygen fluctuated daily with decreases observed at night.

Dissolved Oxygen Concentration and Saturation : Dumbell Stream at Dumbell Lake
June 7 to July 21, 2022

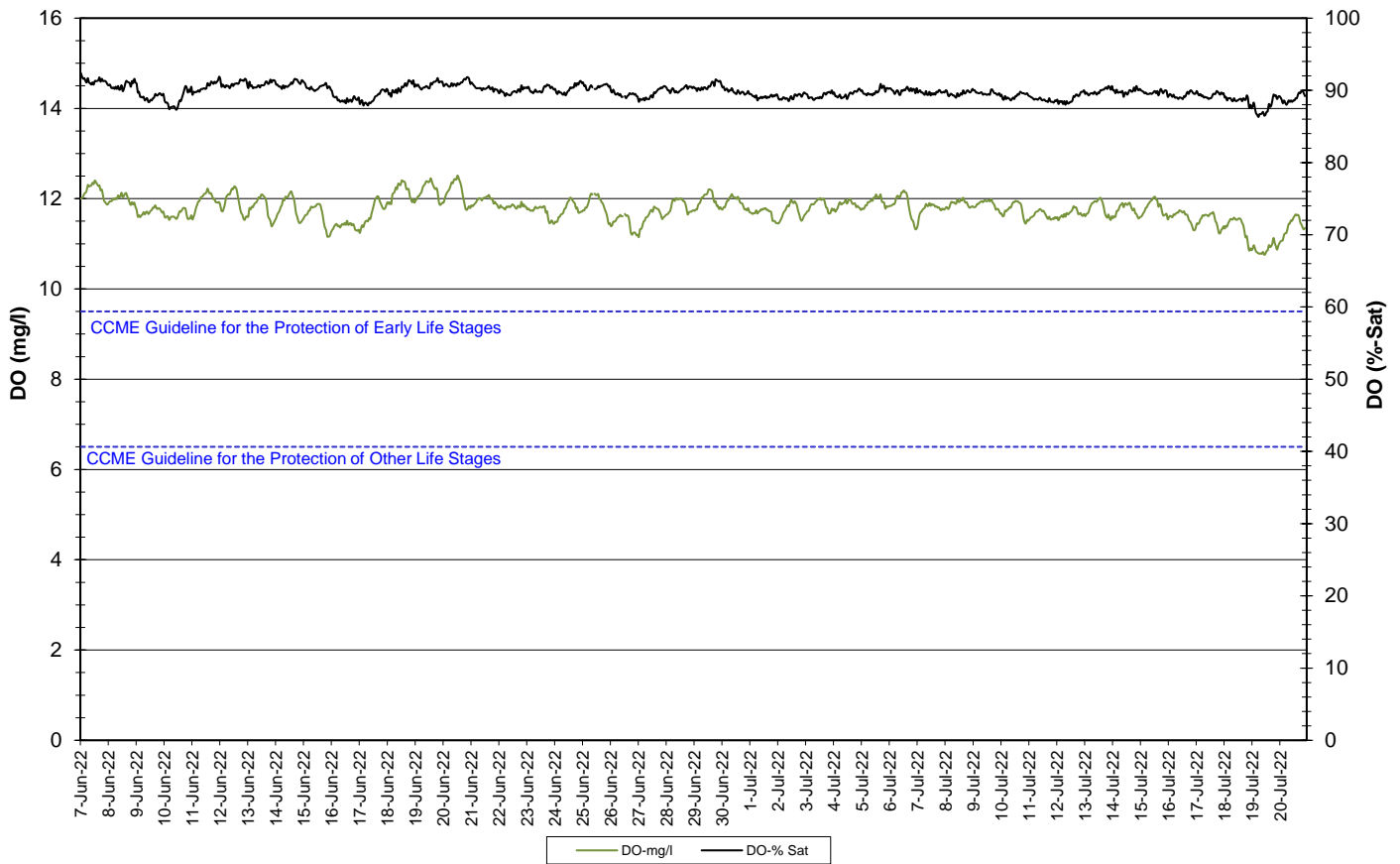
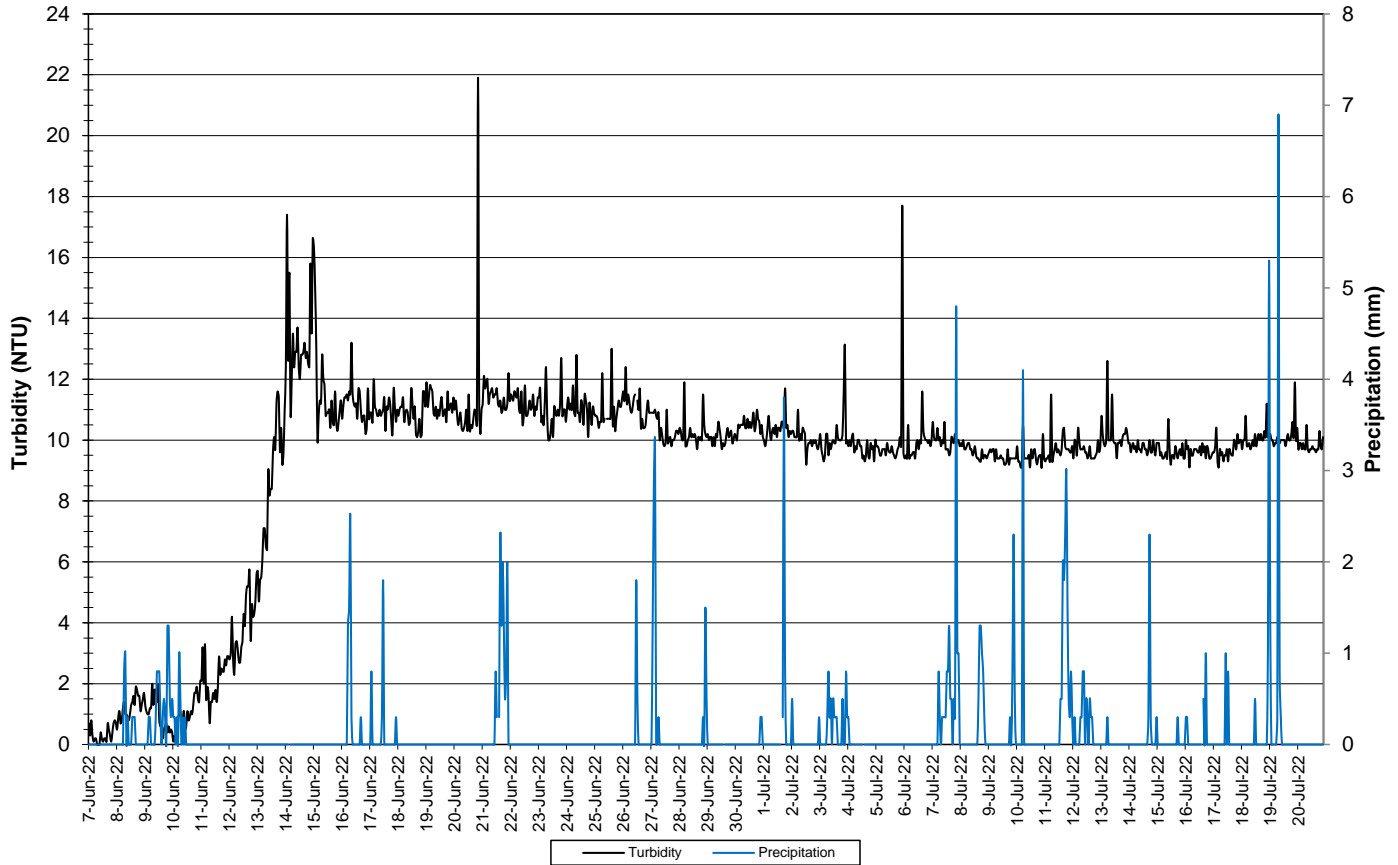


Figure 12: Dissolved oxygen – Dumbell Stream

- Turbidity values ranged from 0.0 NTU to 21.9 NTU, throughout the deployment period (Figure 13). The median value was 10.0 NTU. This elevated turbidity could be due to biofouling.

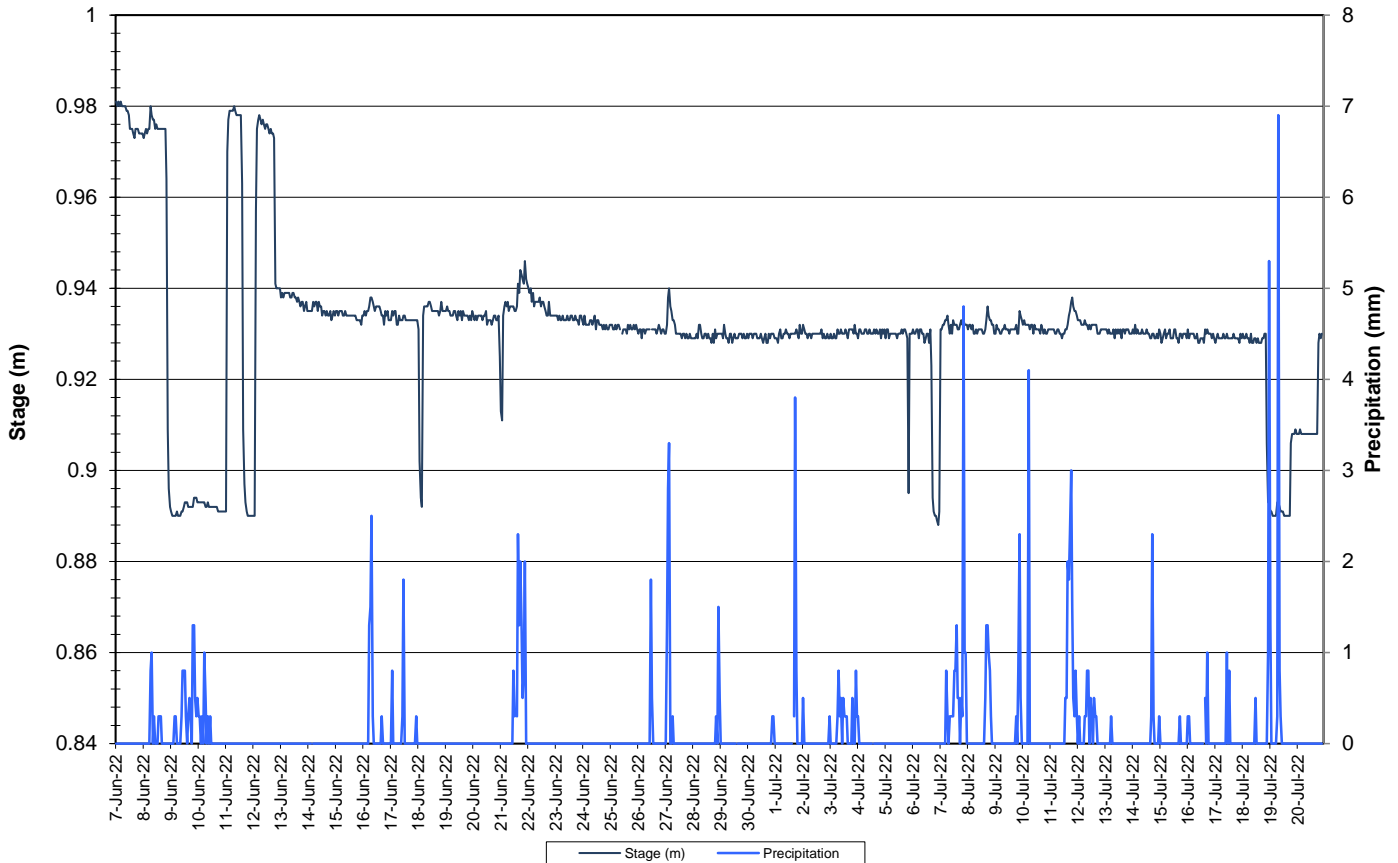
**Water Turbidity and Precipitation : Dumbell Stream above Dumbell Lake
June 7 to July 21, 2022**



**Figure 13: Turbidity and Precipitation – Dumbell Stream
(Weather data collected from climate station near Moosehead Lake)**

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Dumbell Stream (Figure 14).
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Stage and Precipitation: Dumbell Stream
June 7 to July 21, 2022**

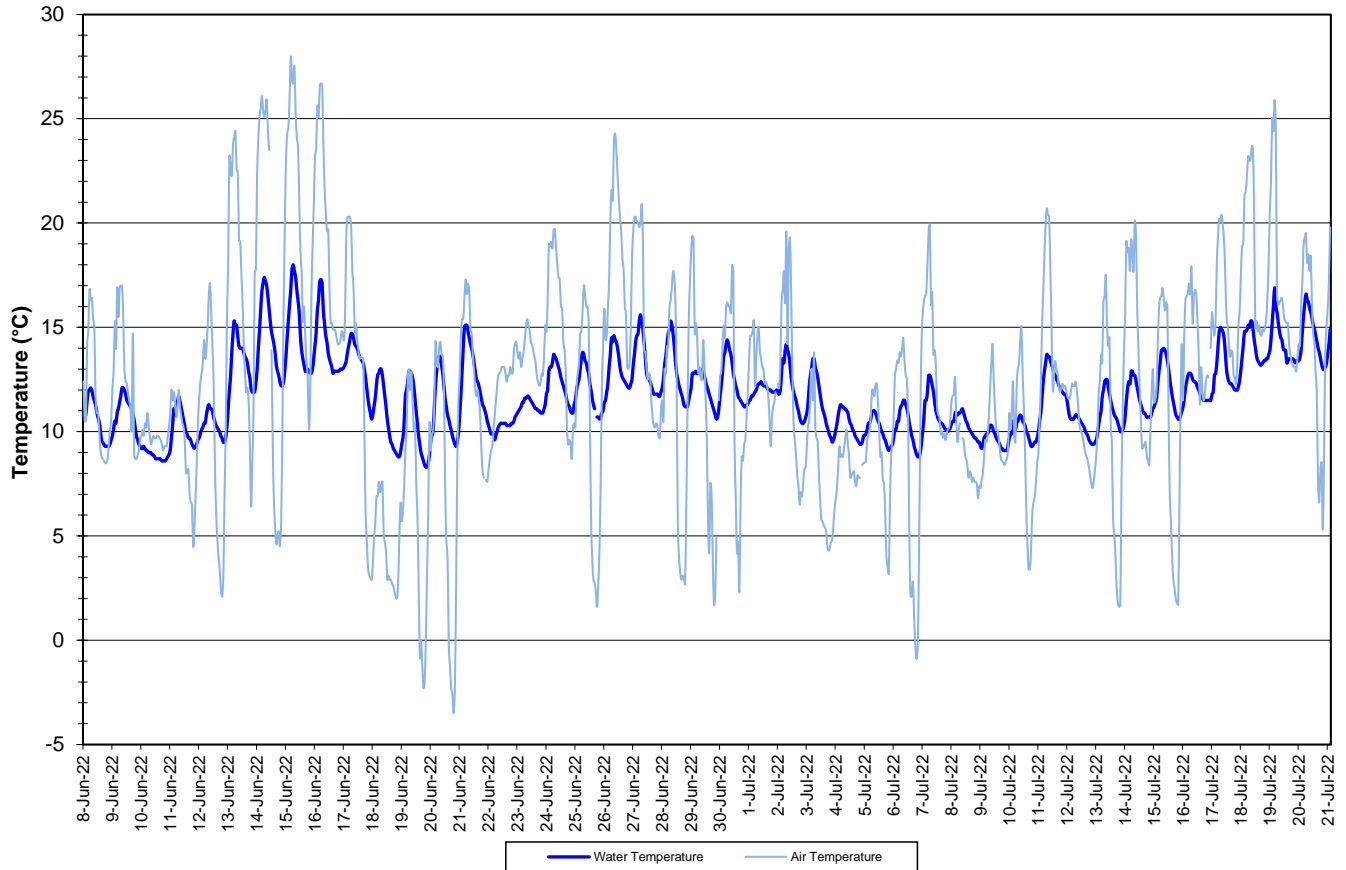


**Figure 14: Stage and Precipitation – Dumbell Stream
(Weather data collected from climate station near Moosehead Lake)**

Pumphouse Stream

- Water temperature ranged from 8.30 to 18.00°C during this deployment period (Figure 15).
- Water temperature decreased after the first week of the deployment, it then increased slightly at the end. Fluctuations corresponded with increases and decreases in ambient air temperature. (Figure 15).

**Water and Air Temperature : Pumphouse Stream above Drum Lake
June 8 to July 21, 2022**



**Figure 15: Water and Air Temperature – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)**

- The pH sensor drifted during the deployment period. The erroneous data has been removed from the dataset and statistics. This data is included on the graph for display purposes only.
- pH ranged from 7.53 to 8.07 pH units (Figure 16). The median pH was 7.83.
- All valid values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units).
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Water pH and Stage : Pumphouse Stream above Drum Lake
June 8 to July 21, 2022

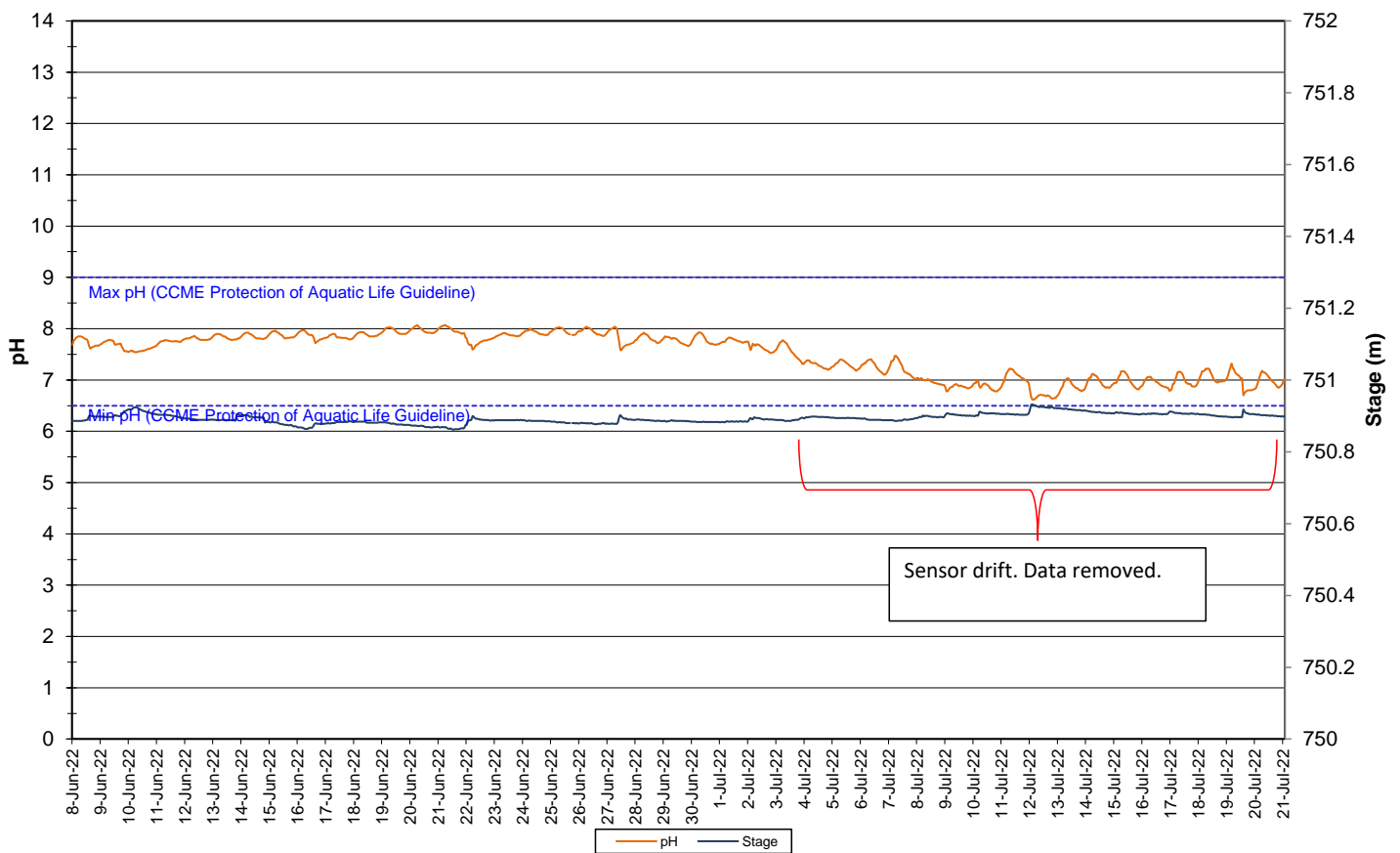
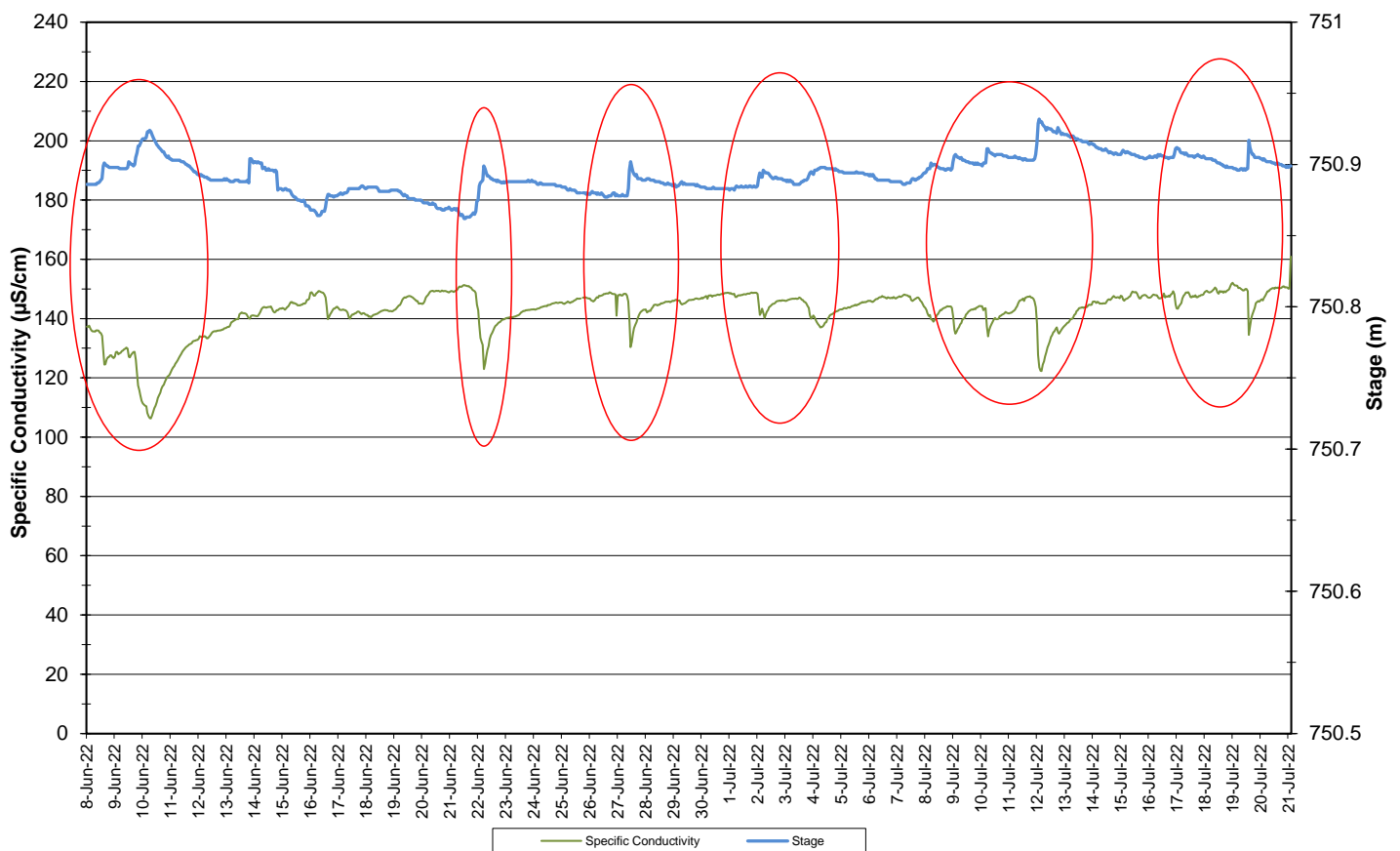


Figure 16: Water pH and Stage – Pumphouse Stream

- Specific conductivity ranged from 106.3 to 152.1 $\mu\text{S}/\text{cm}$, throughout the deployment period (Figure 17).
- The majority of decreases in specific conductivity correspond to increases in stage. As more water is added to the system from precipitation, the solids in the water are diluted, decreasing conductivity. Some correlations are identified on the graph in red.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Specific Conductivity of Water and Stage: Pumphouse Stream above Drum Lake
June 8 to July 21, 2022**



**Figure 17: Specific Conductivity and Stage – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)**

- The saturation of dissolved oxygen ranged from 75.7 to 91.1% while the dissolved oxygen ranged from 8.17 to 9.59 mg/l with a median value of 8.98 mg/l (Figure 18).
- All values recorded at Pumphouse Stream were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Other Life Stages of 6.5 mg/l. The majority of the values were below the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/l. The guidelines are indicated in blue on Figure 18.
- Dissolved oxygen decreased during the second week of deployment and at the end of the deployment period when water temperatures were at the warmest. Dissolved oxygen fluctuated daily with decreases observed at night.

Dissolved Oxygen Concentration and Saturation : Pumphouse Stream above Drum Lake
June 8 to July 20, 2022

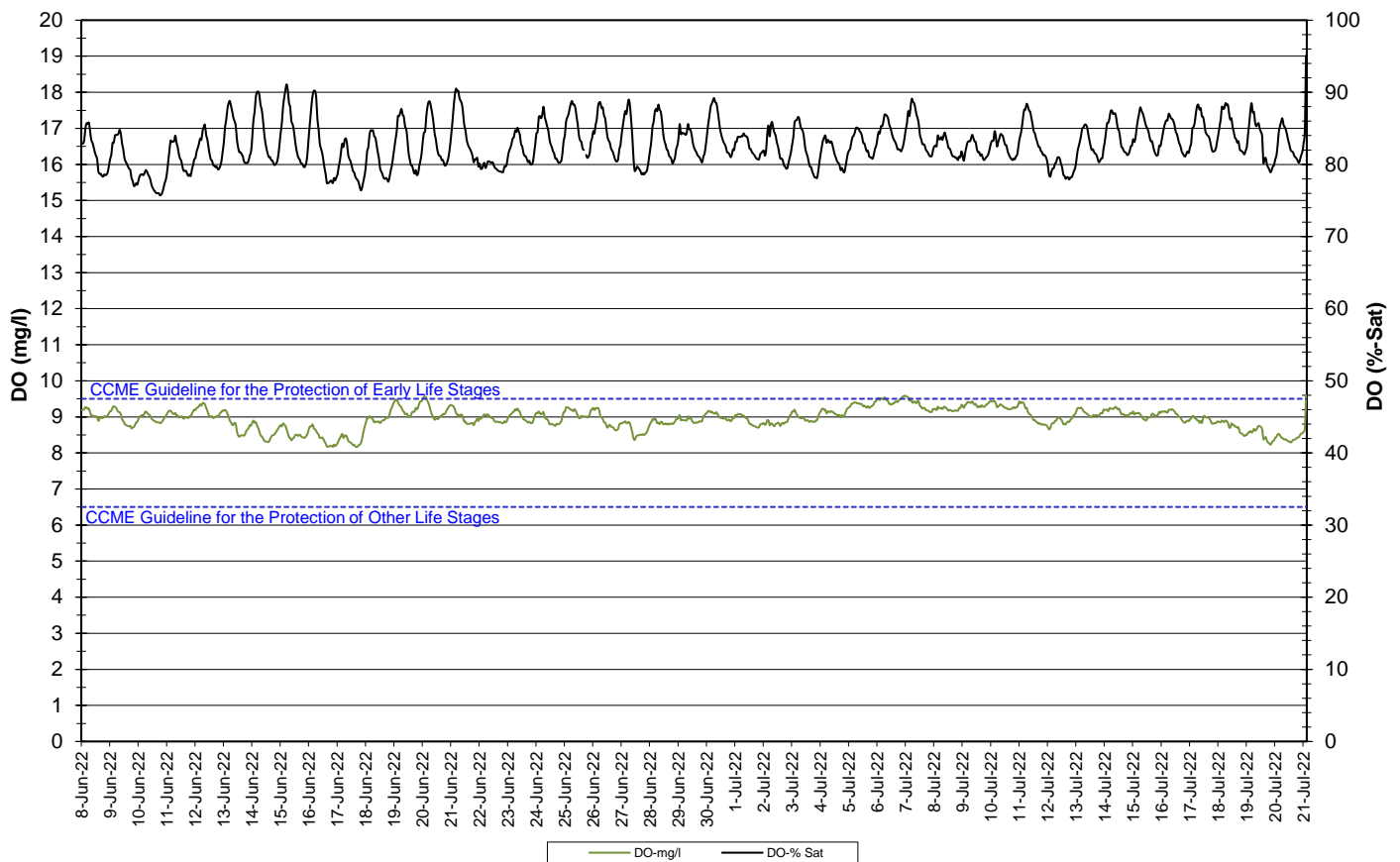
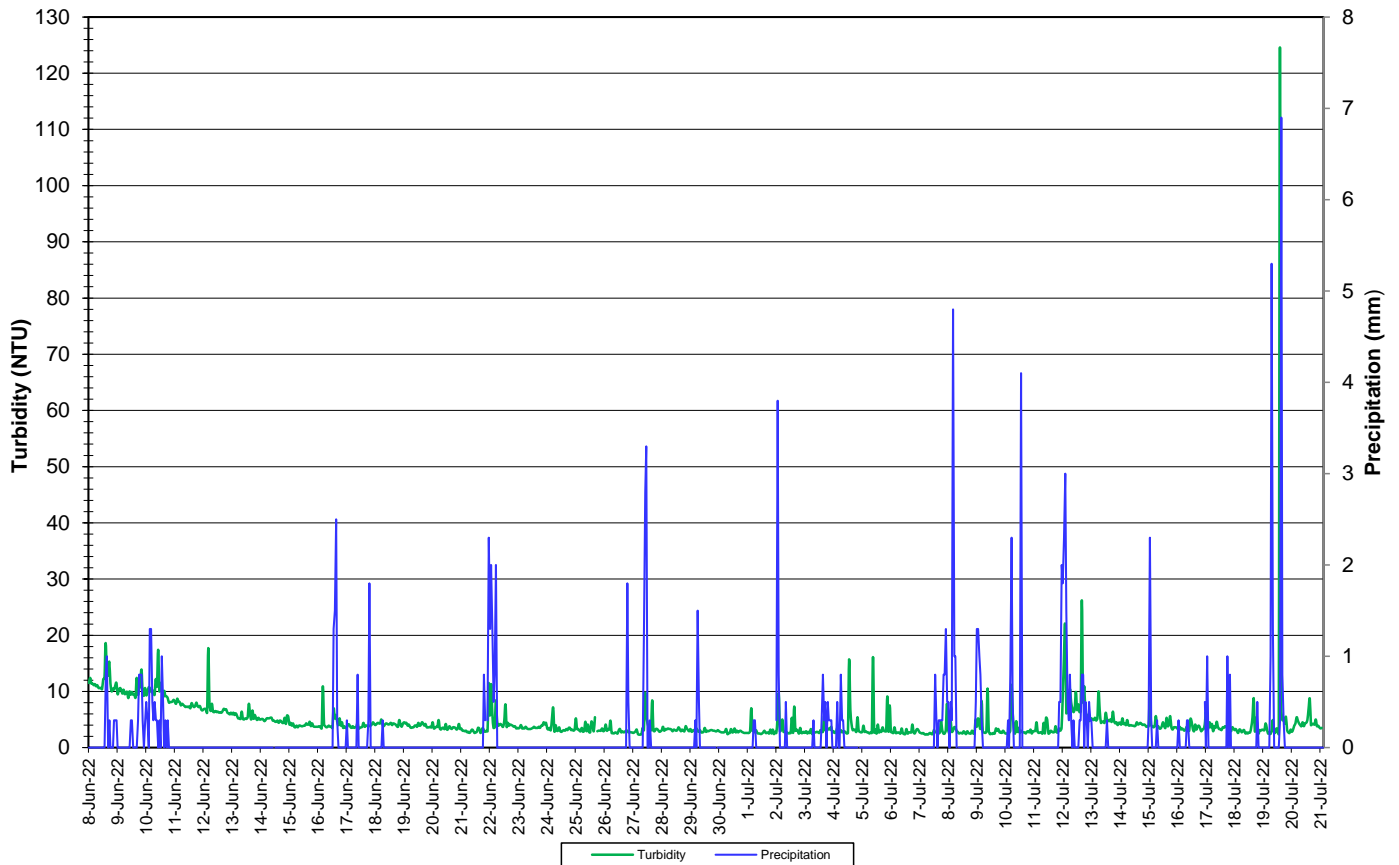


Figure 18: Dissolved Oxygen – Pumphouse Stream

- Turbidity values range from 2.3 to 124.6 NTU throughout the deployment period (Figure 19). The median value was 3.6 NTU.
- In some instances, turbidity spikes can be attributed to precipitation events.

**Water Turbidity and Precipitation : Pumphouse Stream above Drum Lake
June 8 to July 21, 2022**



**Figure 19a: Turbidity and Precipitation – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)**

Water Turbidity <30 NTU and Precipitation : Pumphouse Stream above Drum Lake
June 8 to July 21, 2022

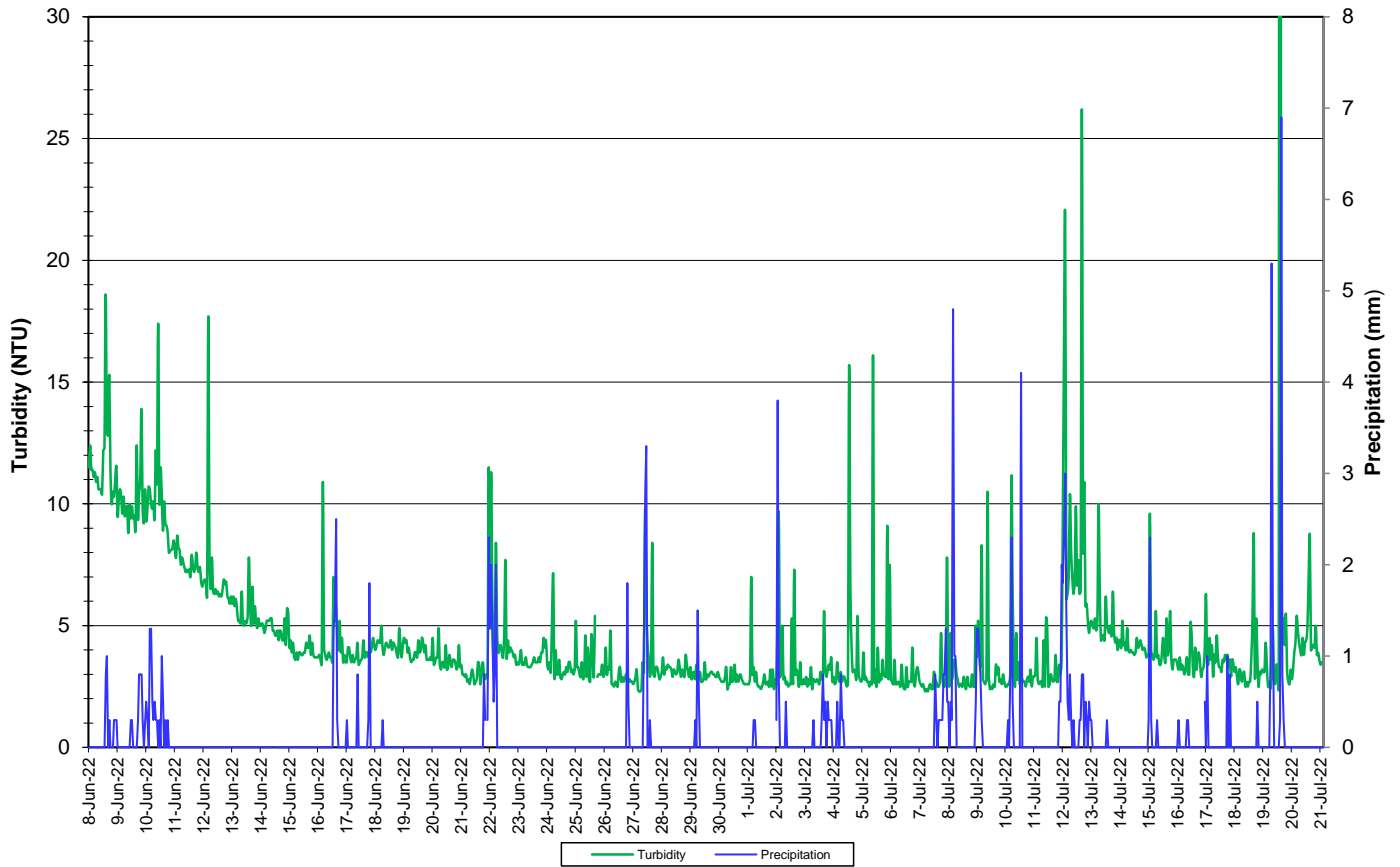
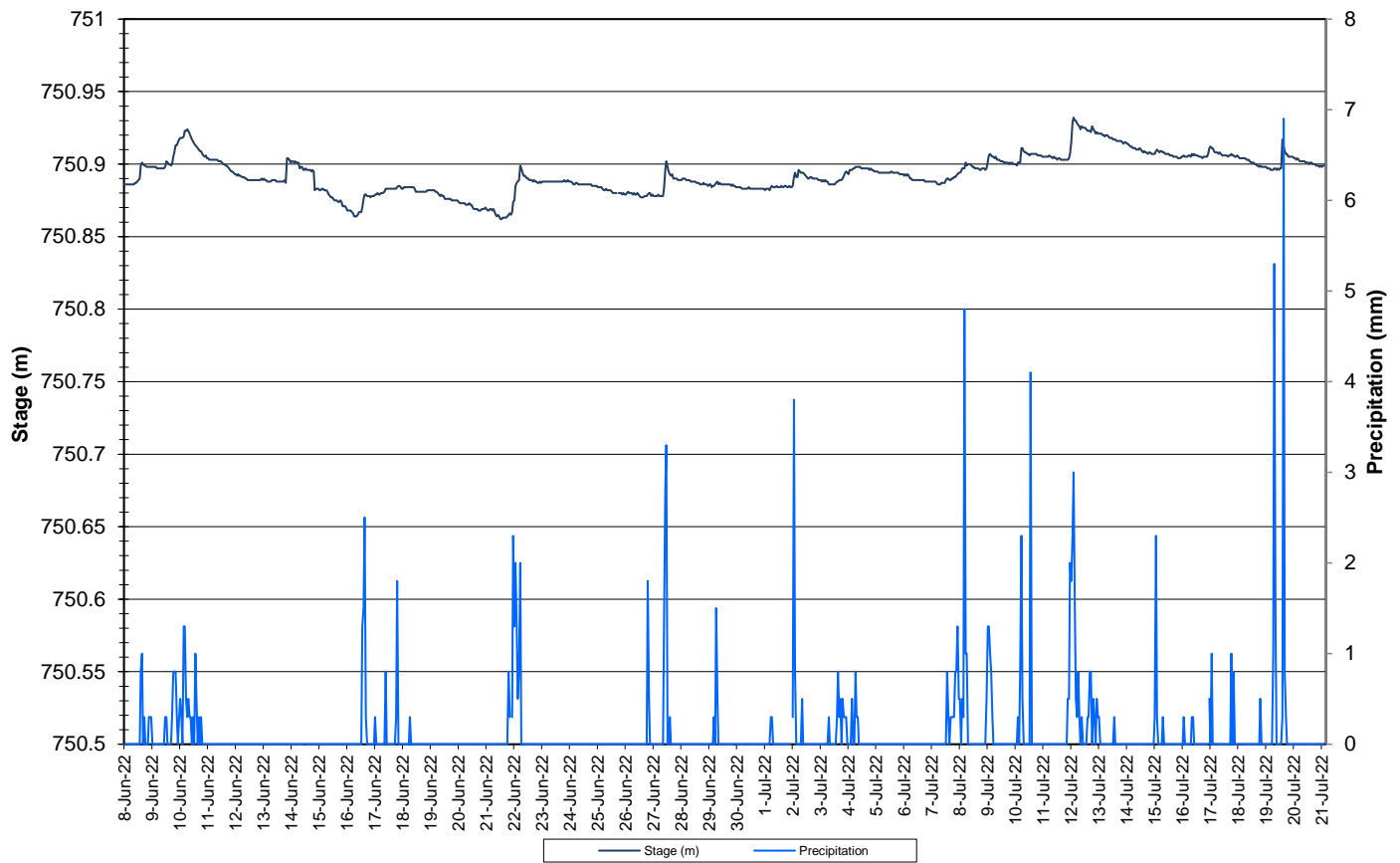


Figure 19b: Turbidity <30 NTU and Precipitation – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Pumphouse Stream (Figure 20).
- Overall, stage increased after high precipitation events.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

**Stage & Precipitation: Pumphouse Stream
June 8 to July 21, 2022**



**Figure 20: Stage and Precipitation – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)**

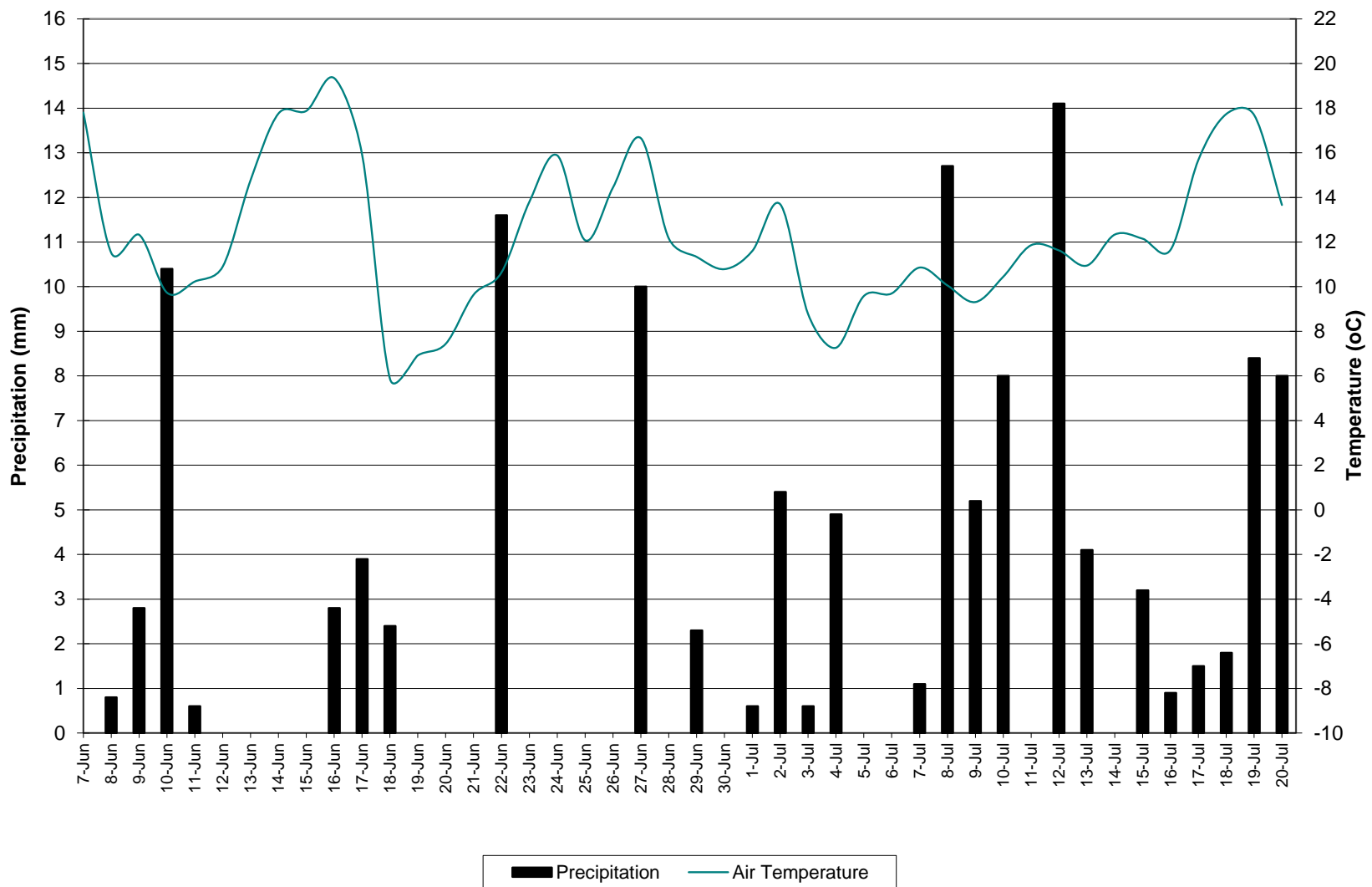
Conclusions

- Instruments were deployed between June 7th and 8th, and removed by July 21st, 2022. This was the first deployment period for this season.
- In most cases, precipitation events or increase/decreases in water level could be used to explain the data fluctuations. Most values recorded were within ranges as suggested by the CCME Guidelines for the Protection of Aquatic Life for pH and dissolved oxygen.
- Water temperature corresponded with air temperature at all stations. Temperature typically ranged between 2.22 and 18.00°C at these stations.
- All of the pH values were within the recommended CCME Guidelines for the Protection of Aquatic Life. pH ranged between 7.19 and 8.15. Fluctuations were noted between day and night.
- Specific conductivity differed between the two Wabush Lake stations. This can be attributed to varying concentrations of iron ore tailings deposited between the stations. Specific conductivity ranged from 43.6 µs/cm to 118.10 µs/cm at the Wabush Lake stations, 76.6 to 301.0 µs/cm at Dumbell Stream and 106.3 to 152.1 µs/cm at Pumphouse Stream.
- At all four stations, all dissolved oxygen values were above the minimum CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Other Life Stages of 6.5 mg/L. When dissolved oxygen values are compared to the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Early Life Stages of 9.5 mg/L, the majority of the values were above this guideline, except for those at Pumphouse Stream.
- At Pumphouse Stream, notable increases and decreases in parameters are related to precipitation. This is a small stream, thus more sensitive to increases in stage.
- Turbidity at Dolomite Road and Julienne Narrows ranged from 0.0 to 1624.0 NTU.
- Turbidity at Dumbell Stream ranged from 0.0 NTU to 21.9 NTU, this could be due to biofouling.
- Turbidity at Pumphouse Stream ranged from 2.3 to 124.6 NTU.
- At Julienne Narrows and Dolomite Road, stage decreased. At Dolomite Road, there were slight increases after precipitation events.
- At Dumbell Stream, stage showed periodic increases after precipitation events but decreased overall. There were occasional decreases; these decreases may not be accurate.
- At Pumphouse Stream, stage increased after precipitation events.
- With the exception of of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

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Appendix 1

Daily Air Temperature and Precipitation: Moosehead Lake, NL June 7 to July 20, 2022



Appendix 2
QA/QC Grab Sample Results



BUREAU
VERITAS

Bureau Veritas Job #: C2G1158
Report Date: 2022/06/27

NL Department of Environment, Climate Change and
Municipalities
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM542 JULIENNE NARROWS								
Sampling Date		2022/06/07 09:45						
Matrix		W						
Sample #		2022-6303-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	57	1.0	mg/L	N/A	2022/06/21		8048416
Nitrate (N)	-	0.55	0.050	mg/L	N/A	2022/06/22		8048419
Total dissolved solids (calc., EC)	-	64	1.0	mg/L	N/A	2022/06/21		8048524
Inorganics								
Conductivity	-	120	1.0	uS/cm	N/A	2022/06/21	NGI	8064561
Chloride (Cl-)	-	1.7	1.0	mg/L	N/A	2022/06/20	SRU	8060546
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/06/20	SRU	8060546
Sulphate (SO4)	-	4.1	1.0	mg/L	N/A	2022/06/20	SRU	8060546
Total Alkalinity (Total as CaCO3)	-	54	2.0	mg/L	N/A	2022/06/21	NGI	8064567
Colour	-	14	5.0	TCU	N/A	2022/06/21	MCN	8064431
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/06/21	NGI	8064568
Total Kjeldahl Nitrogen (TKN)	-	0.11	0.10	mg/L	2022/06/20	2022/06/22	MJ1	8064190
Nitrate + Nitrite (N)	-	0.56	0.050	mg/L	N/A	2022/06/21	MCN	8064436
Nitrite (N)	-	0.010	0.010	mg/L	N/A	2022/06/21	MCN	8064438
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/06/16	MCN	8057422
Dissolved Organic Carbon (C)	-	3.0	0.50	mg/L	N/A	2022/06/26	KMC	8075219
Total Organic Carbon (C)	-	2.9	0.50	mg/L	N/A	2022/06/24	JHH	8072887
pH	-	7.86		pH	N/A	2022/06/21	NGI	8064565
Total Phosphorus	-	ND	0.004	mg/L	2022/06/21	2022/06/22	SSV	8056751
Total Suspended Solids	-	1.6	1.0	mg/L	2022/06/13	2022/06/15	A1M	8049123
Turbidity	-	4.6	0.10	NTU	N/A	2022/06/21	NGI	8064653
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/06/20	2022/06/21	EPU	8062383
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.061	0.0050	mg/L	2022/06/23	2022/06/23	JHY	8069928
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Barium (Ba)	-	0.0025	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Boron (B)	-	ND	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Calcium (Ca)	-	13	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Copper (Cu)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Iron (Fe)	-	0.27	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Magnesium (Mg)	-	5.7	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Manganese (Mn)	-	0.072	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062700



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NL Department of Environment, Climate Change and
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Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM542 JULIENNE NARROWS								
Sampling Date		2022/06/07 09:45						
Matrix		W						
Sample #		2022-6303-00-SI-SP						
Registration #		WS-S-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Potassium (K)	-	1.2	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Sodium (Na)	-	1.9	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Strontium (Sr)	-	0.017	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Uranium (U)	-	0.00013	0.00010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/06/20	2022/06/21	JHY	8062700



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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM544 DOLOMITE ROAD								
Sampling Date		2022/06/07 11:35						
Matrix		W						
Sample #		2022-6305-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	22	1.0	mg/L	N/A	2022/06/21		8048416
Nitrate (N)	-	ND	0.050	mg/L	N/A	2022/06/22		8048419
Total dissolved solids (calc., EC)	-	25	1.0	mg/L	N/A	2022/06/21		8048524
Inorganics								
Conductivity	-	45	1.0	uS/cm	N/A	2022/06/21	NGI	8064561
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Sulphate (SO4)	-	1.3	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Total Alkalinity (Total as CaCO3)	-	21	2.0	mg/L	N/A	2022/06/21	NGI	8064567
Colour	-	34	5.0	TCU	N/A	2022/06/21	MCN	8064431
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/06/21	NGI	8064568
Total Kjeldahl Nitrogen (TKN)	-	ND	0.10	mg/L	2022/06/20	2022/06/21	MJ1	8064190
Nitrate + Nitrite (N)	-	0.061	0.050	mg/L	N/A	2022/06/21	MCN	8064436
Nitrite (N)	-	0.013	0.010	mg/L	N/A	2022/06/21	MCN	8064438
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/06/20	MCN	8062357
Dissolved Organic Carbon (C)	-	5.2	0.50	mg/L	N/A	2022/06/26	KMC	8075219
Total Organic Carbon (C)	-	5.4	0.50	mg/L	N/A	2022/06/24	JHH	8072895
pH	-	7.41		pH	N/A	2022/06/21	NGI	8064565
Total Phosphorus	-	0.008	0.004	mg/L	2022/06/22	2022/06/24	SSV	8065190
Total Suspended Solids	-	1.4	1.0	mg/L	2022/06/13	2022/06/15	A1M	8049123
Turbidity	-	1.4	0.10	NTU	N/A	2022/06/21	NGI	8064653
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/06/20	2022/06/21	EPU	8062383
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.051	0.0050	mg/L	2022/06/23	2022/06/23	JHY	8069928
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Barium (Ba)	-	0.0079	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Boron (B)	-	ND	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Calcium (Ca)	-	5.2	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Copper (Cu)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Iron (Fe)	-	0.096	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Magnesium (Mg)	-	2.2	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Manganese (Mn)	-	0.021	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062700



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Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM544 DOLOMITE ROAD								
Sampling Date		2022/06/07 11:35						
Matrix		W						
Sample #		2022-6305-00-SI-SP						
Registration #		WS-S-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Potassium (K)	-	0.75	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Sodium (Na)	-	0.61	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Strontium (Sr)	-	0.010	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Uranium (U)	-	ND	0.00010	mg/L	2022/06/20	2022/06/21	JHY	8062700
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/06/20	2022/06/21	JHY	8062700



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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM545 DUMBELL STREAM								
Sampling Date		2022/06/07 17:19						
Matrix		W						
Sample #		2022-6306-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	87	1.0	mg/L	N/A	2022/06/21		8048416
Nitrate (N)	-	9.4	0.25	mg/L	N/A	2022/06/22		8048419
Total dissolved solids (calc., EC)	-	110	1.0	mg/L	N/A	2022/06/21		8048524
Inorganics								
Conductivity	-	190	1.0	uS/cm	N/A	2022/06/21	NGI	8064561
Chloride (Cl-)	-	2.7	1.0	mg/L	N/A	2022/06/20	SRU	8060546
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/06/20	SRU	8060546
Sulphate (SO4)	-	8.2	1.0	mg/L	N/A	2022/06/20	SRU	8060546
Total Alkalinity (Total as CaCO3)	-	44	2.0	mg/L	N/A	2022/06/21	NGI	8064567
Colour	-	ND	5.0	TCU	N/A	2022/06/21	MCN	8064431
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/06/21	NGI	8064568
Total Kjeldahl Nitrogen (TKN)	-	ND(1)	0.50	mg/L	2022/06/20	2022/06/22	MJ1	8064190
Nitrate + Nitrite (N)	-	9.4	0.25	mg/L	N/A	2022/06/21	MCN	8064436
Nitrite (N)	-	0.020	0.010	mg/L	N/A	2022/06/21	MCN	8064438
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/06/20	MCN	8062357
Dissolved Organic Carbon (C)	-	0.85	0.50	mg/L	N/A	2022/06/26	KMC	8075219
Total Organic Carbon (C)	-	0.71	0.50	mg/L	N/A	2022/06/23	JHH	8069827
pH	-	7.74		pH	N/A	2022/06/21	NGI	8064565
Total Phosphorus	-	ND	0.004	mg/L	2022/06/21	2022/06/22	SSV	8056751
Total Suspended Solids	-	ND	1.0	mg/L	2022/06/13	2022/06/15	A1M	8049123
Turbidity	-	0.64	0.10	NTU	N/A	2022/06/21	NGI	8064653
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/06/20	2022/06/21	EPU	8062383
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.014	0.0050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Barium (Ba)	-	0.0037	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Boron (B)	-	ND	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Calcium (Ca)	-	20	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Copper (Cu)	-	0.00060	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Iron (Fe)	-	ND	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Magnesium (Mg)	-	8.9	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.



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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM545 DUMBELL STREAM								
Sampling Date 2022/06/07 17:19								
Matrix W								
Sample # 2022-6306-00-SI-SP								
Registration # WS-S-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.0023	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Potassium (K)	-	1.3	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Sodium (Na)	-	0.88	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Strontium (Sr)	-	0.023	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Uranium (U)	-	ND	0.00010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/06/20	2022/06/21	JHY	8062905



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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM546 PUMPHOUSE STREAM								
Sampling Date		2022/06/08 09:20						
Matrix		W						
Sample #		2022-6307-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	72	1.0	mg/L	N/A	2022/06/21		8048416
Nitrate (N)	-	1.9	0.050	mg/L	N/A	2022/06/22		8048419
Total dissolved solids (calc., EC)	-	78	1.0	mg/L	N/A	2022/06/21		8048524
Inorganics								
Conductivity	-	140	1.0	uS/cm	N/A	2022/06/21	NGI	8064561
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Sulphate (SO4)	-	6.4	1.0	mg/L	N/A	2022/06/17	SUR	8058222
Total Alkalinity (Total as CaCO3)	-	59	2.0	mg/L	N/A	2022/06/21	NGI	8064567
Colour	-	8.3	5.0	TCU	N/A	2022/06/21	MCN	8064431
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/06/21	NGI	8064568
Total Kjeldahl Nitrogen (TKN)	-	ND	0.10	mg/L	2022/06/20	2022/06/21	MJ1	8064190
Nitrate + Nitrite (N)	-	1.9	0.050	mg/L	N/A	2022/06/21	MCN	8064436
Nitrite (N)	-	0.016	0.010	mg/L	N/A	2022/06/21	MCN	8064438
Nitrogen (Ammonia Nitrogen)	-	0.064	0.050	mg/L	N/A	2022/06/20	MCN	8062357
Dissolved Organic Carbon (C)	-	1.9	0.50	mg/L	N/A	2022/06/26	JHH	8073391
Total Organic Carbon (C)	-	2.0	0.50	mg/L	N/A	2022/06/24	JHH	8072895
pH	-	7.83		pH	N/A	2022/06/21	NGI	8064565
Total Phosphorus	-	0.007	0.004	mg/L	2022/06/22	2022/06/24	SSV	8065190
Total Suspended Solids	-	2.4	1.0	mg/L	2022/06/13	2022/06/15	A1M	8049123
Turbidity	-	5.2	0.10	NTU	N/A	2022/06/21	NGI	8064653
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/06/20	2022/06/21	EPU	8062383
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.099	0.0050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Barium (Ba)	-	0.0095	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Boron (B)	-	ND	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Calcium (Ca)	-	18	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Copper (Cu)	-	0.00051	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Iron (Fe)	-	0.48	0.050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Magnesium (Mg)	-	6.8	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Manganese (Mn)	-	0.20	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062905



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Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
SWM546 PUMPHOUSE STREAM								
Sampling Date		2022/06/08 09:20						
Matrix		W						
Sample #		2022-6307-00-SI-SP						
Registration #		WS-S-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Potassium (K)	-	1.3	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Sodium (Na)	-	0.46	0.10	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Strontium (Sr)	-	0.017	0.0020	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Uranium (U)	-	0.00013	0.00010	mg/L	2022/06/20	2022/06/21	JHY	8062905
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/06/20	2022/06/21	JHY	8062905