

Real-Time Water Quality Deployment Report

Iron Ore Company of Canada
Labrador West Network

July 20 to
September 8, 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 July 20th and 21st, real-time water quality monitoring instruments were deployed at the four IOC stations. The instruments were deployed for a period of 48-50 days at each station. The instruments were removed between September 7th and 8th. This was the second deployment of 2022 for these stations.
- The instrument at Pumphouse Stream was not removed in September, as a replacement instrument was not available. For the purpose of this report, only data from July 21st to September 7th will be included.



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 July 20-21 and September 07-08 are summarized in Table 2.

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

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Dolomite Road	July 20, 2022	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	Sept 08, 2022	Removal	Excellent	Excellent	Excellent	Excellent	Poor
Julienne Narrows	July 20, 2022	Deployment	Excellent	Excellent	Excellent	Excellent	Good
	Sept 08, 2022	Removal	Excellent	Excellent	Fair	Excellent	Excellent
Dumbell Stream	July 21, 2022	Deployment	Excellent	Excellent	Excellent	Good	Poor
	Sept 07, 2022	Removal	Good	Good	Excellent	Fair	Good
Pumphouse Stream	July 21, 2022	Deployment	Excellent	Excellent	Excellent	Fair	Excellent
	Oct 20, 2022	Removal	Excellent	Good	Good	Good	Excellent

▪ **Dolomite Road**

At deployment, all parameters ranked ‘excellent’.

At removal, all parameters except turbidity ranked ‘excellent’. Turbidity ranked ‘poor’. The field instrument read a value of 10.3 NTU, while the QA/QC instrument read a value of 0.0 NTU.

▪ **Julienne Narrows**

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

At removal, all parameters except conductivity ranked ‘excellent’. Conductivity ranked ‘fair’. The field instrument read a value of 121.5 µs/cm, while the QA/QC instrument read a value of 107.9 µs/cm.

▪ **Dumbell Stream**

At deployment, all parameters except turbidity ranked either ‘excellent’ or ‘good’. Turbidity ranked ‘poor’. The field instrument read a value of 12.0 NTU, while the QA/QC instrument read a value of 0.0 NTU.

At removal, all parameters except dissolved oxygen ranked either ‘good’ or ‘excellent’. Dissolved oxygen ranked ‘fair’. The field instrument read a value of 12.18 mg/l, while the QA/QC instrument read a value of 11.60 mg/l.

▪ **Pumphouse Stream**

At deployment and removal, all parameters except dissolved oxygen ranked ‘excellent’. Dissolved oxygen ranked ‘fair’. The field instrument read a value of 9.53 mg/l, while the QA/QC instrument read a value of 8.95 mg/l.

At 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.

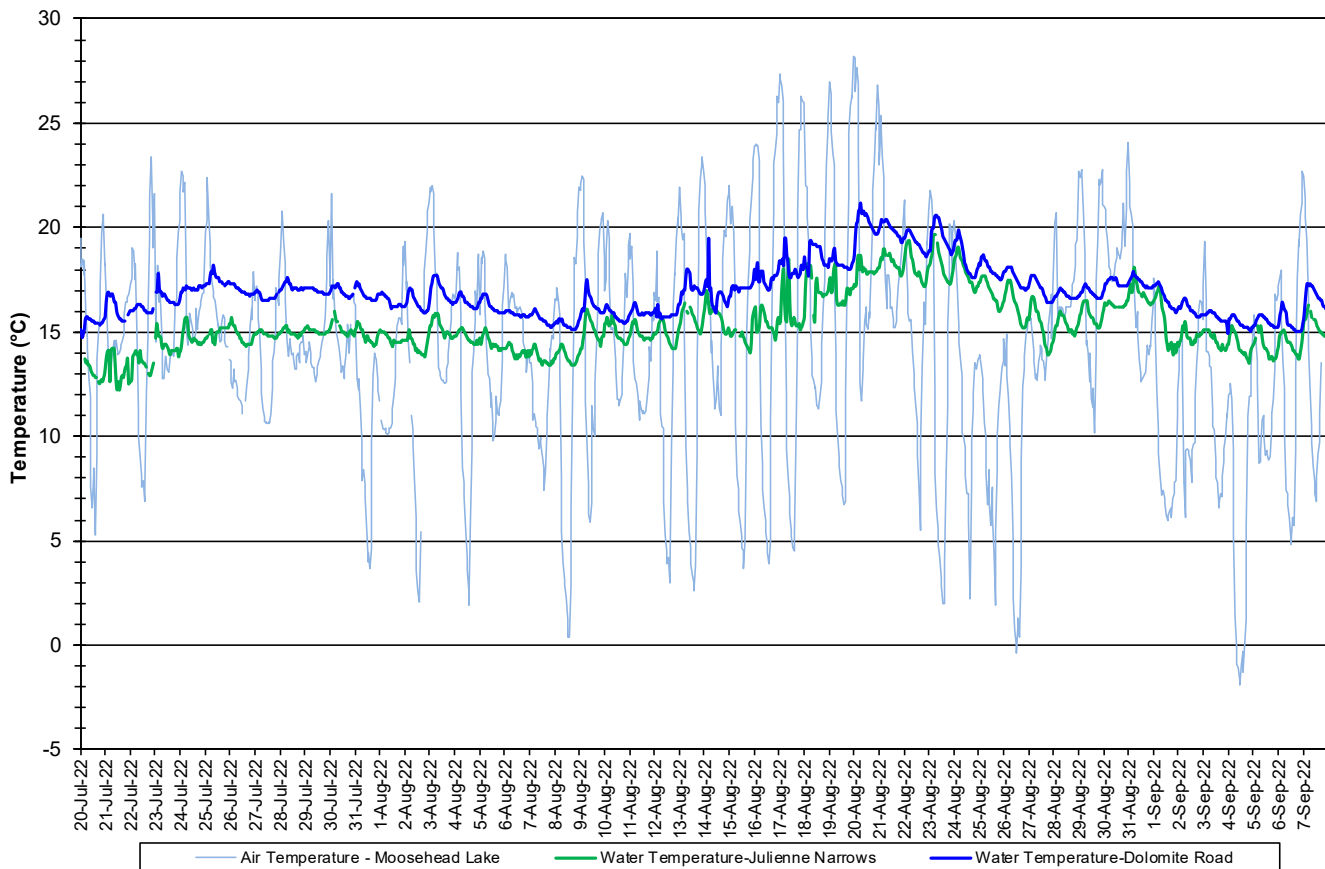
Data Interpretation

- The following graphs and discussion illustrate water quality-related events from July 20-21 to September 07-08, 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 14.70 to 21.20°C at Dolomite Road and 12.20 to 19.70°C at Julienne Narrows during this deployment period (Figure 2).
- Water temperature at both stations fluctuated during this deployment period. Water temperature corresponded to increases/decreases in ambient air temperature trends (Figure 2).

**Water and Air Temperature : Wabush Lake Network
July 20 to September 8, 2022**



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

- pH ranges from 6.22 to 7.88 pH units at Dolomite Road, and from 7.18 to 8.30 pH units at Julienne Narrows throughout the deployment period (Figure 3). The median pH is 6.76 and 7.93 units respectively.
- At Julienne Narrows, all values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units), while at Dolomite Road, most values were within this range. pH fluctuates slightly throughout the day and night.
- At Dolomite Road, there is a decrease in pH during the first week of August. This corresponds with a rise in stage due to precipitation. Some values were below the CCME Guidelines for the Protection of Aquatic Life of 6.5 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: Wabush Lake Network
July 20 to September 8, 2022**

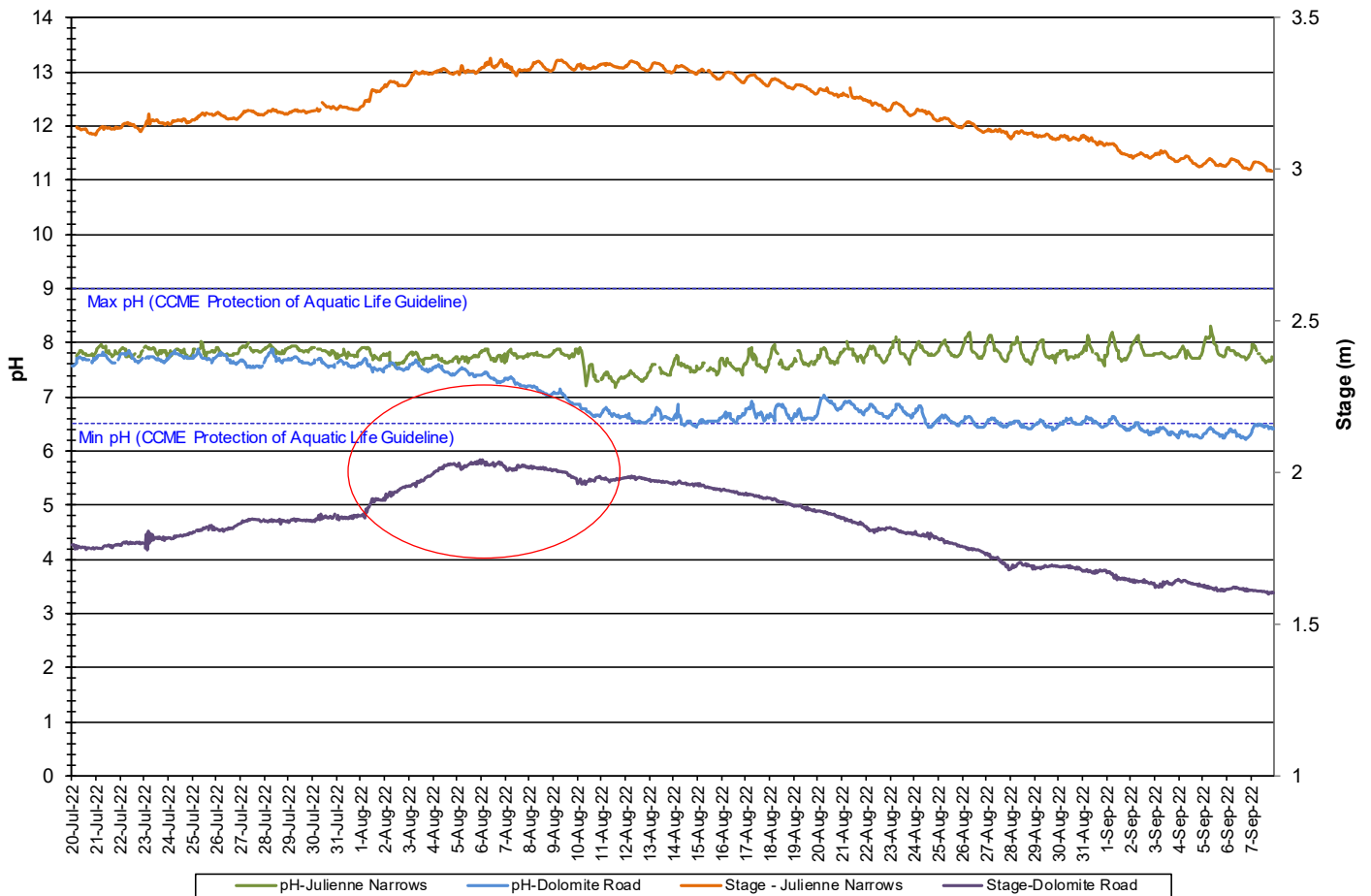


Figure 3: Water pH and Stage– Wabush Lake network

- Specific conductivity ranged from 42.2 to 58.0 $\mu\text{S}/\text{cm}$ at Dolomite Road and from 62.6 to 209.0 $\mu\text{S}/\text{cm}$ 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.
- From August 22nd, there is unusual conductivity activity at Julienne Narrows. This corresponds with an increase in turbidity activity; this could be due to sediment buildup around the sonde and sensors.
- 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
July 20 to September 8, 2022**

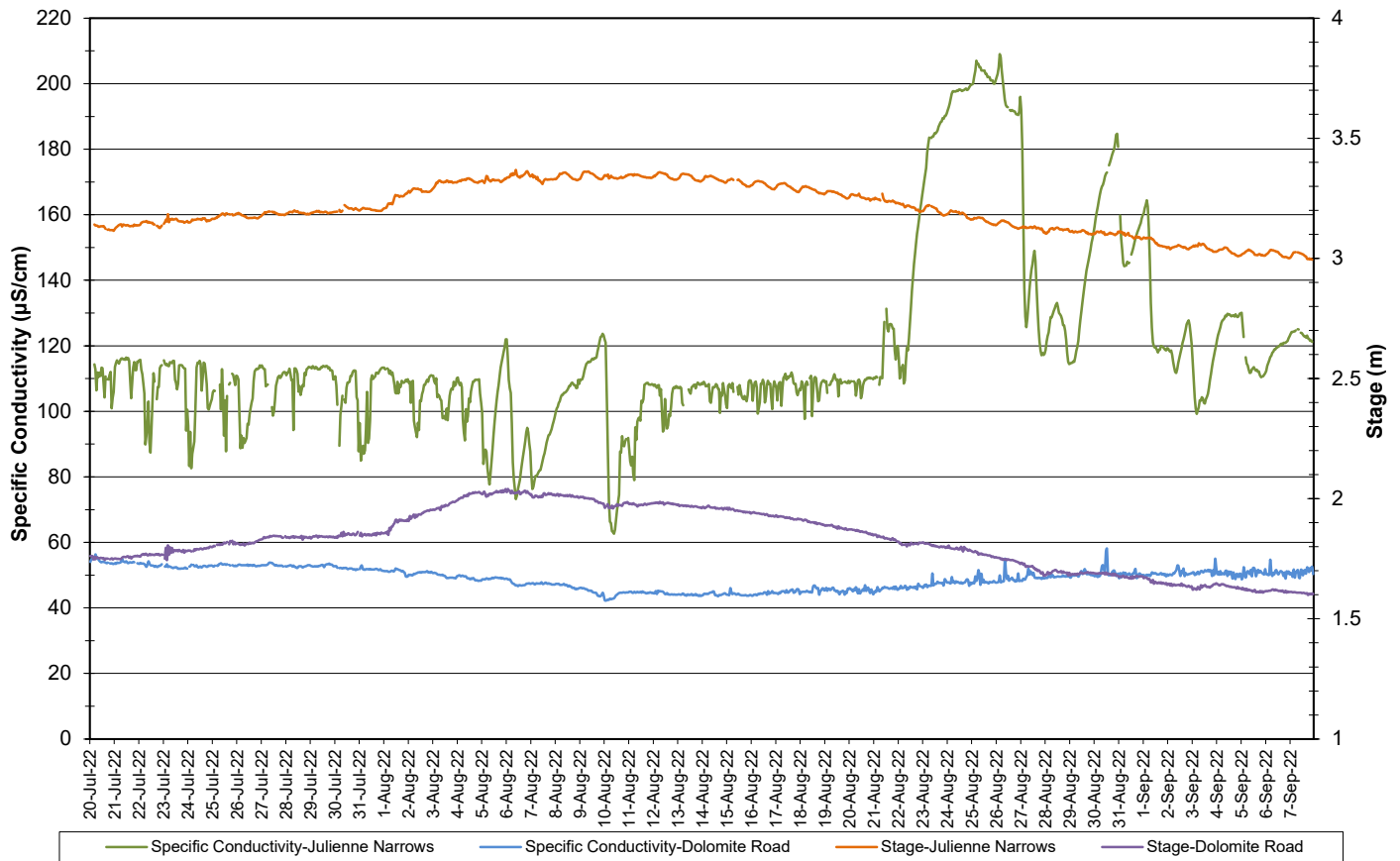


Figure 4: Specific Conductivity and Stage – Wabush Lake network

- At the Dolomite Road station, the saturation of dissolved oxygen ranged from 84.8 to 105.9% while the dissolved oxygen content ranged from 8.33 to 9.63 mg/l with a median value of 8.91 mg/l (Figure 5).
- At the Julienne Narrows station, the saturation of dissolved oxygen ranged from 88.2 to 110.2% while the dissolved oxygen content ranged from 8.49 to 11.03 mg/l with a median value of 9.63 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 were below the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota of Early Life Stages of 9.5 mg/l, while the majority of the values at Julienne Narrows were above this guideline. The guidelines are indicated in blue on Figure 5.
- Overall, 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
July 20 to September 8, 2022**

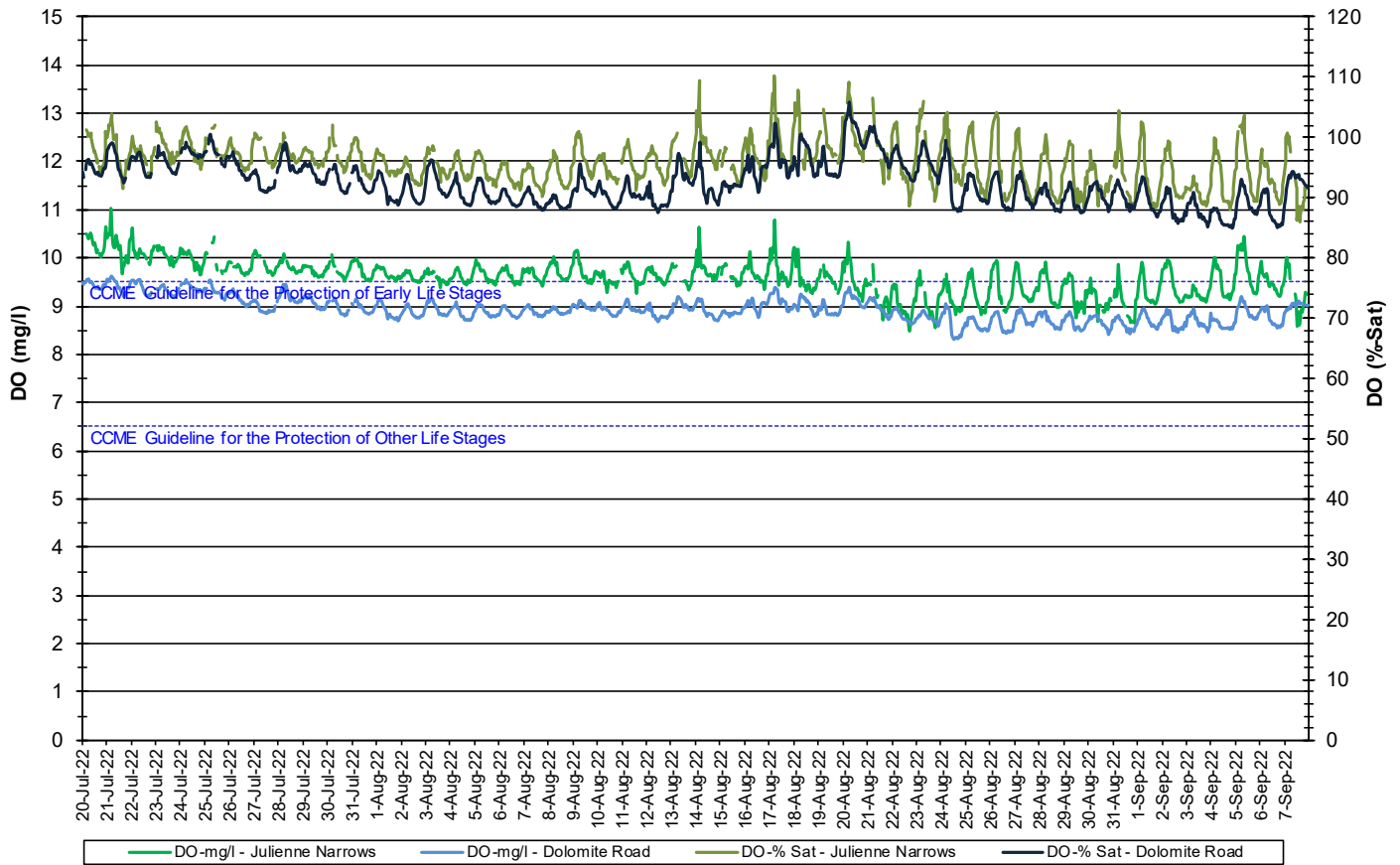
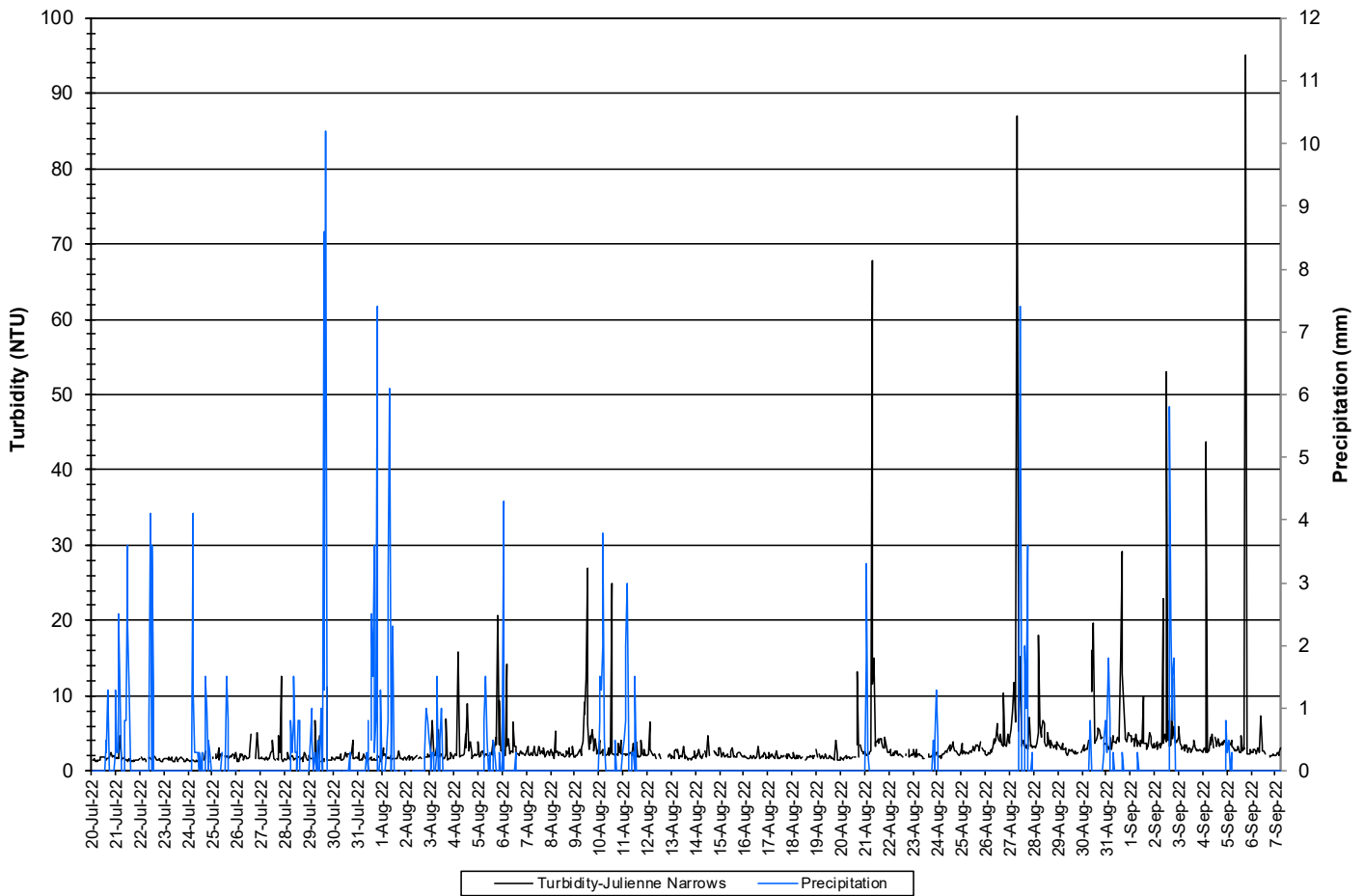


Figure 5: Dissolved Oxygen and Percent Saturation – Wabush Lake Network

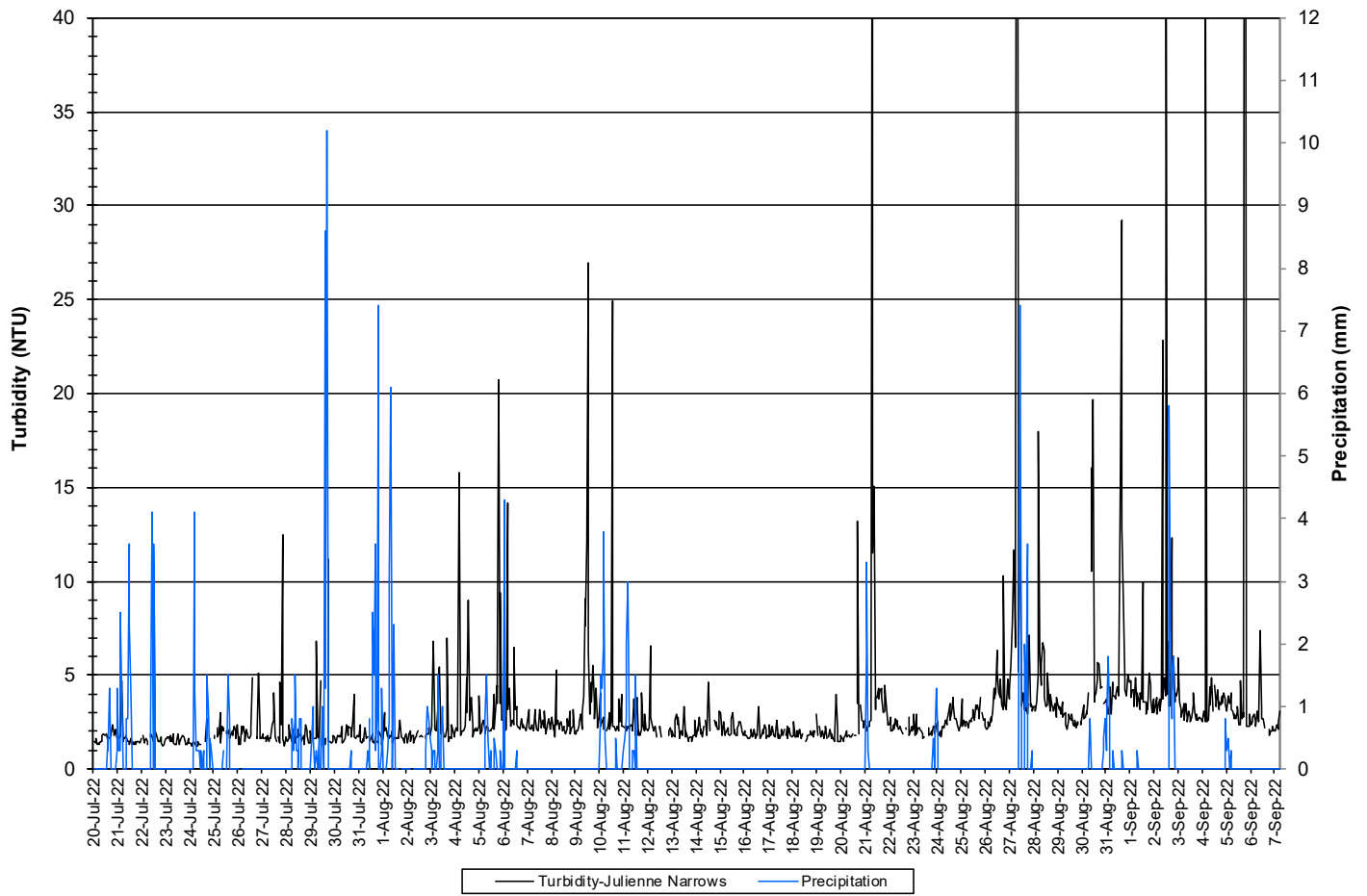
- At the Julienne Narrows station, turbidity values range from 1.2 to 87.0 NTU throughout the deployment period (Figure 6a). The median value was 0.0 NTU, indicating low background turbidity levels.
- In some instances, turbidity spikes can be attributed to precipitation events. Others may be the result of wave action near the instrument. Large spikes were infrequent and for short periods of time.

**Water Turbidity and Precipitation: Julienne Narrows
July 20 to September 8, 2022**



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

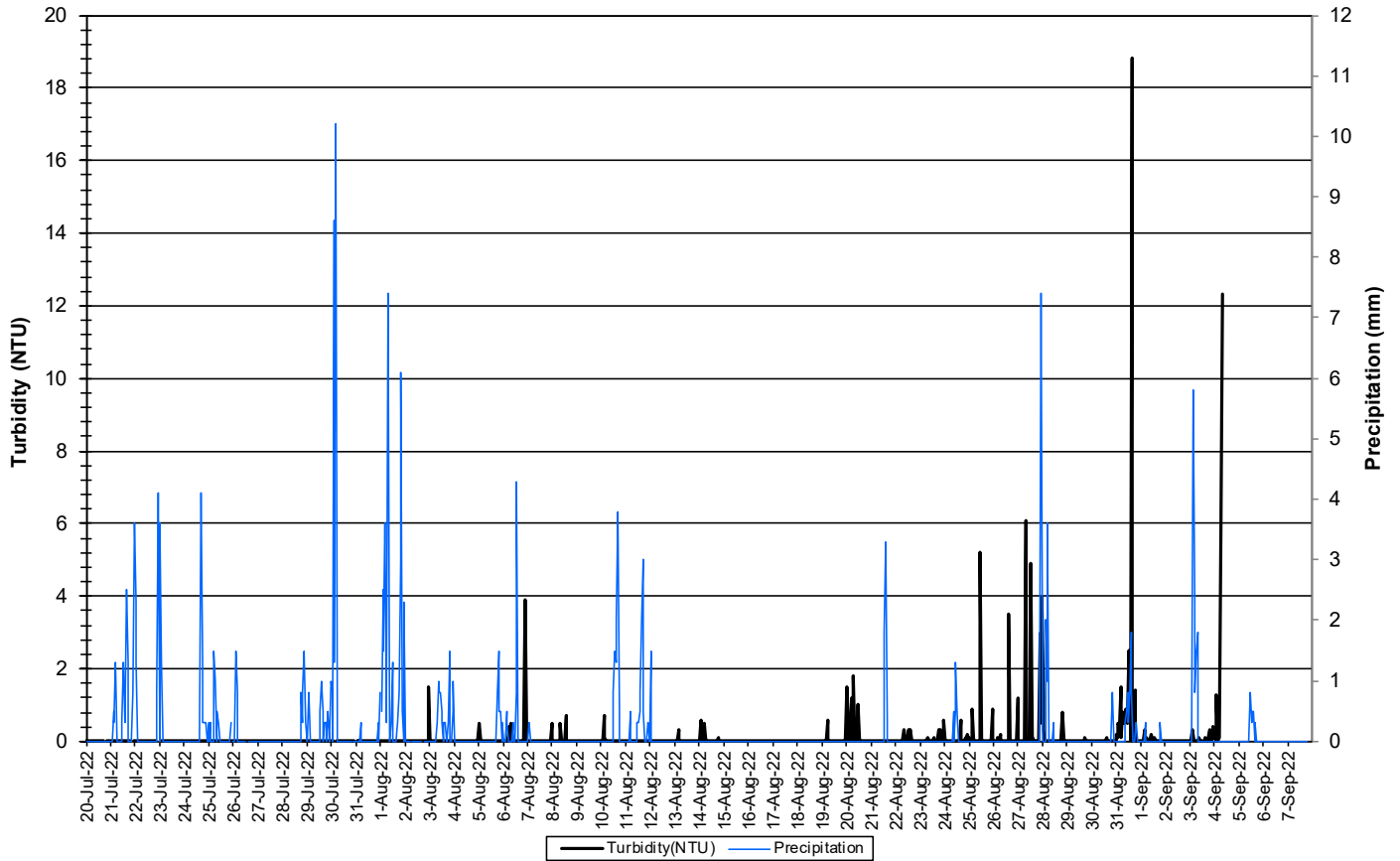
**Water Turbidity <40 NTU and Precipitation: Julienne Narrows
July 20 to September 8, 2022**



**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 18.8 NTU throughout the deployment period (Figure 7). The median value was 0.0 NTU.

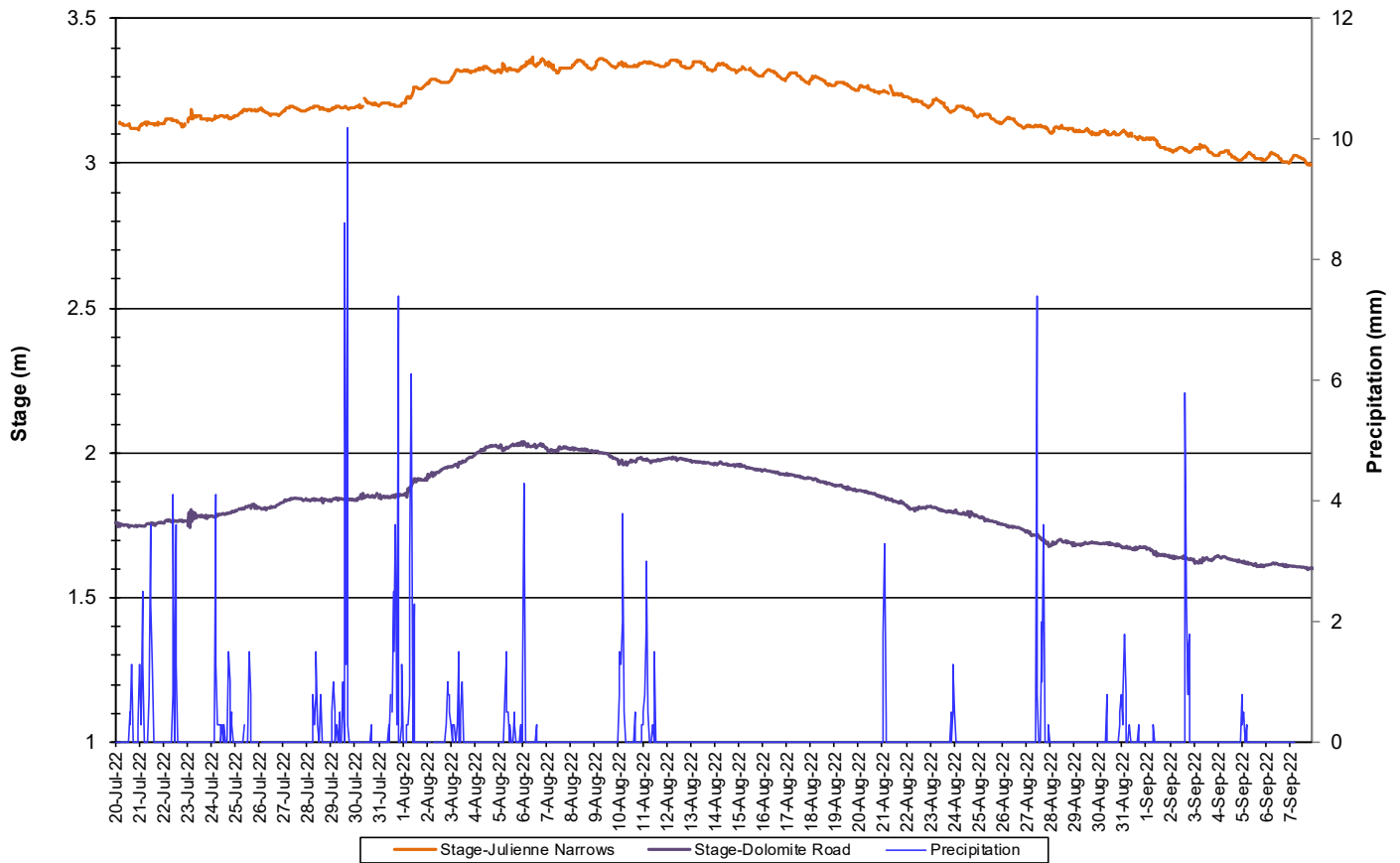
**Turbidity and Precipitation : Dolomite Road
July 20 to September 8, 2022**



**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 increased at both Julienne Narrows and Dolomite Road at the beginning of August. It then decreased gradually over the remainder of the deployment period.
- 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
July 20 to September 8, 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 2.65 to 7.46°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
July 21 to September 7, 2022

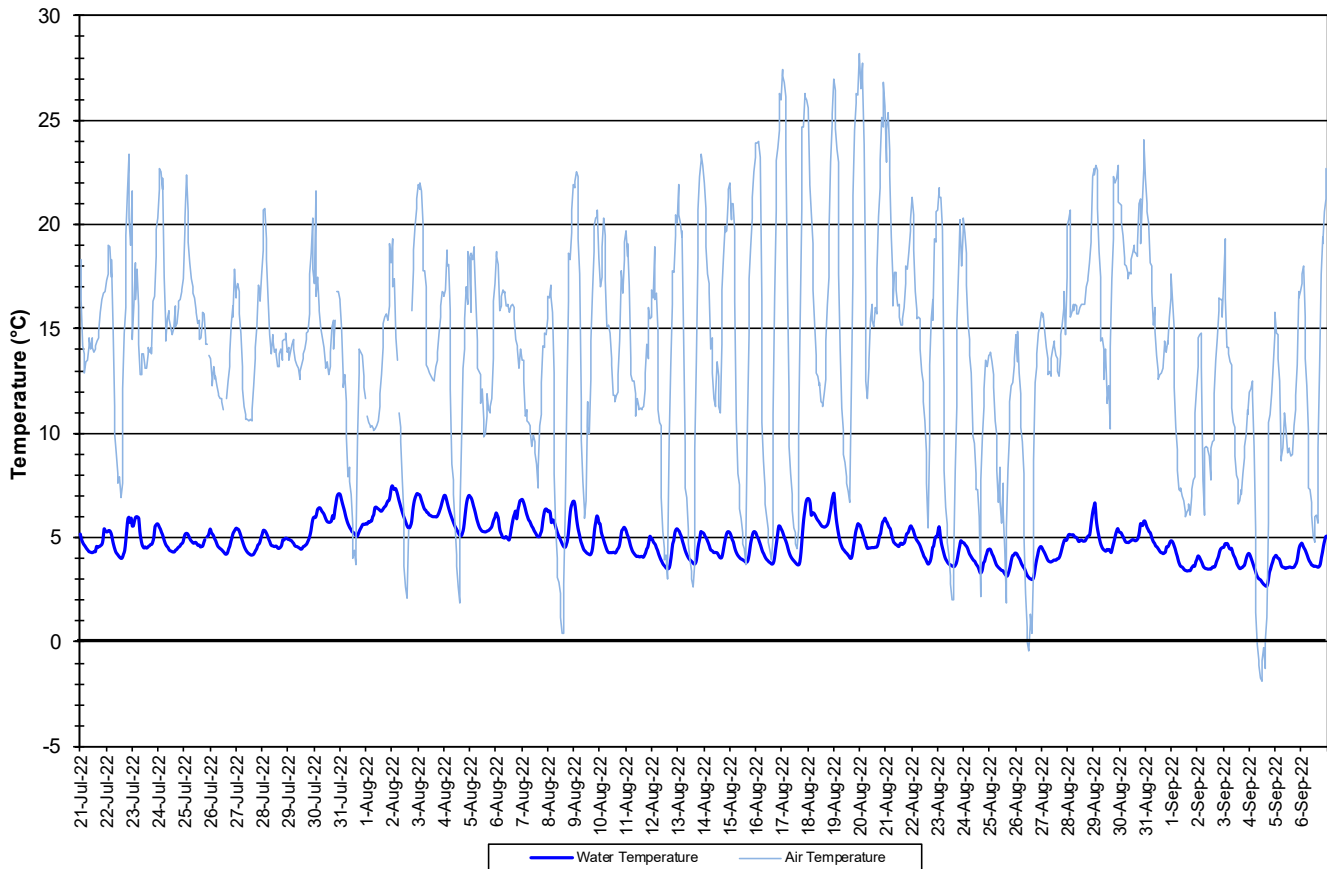


Figure 9: Water and Air Temperature – Dumbell Stream
(Weather data collected from climate station near Moosehead Lake)

- pH ranged from 6.95 to 7.86 pH units (Figure 10). The median pH was 7.49.
- 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
July 21 to September 7, 2022

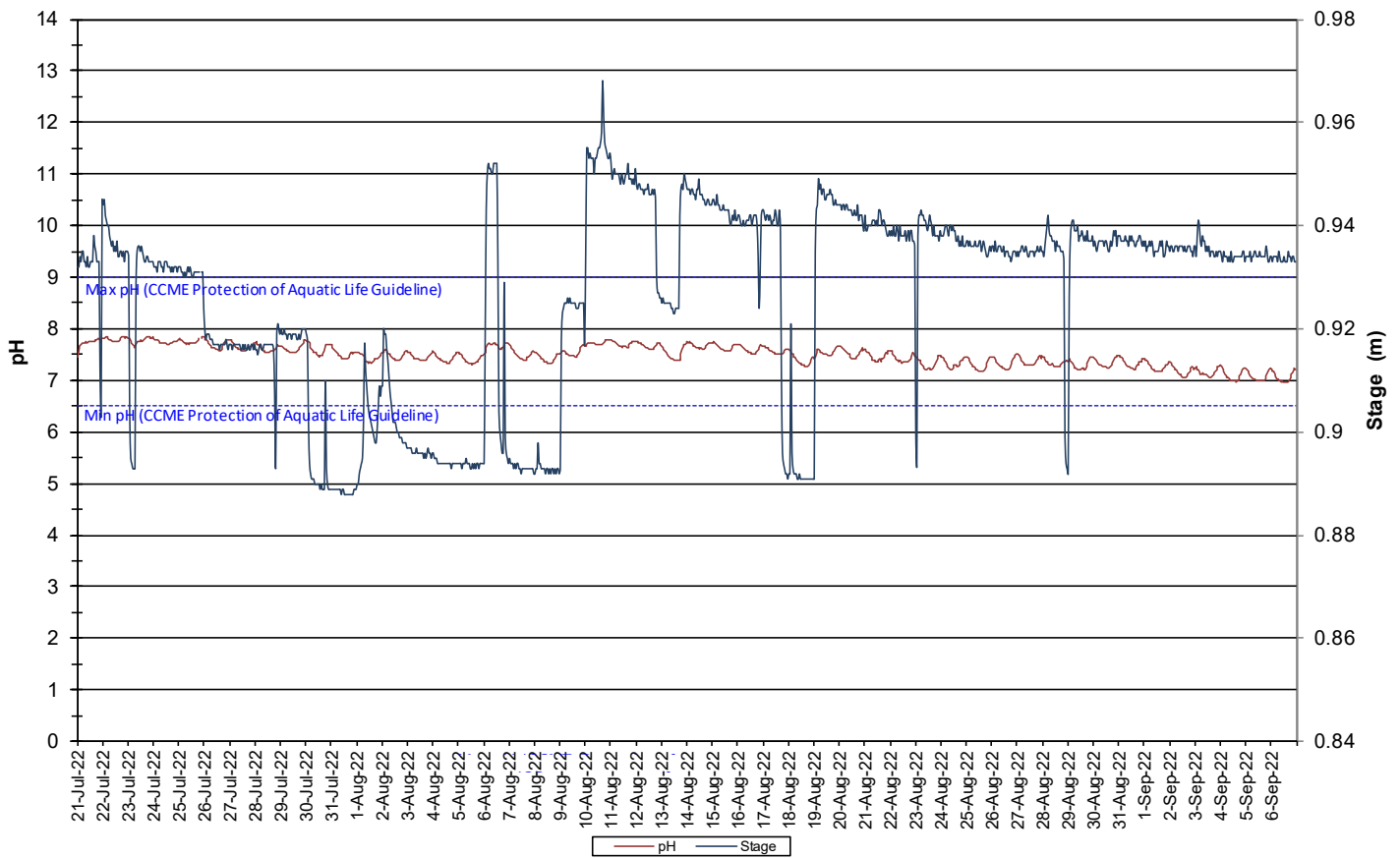
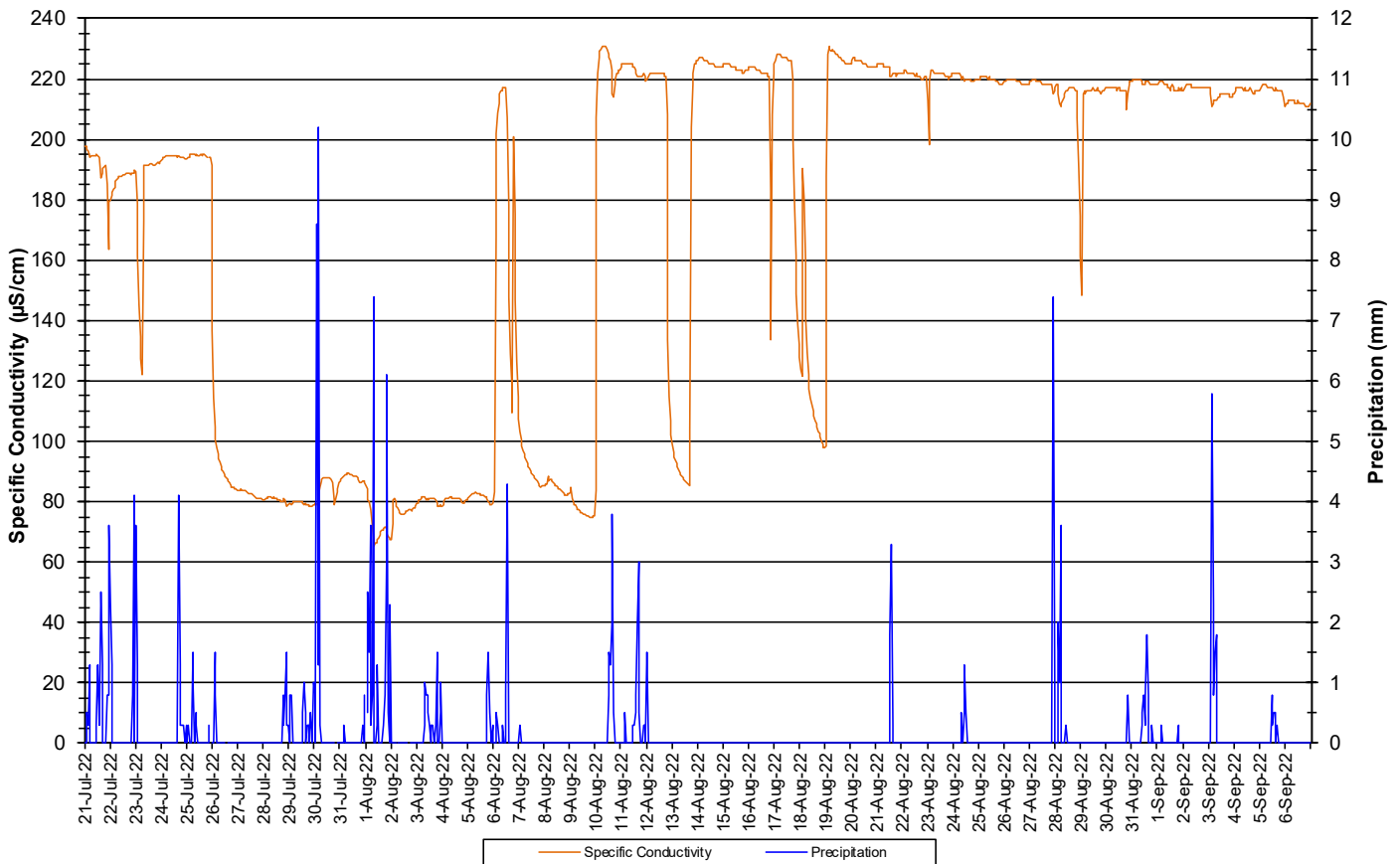


Figure 10: Water pH and Stage – Dumbell Stream

- Specific conductivity ranged from 65.3 to 231.0 $\mu\text{S}/\text{cm}$, throughout the deployment period (Figure 11).
- Overall, specific conductivity increased in August. It was then relatively stable over the course of the deployment period, with periodic decreases noted during or after precipitation events as the system is temporarily diluted.
- 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
July 21 to September 7, 2022**



**Figure 11: Specific conductivity and stage – Dumbell Stream
(Weather data collected from climate station near Moosehead Lake)**

- The saturation of dissolved oxygen ranged from 92.8 to 97.3% while the dissolved oxygen content ranged from 11.23 to 12.96 mg/l with a median value of 12.16 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/. The guidelines are indicated in blue on Figure 12.
- Overall, dissolved oxygen increases slightly over this deployment period. Dissolved oxygen fluctuated daily with decreases observed at night.

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

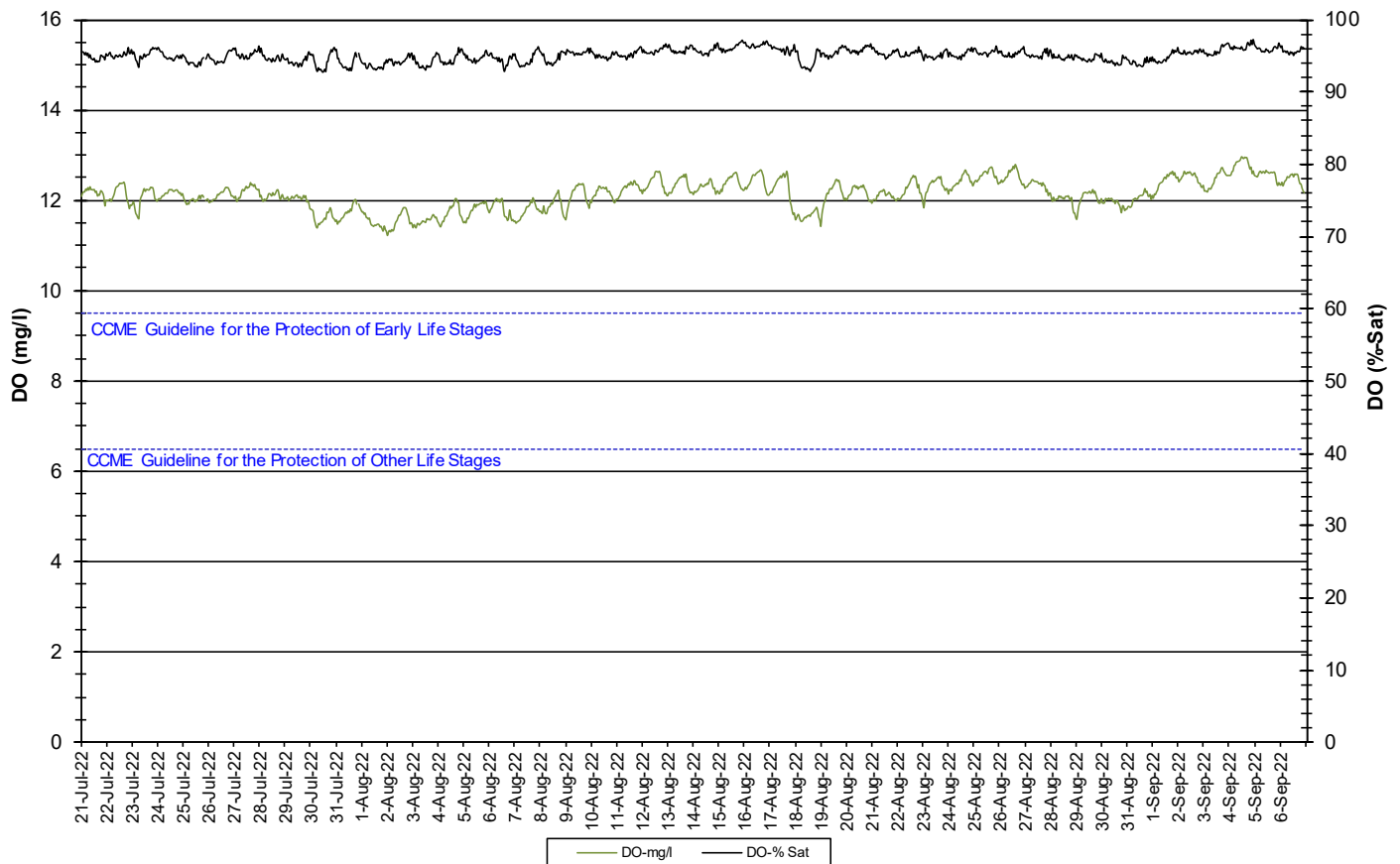
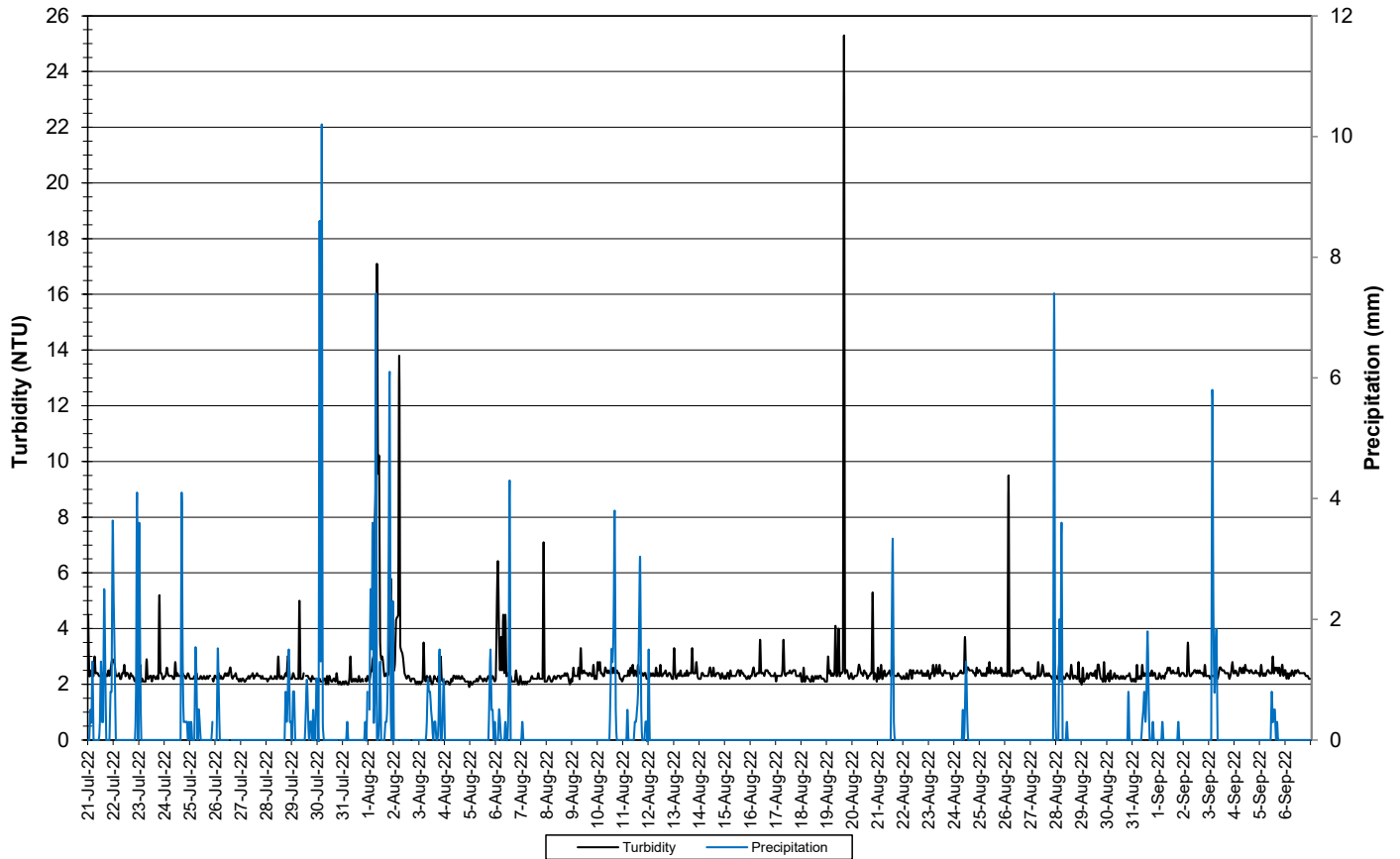


Figure 12: Dissolved oxygen – Dumbell Stream

- Turbidity values ranged from 1.9 NTU to 25.3 NTU, throughout the deployment period (Figure 13). The median value was 12.16 NTU.

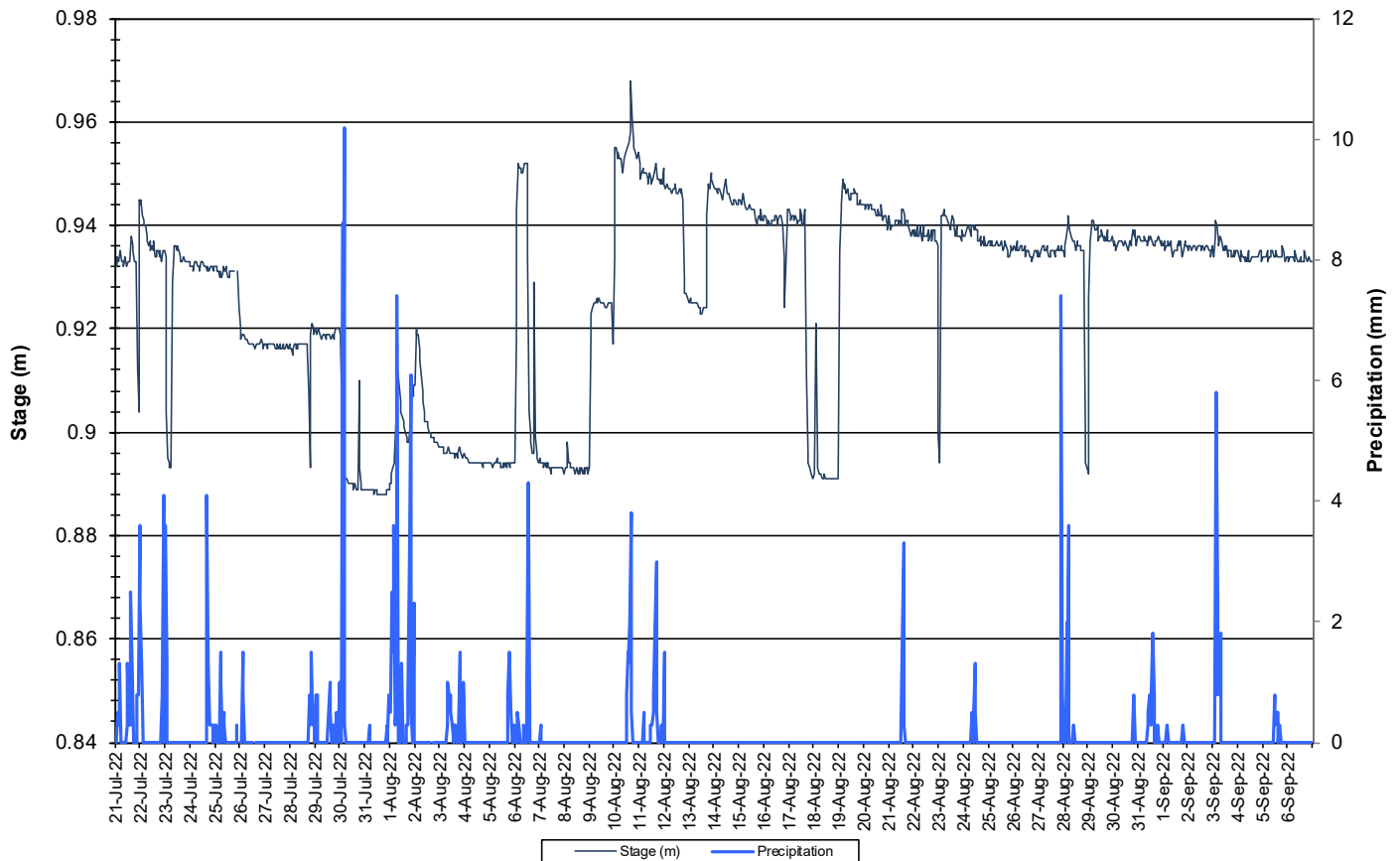
**Water Turbidity and Precipitation : Dumbell Stream above Dumbell Lake
July 21 to September 7, 2022**



**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
July 21 to September 7, 2022**

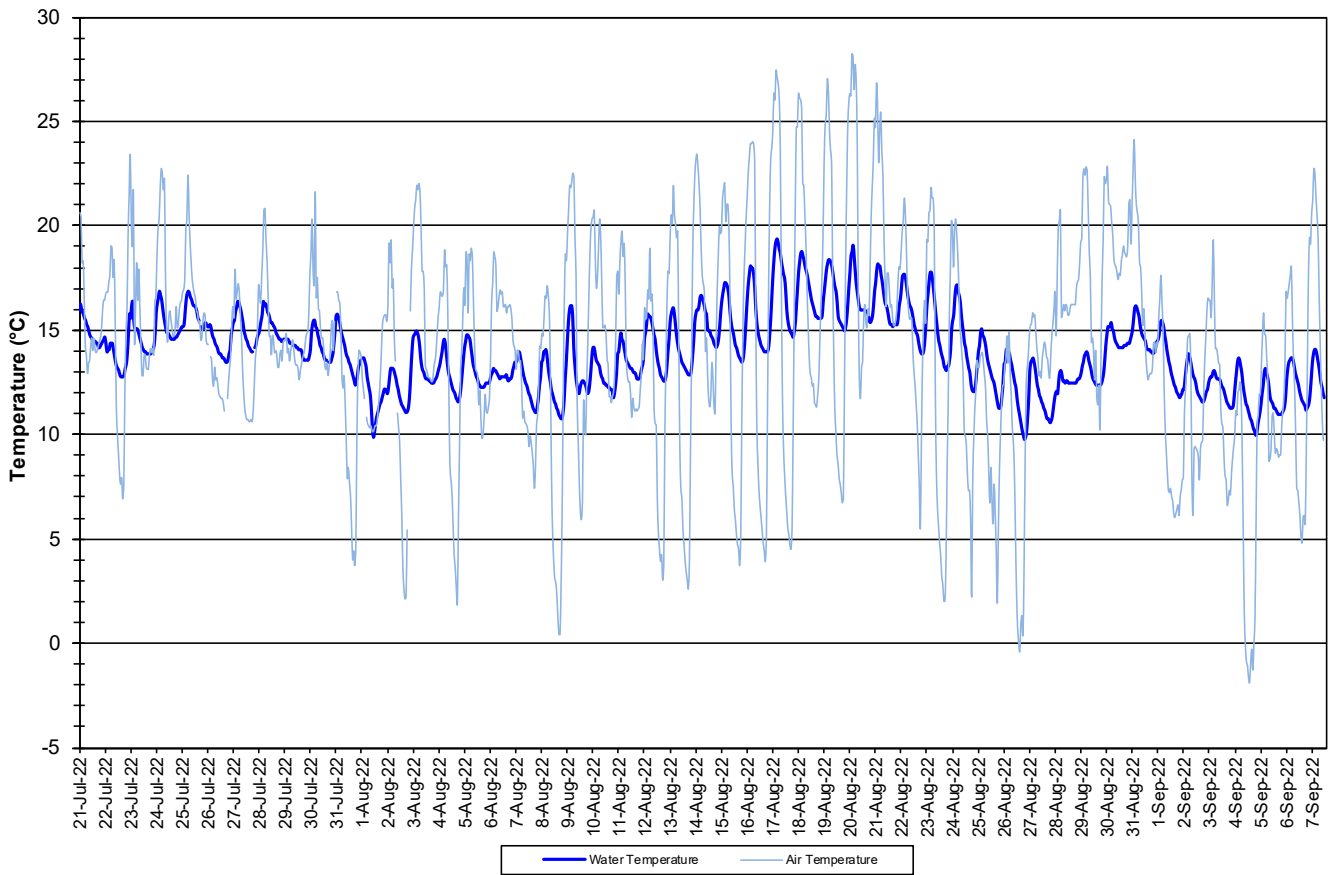


**Figure 14: Stage and Precipitation – Dumbell Stream
(Weather data collected from climate station near Moosehead Lake)**

Pumphouse Stream

- Water temperature ranged from 9.80 to 19.40°C during this deployment period (Figure 15).
- Water temperature decreased after the first week of the deployment. It then increased slightly until the third week of August before gradually decreasing until the end of the deployment period. Fluctuations corresponded with increases and decreases in ambient air temperature. (Figure 15).

**Water and Air Temperature : Pumphouse Stream above Drum Lake
July 21 to September 7, 2022**



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

- pH ranged from 6.92 to 8.04 pH units (Figure 16). The median pH was 7.83.
- There are noticeable decreases in pH, corresponding with increases in stage. They are identified on the graph in red.
- 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
July 21 to September 7, 2022

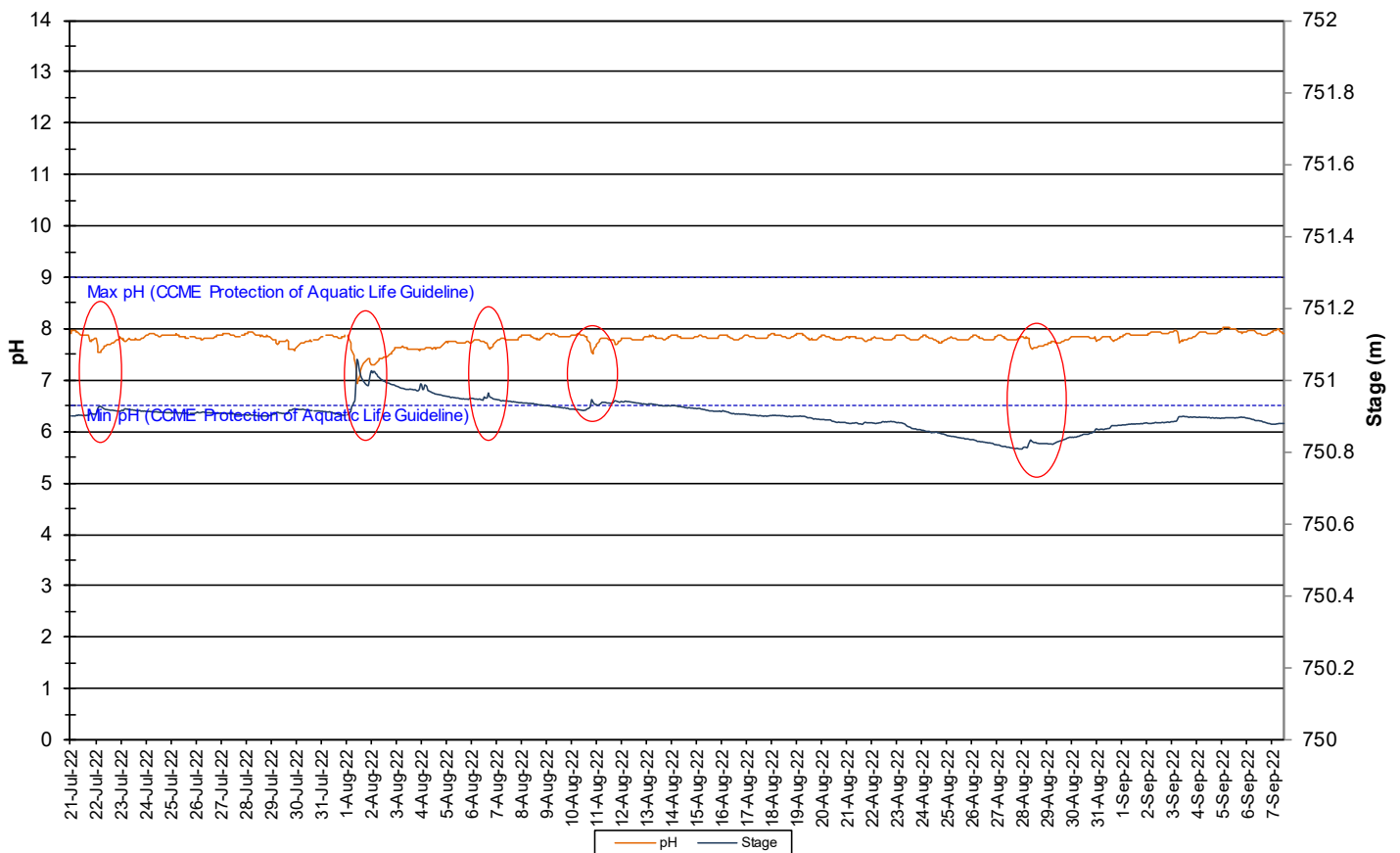
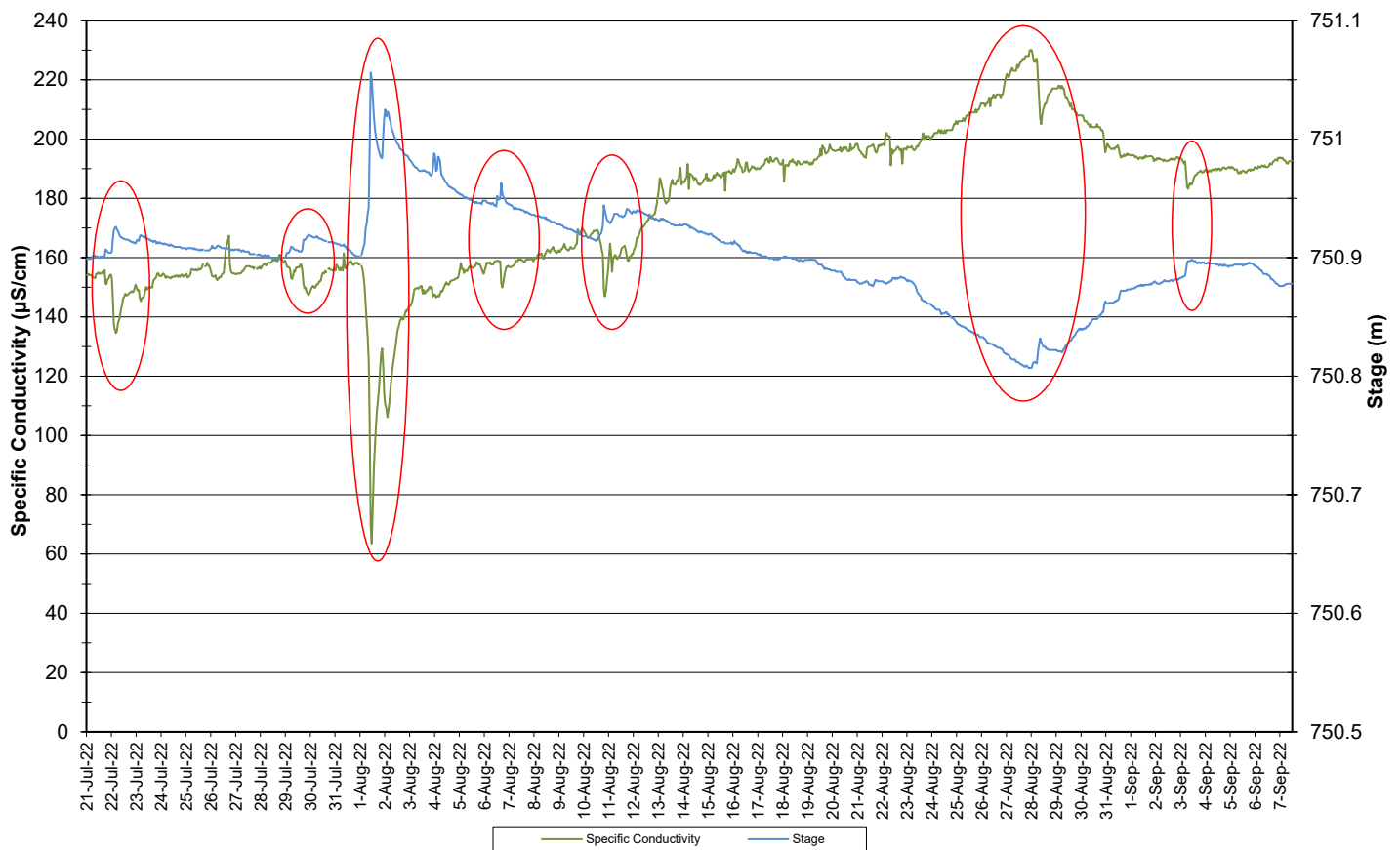


Figure 16: Water pH and Stage – Pumphouse Stream

- Specific conductivity ranged from 63.5 to 230.0 $\mu\text{S}/\text{cm}$, 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. Overall the conductance increased gradually over the deployment period.
- 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
July 21 to September 7, 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 82.4 to 99.9% while the dissolved oxygen ranged from 8.84 to 10.52 mg/l with a median value of 9.40 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.
- Overall, dissolved oxygen increased slightly from the beginning to the end of the deployment period.

**Dissolved Oxygen Concentration and Saturation : Pumphouse Stream above Drum Lake
July 21 to September 7, 2022**

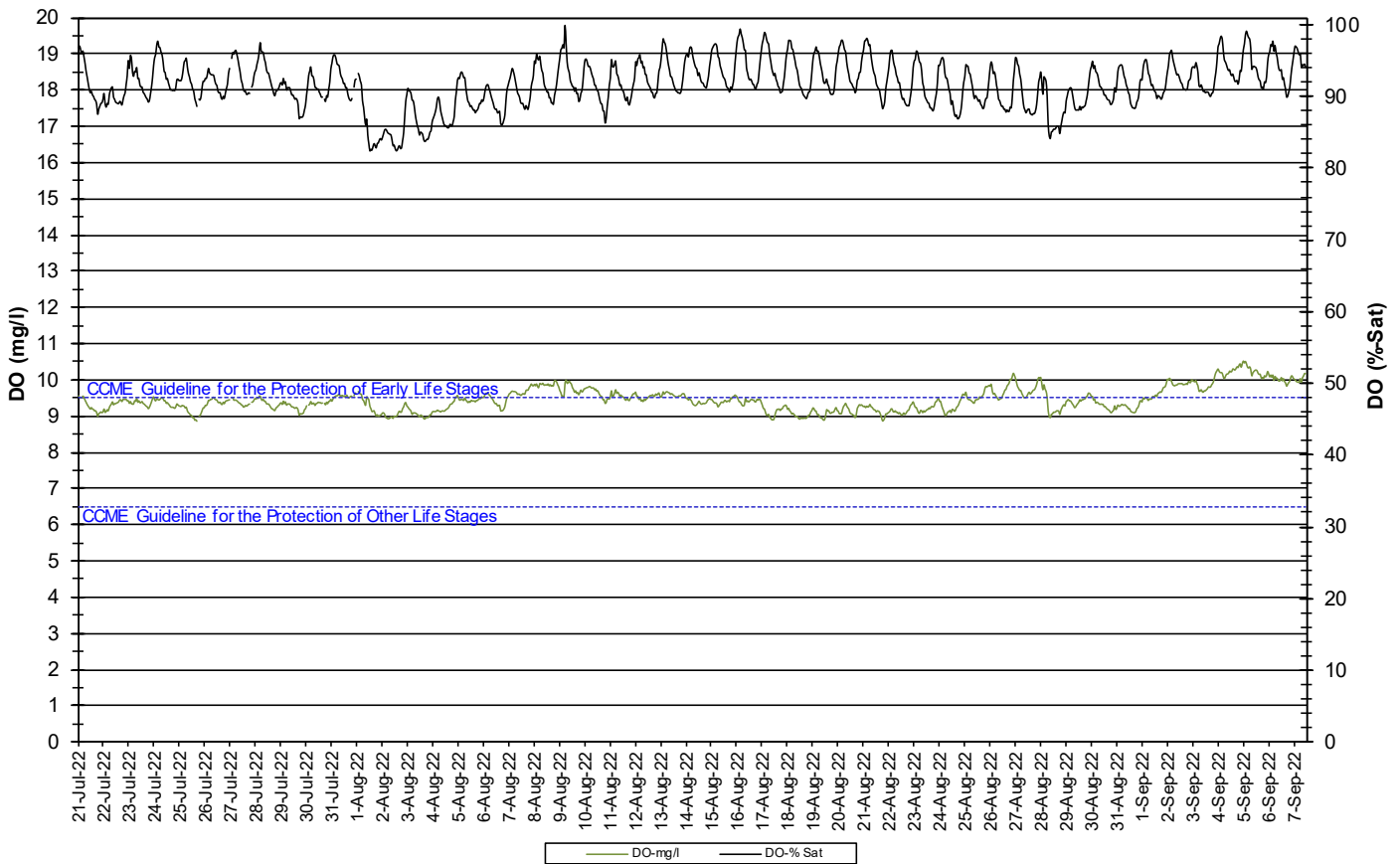


Figure 18: Dissolved Oxygen – Pumphouse Stream

- Turbidity values range from 0.0 to 53.6 NTU throughout the deployment period (Figure 19). The median value was 2.2 NTU.
- In some instances, turbidity spikes can be attributed to precipitation events.
- The turbidity sensor failed during the later portion of the deployment period, thus this data was removed.

Water Turbidity and Precipitation : Pumphouse Stream above Drum Lake
July 21 to September 7, 2022

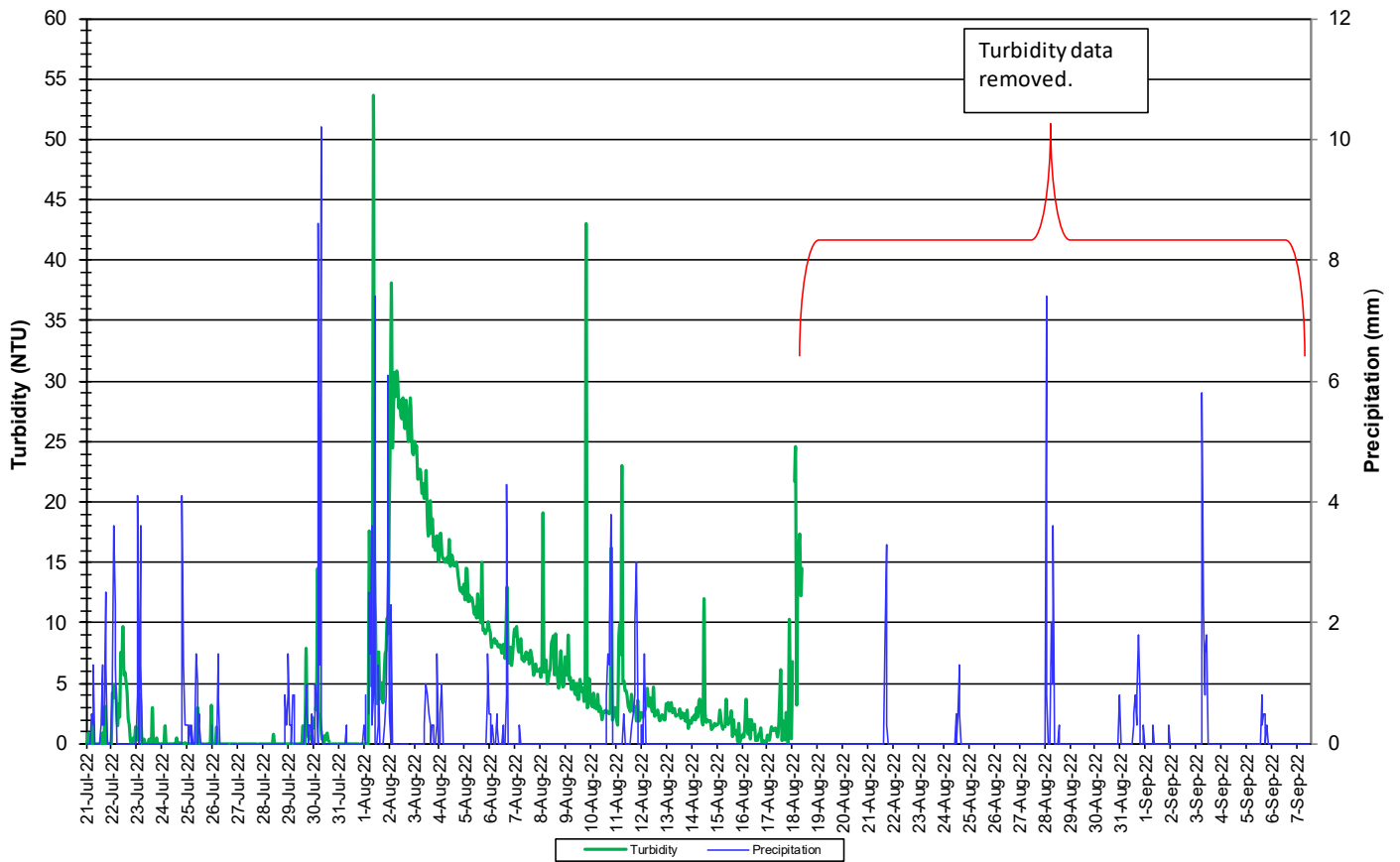


Figure 19: Turbidity and Precipitation – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)

- Stage and precipitation are graphed below to show the relationship between rainfall and water level at Pumphouse Stream (Figure 20).
- 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
July 21 to September 7, 2022

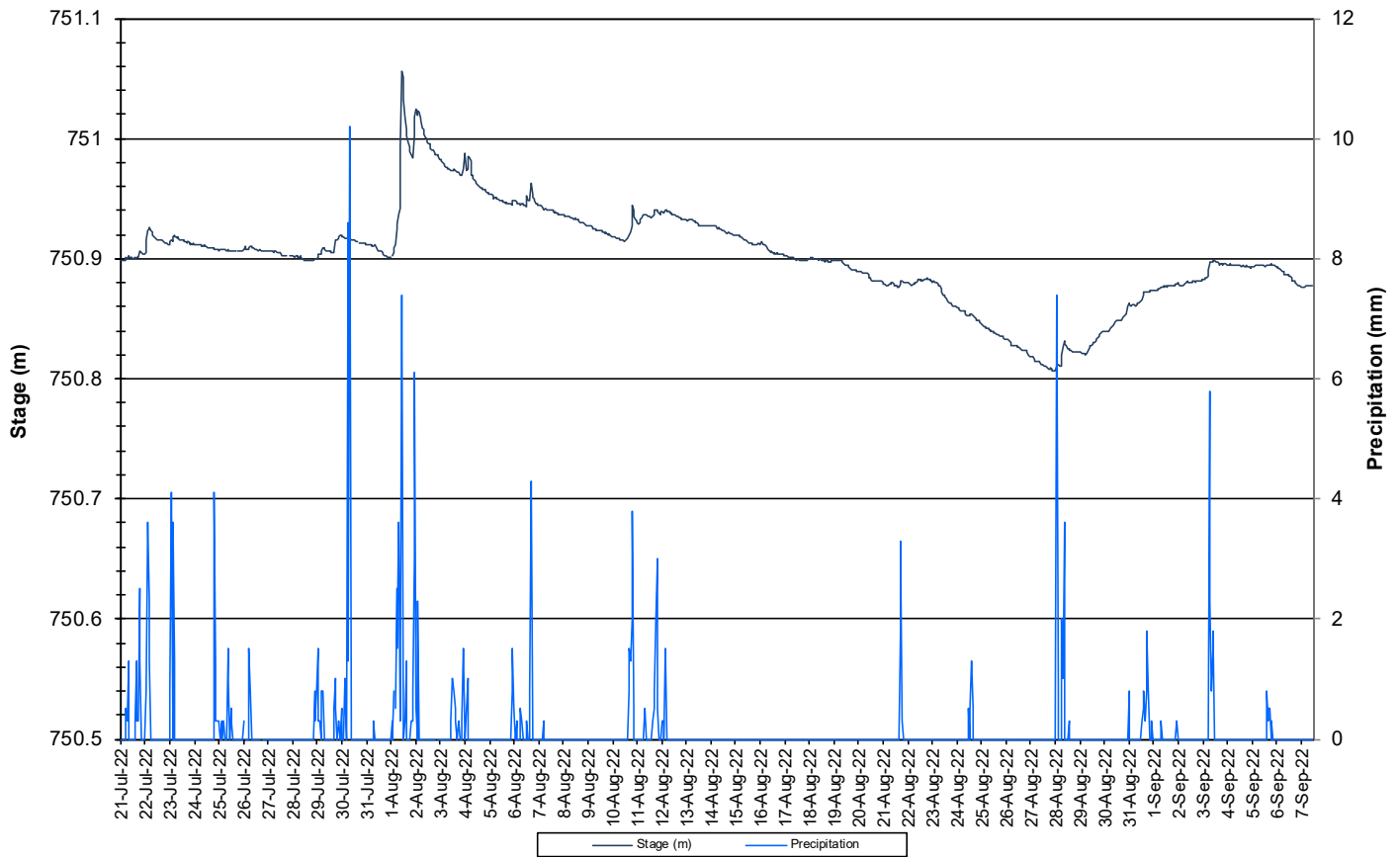


Figure 20: Stage and Precipitation – Pumphouse Stream
(Weather data collected from climate station near Moosehead Lake)

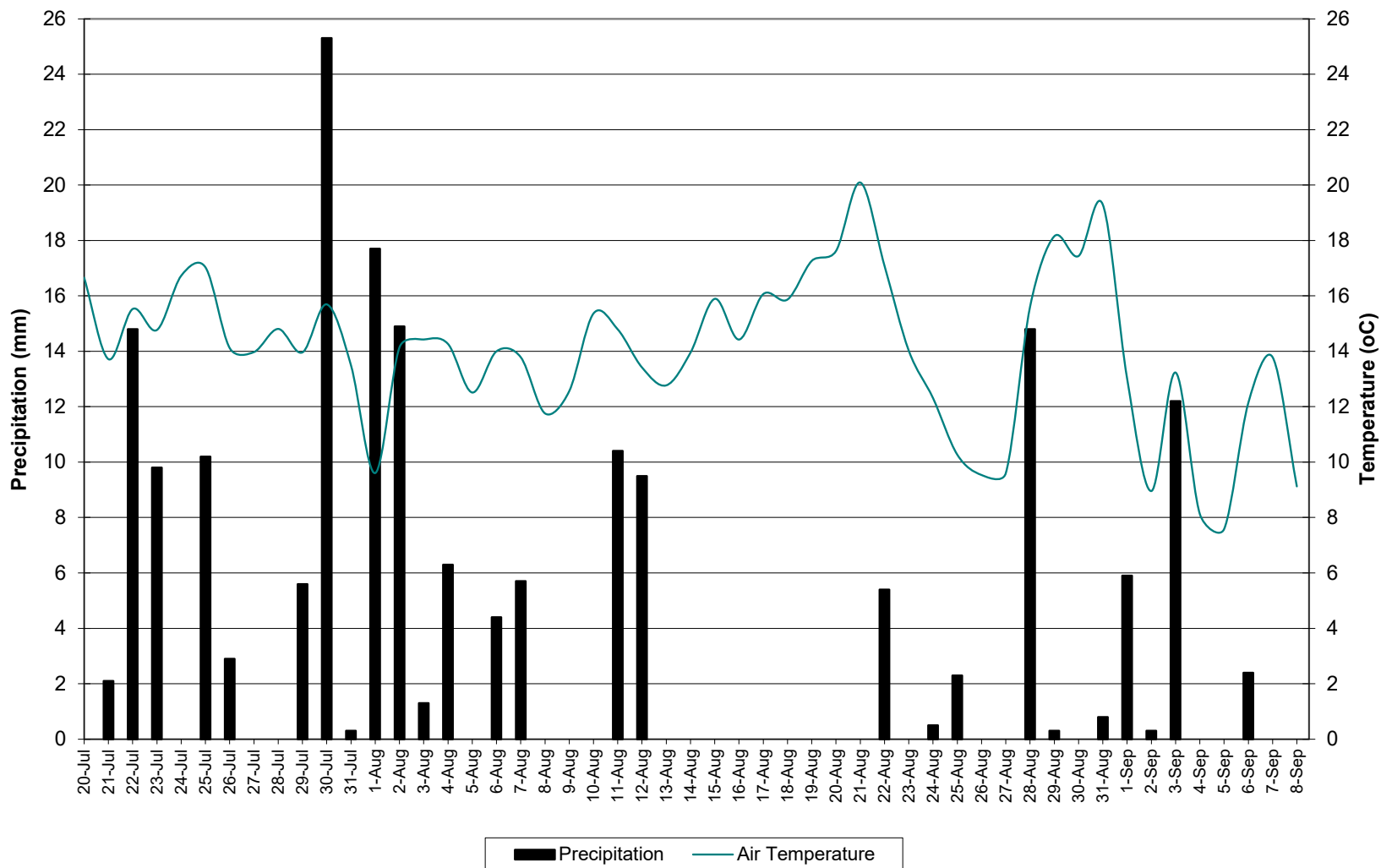
Conclusions

- Instruments were deployed between July 20th and 21st, and removed by September 8th, 2022, except for the instrument at Pumphouse Stream. This was the second 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 2.65 and 21.20°C at these stations.
- The majority of pH values were within the recommended CCME Guidelines for the Protection of Aquatic Life. pH ranged between 6.22 and 8.30. 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 42.2 µs/cm to 209.0 µs/cm at the Wabush Lake stations, 65.3 to 231.0 µs/cm at Dumbell Stream and 63.5 to 230.0 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 values at Dolomite Road and Pumphouse stream were below the guideline, the majority of values at Julienne Narrows were above the guideline, and all of the values at Dumbell Stream were above the guideline.
- 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 87.0 NTU.
- Turbidity at Dumbell Stream ranged from 1.9 NTU to 25.3 NTU.
- Turbidity at Pumphouse Stream ranged from 0.0 to 53.6 NTU.
- At Julienne Narrows and Dolomite Road, stage increased after a number of days with precipitation, it then gradually decreased until the end of the deployment period.
- At Dumbell Stream, stage showed periodic increases after precipitation events and increased overall. There were occasional decreases; these decreases may not be accurate.
- At Pumphouse Stream, stage showed periodic increases after precipitation events and decreased overall.
- 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 July 20 to September 8, 2022



Appendix 2
QA/QC Grab Sample Results



BUREAU
VERITAS

Bureau Veritas Job #: C2L3227
Report Date: 2023/01/17

NL Department of Environment, Climate Change and
Municipalities
Client Project #: RTWQ
Site Location: LABRADOR
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
THQ455 JULIENNE NARROW								
Sampling Date		2022/07/20 15:00						
Matrix		W						
Sample #		2022-6314-00-SI-SP						
Registration #		WS-0-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	52	1.0	mg/L	N/A	2022/08/10		8137781
Nitrate (N)	-	0.51	0.050	mg/L	N/A	2022/08/04		8137785
Total dissolved solids (calc., EC)	-	60	1.0	mg/L	N/A	2022/08/03		8137821
Inorganics								
Conductivity	-	110	1.0	uS/cm	N/A	2022/08/02	NGI	8141682
Chloride (Cl-)	-	1.7	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Dup.Chloride (Cl-)	-	1.7	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Dup.Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Sulphate (SO4)	-	4.2	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Dup.Sulphate (SO4)	-	4.1	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Total Alkalinity (Total as CaCO3)	-	47	2.0	mg/L	N/A	2022/08/02	NGI	8141684
Colour	-	13	5.0	TCU	N/A	2022/08/04	TGO	8143902
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/08/03	NGI	8141685
Total Kjeldahl Nitrogen (TKN)	-	0.24	0.10	mg/L	2022/08/04	2022/08/05	RTY	8147915
Nitrate + Nitrite (N)	-	0.51	0.050	mg/L	N/A	2022/08/03	TGO	8143904
Nitrite (N)	-	ND	0.010	mg/L	N/A	2022/08/03	TGO	8143905
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/08/02	TGO	8141634
Dissolved Organic Carbon (C)	-	3.1	0.50	mg/L	N/A	2022/08/02	KMC	8138119
Total Organic Carbon (C)	-	3.3	0.50	mg/L	N/A	2022/08/02	KMC	8138114
pH	-	7.78		pH	N/A	2022/08/02	NGI	8141683
Total Phosphorus	-	ND	0.004	mg/L	2022/08/03	2022/08/05	SSV	8145071
Total Suspended Solids	-	ND	1.0	mg/L	2022/07/29	2022/07/29	RMK	8137996
Turbidity	-	0.87	0.10	NTU	N/A	2022/08/03	NGI	8143950
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/08/02	2022/08/02	FJO	8138417
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.017	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Barium (Ba)	-	0.0023	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Boron (B)	-	ND	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Cadmium (Cd)	-	0.000018	0.000010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Calcium (Ca)	-	13	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Copper (Cu)	-	0.00094	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038



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Bureau Veritas Job #: C2L3227
Report Date: 2023/01/17

NL Department of Environment, Climate Change and
Municipalities
Client Project #: RTWQ
Site Location: LABRADOR
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
THQ455 JULIENNE NARROW								
Sampling Date		2022/07/20 15:00						
Matrix		W						
Sample #		2022-6314-00-SI-SP						
Registration #		WS-0-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Iron (Fe)	-	ND	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Magnesium (Mg)	-	5.1	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Manganese (Mn)	-	0.012	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Potassium (K)	-	1.1	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Sodium (Na)	-	1.4	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Strontium (Sr)	-	0.016	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Uranium (U)	-	0.00012	0.00010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038



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Bureau Veritas Job #: C2L3227
Report Date: 2023/01/17

NL Department of Environment, Climate Change and
Municipalities
Client Project #: RTWQ
Site Location: LABRADOR
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
THQ456 DOLOMITE ROAD								
Sampling Date		2022/07/20 11:00						
Matrix		W						
Sample #		2022-6315-00-SI-SP						
Registration #		WS-0-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	25	1.0	mg/L	N/A	2022/08/10		8137781
Nitrate (N)	-	0.064	0.050	mg/L	N/A	2022/08/04		8137785
Total dissolved solids (calc., EC)	-	30	1.0	mg/L	N/A	2022/08/03		8137821
Inorganics								
Conductivity	-	55	1.0	uS/cm	N/A	2022/08/02	NGI	8141682
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Sulphate (SO4)	-	2.2	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Total Alkalinity (Total as CaCO3)	-	24	2.0	mg/L	N/A	2022/08/02	NGI	8141684
Colour	-	21	5.0	TCU	N/A	2022/08/04	TGO	8143902
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/08/03	NGI	8141685
Total Kjeldahl Nitrogen (TKN)	-	0.10	0.10	mg/L	2022/08/04	2022/08/05	RTY	8147915
Dup.Total Kjeldahl Nitrogen (TKN)	-	0.10	0.10	mg/L	2022/08/04	2022/08/05	RTY	8147915
Nitrate + Nitrite (N)	-	0.064	0.050	mg/L	N/A	2022/08/03	TGO	8143904
Nitrite (N)	-	ND	0.010	mg/L	N/A	2022/08/03	TGO	8143905
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/08/02	TGO	8141634
Dissolved Organic Carbon (C)	-	4.4	0.50	mg/L	N/A	2022/08/02	KMC	8138119
Total Organic Carbon (C)	-	4.2	0.50	mg/L	N/A	2022/08/02	KMC	8138114
pH	-	7.50		pH	N/A	2022/08/02	NGI	8141683
Total Phosphorus	-	ND	0.004	mg/L	2022/08/03	2022/08/05	SSV	8145071
Total Suspended Solids	-	ND	1.0	mg/L	2022/07/29	2022/07/29	RMK	8137996
Turbidity	-	0.83	0.10	NTU	N/A	2022/08/03	NGI	8143950
Dup.Turbidity	-	0.86	0.10	NTU	N/A	2022/08/03	NGI	8143950
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/07/29	2022/08/02	FJO	8138417
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.023	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Barium (Ba)	-	0.0085	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Boron (B)	-	ND	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Cadmium (Cd)	-	0.000010	0.000010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Calcium (Ca)	-	5.9	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Copper (Cu)	-	0.0011	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Iron (Fe)	-	0.052	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038



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Bureau Veritas Job #: C2L3227
Report Date: 2023/01/17

NL Department of Environment, Climate Change and
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Client Project #: RTWQ
Site Location: LABRADOR
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
THQ456 DOLOMITE ROAD								
Sampling Date 2022/07/20 11:00								
Matrix W								
Sample # 2022-6315-00-SI-SP								
Registration # WS-0-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Magnesium (Mg)	-	2.4	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Manganese (Mn)	-	0.017	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Potassium (K)	-	0.85	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Sodium (Na)	-	0.79	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Strontium (Sr)	-	0.012	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Uranium (U)	-	ND	0.00010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038



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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
THQ459 DUMBELL STREAM								
Sampling Date		2022/07/21 15:30						
Matrix		W						
Sample #		2022-6318-00-SI-SP						
Registration #		WS-0-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	93	1.0	mg/L	N/A	2022/08/10		8137781
Nitrate (N)	-	10	0.50	mg/L	N/A	2022/08/04		8137785
Total dissolved solids (calc., EC)	-	110	1.0	mg/L	N/A	2022/08/05		8137821
Inorganics								
Conductivity	-	200	1.0	uS/cm	N/A	2022/08/04	NGI	8146417
Dup. Conductivity	-	200	1.0	uS/cm	N/A	2022/08/04	NGI	8146417
Chloride (Cl-)	-	3.0	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Sulphate (SO4)	-	7.4	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Total Alkalinity (Total as CaCO3)	-	42	2.0	mg/L	N/A	2022/08/04	NGI	8146423
Dup. Total Alkalinity (Total as CaCO3)	-	42	2.0	mg/L	N/A	2022/08/04	NGI	8146423
Colour	-	ND	5.0	TCU	N/A	2022/08/04	TGO	8143902
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/08/04	NGI	8146430
Dup. Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/08/04	NGI	8146430
Total Kjeldahl Nitrogen (TKN)	-	ND(2)	0.50	mg/L	2022/08/09	2022/08/11	RTY	8155159
Nitrate + Nitrite (N)	-	11	0.50	mg/L	N/A	2022/08/03	TGO	8143904
Nitrite (N)	-	0.024	0.010	mg/L	N/A	2022/08/03	TGO	8143905
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/08/02	TGO	8141634
Dup. Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/08/02	TGO	8141634
Dissolved Organic Carbon (C)	-	0.77	0.50	mg/L	N/A	2022/08/02	KMC	8138119
Total Organic Carbon (C)	-	0.66	0.50	mg/L	N/A	2022/08/02	KMC	8138114
pH	-	7.64		pH	N/A	2022/08/04	NGI	8146422
Dup. pH	-	7.68		pH	N/A	2022/08/04	NGI	8146422
Total Phosphorus	-	ND	0.004	mg/L	2022/08/03	2022/08/05	SSV	8145071
Total Suspended Solids	-	8.6	1.0	mg/L	2022/07/29	2022/07/29	RMK	8137996
Turbidity	-	0.17	0.10	NTU	N/A	2022/08/03	NGI	8143950
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2022/07/29	2022/08/02	FJO	8138417
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.017	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Barium (Ba)	-	0.0040	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Boron (B)	-	ND	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2022/08/08	2022/08/09	JHY	8153038

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



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Bureau Veritas Job #: C2L3227
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Client Project #: RTWQ
Site Location: LABRADOR
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
THQ459 DUMBELL STREAM								
Sampling Date		2022/07/21 15:30						
Matrix		W						
Sample #		2022-6318-00-SI-SP						
Registration #		WS-0-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Calcium (Ca)	-	21	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Chromium (Cr)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Copper (Cu)	-	0.00054	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Iron (Fe)	-	0.062	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Lead (Pb)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Magnesium (Mg)	-	9.4	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Manganese (Mn)	-	0.0060	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Nickel (Ni)	-	ND	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Phosphorus (P)	-	ND	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Potassium (K)	-	1.4	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Sodium (Na)	-	0.94	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Strontium (Sr)	-	0.025	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Uranium (U)	-	ND	0.00010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Zinc (Zn)	-	ND	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038



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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
THQ458 PUMPHOUSE STREAM								
Sampling Date		2022/07/21 11:45						
Matrix		W						
Sample #		2022-6317-00-SI-SP						
Registration #		WS-0-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	80	1.0	mg/L	N/A	2022/08/10		8137781
Nitrate (N)	-	1.9	0.10	mg/L	N/A	2022/08/04		8137785
Total dissolved solids (calc., EC)	-	85	1.0	mg/L	N/A	2022/08/03		8137821
Inorganics								
Conductivity	-	150	1.0	uS/cm	N/A	2022/08/02	NGI	8141682
Chloride (Cl-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Sulphate (SO4)	-	7.1	1.0	mg/L	N/A	2022/08/03	LKH	8144160
Total Alkalinity (Total as CaCO3)	-	62	2.0	mg/L	N/A	2022/08/02	NGI	8141684
Colour	-	ND	5.0	TCU	N/A	2022/08/04	TGO	8143902
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2022/08/03	NGI	8141685
Total Kjeldahl Nitrogen (TKN)	-	0.16	0.10	mg/L	2022/08/04	2022/08/05	RTY	8147915
Nitrate + Nitrite (N)	-	1.9(1)	0.10	mg/L	N/A	2022/08/03	TGO	8143904
Nitrite (N)	-	0.012	0.010	mg/L	N/A	2022/08/03	TGO	8143905
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2022/08/02	TGO	8141634
Dissolved Organic Carbon (C)	-	1.5	0.50	mg/L	N/A	2022/08/02	KMC	8138119
Total Organic Carbon (C)	-	2.4	0.50	mg/L	N/A	2022/08/03	JHH	8143813
Dup.Total Organic Carbon (C)	-	2.5	0.50	mg/L	N/A	2022/08/03	JHH	8143813
pH	-	7.84		pH	N/A	2022/08/02	NGI	8141683
Total Phosphorus	-	ND	0.004	mg/L	2022/08/03	2022/08/05	SSV	8145071
Total Suspended Solids	-	1.8	1.0	mg/L	2022/07/29	2022/07/29	RMK	8137996
Turbidity	-	4.7	0.10	NTU	N/A	2022/08/03	NGI	8143950
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	0.000018	0.000013	mg/L	2022/07/29	2022/08/02	FJO	8138417
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.64	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Antimony (Sb)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Arsenic (As)	-	ND	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Barium (Ba)	-	0.018	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Boron (B)	-	ND	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Cadmium (Cd)	-	0.000037	0.000010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Calcium (Ca)	-	19	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Chromium (Cr)	-	0.0020	0.0010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Copper (Cu)	-	0.0020	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Iron (Fe)	-	1.8	0.050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Lead (Pb)	-	0.00061	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038

(1) Elevated reporting limit due to sample matrix.



BUREAU
VERITAS

Bureau Veritas Job #: C2L3227
Report Date: 2023/01/17

NL Department of Environment, Climate Change and
Municipalities
Client Project #: RTWQ
Site Location: LABRADOR
Your P.O. #: 220028978-6

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
THQ458 PUMPHOUSE STREAM								
Sampling Date 2022/07/21 11:45								
Matrix W								
Sample # 2022-6317-00-SI-SP								
Registration # WS-0-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Magnesium (Mg)	-	7.8	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Manganese (Mn)	-	0.39	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Nickel (Ni)	-	0.0021	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Phosphorus (P)	-	0.10	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Potassium (K)	-	1.4	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Selenium (Se)	-	ND	0.00050	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Sodium (Na)	-	0.53	0.10	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Strontium (Sr)	-	0.018	0.0020	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Uranium (U)	-	0.00035	0.00010	mg/L	2022/08/08	2022/08/09	JHY	8153038
Total Zinc (Zn)	-	0.011	0.0050	mg/L	2022/08/08	2022/08/09	JHY	8153038