Real-Time Water Quality Deployment Report

Flora Creek below TLH

July 16 to
September 2, 2020

Newfoundland Labrador

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

Contents

General

- The Water Resources Management Division, in partnership with Tacora Resources Inc. – Wabush Mines, maintains one real-time water quality and water quantity station at Flora Creek.
- This station is situated downstream of the former Wabush Mines tailings disposal area, in Flora Lake.
- Water Resources Management Division staff monitor the real-time web pages regularly.
- On July 16, 2020, a real-time water quality monitoring instrument was deployed at the station Flora Creek below TLH. The instrument was deployed for a period of 48 days. This was the first deployment for the 2020 season. This was a later start to the deployment season than usual due to the COVID-19 pandemic.
- Stage data is missing from the later portion of the deployment period. This was due to a power issue.

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. 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 along side 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

	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 > 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 dependant, 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.

Flora Creek below TLH, Newfoundland and Labrador

- Deployment and removal comparison rankings for the station on Flora Creek deployed between July 16 and September 2, 2020 are summarized in Table 2.

Table 2: Comparison rankings for Flora Creek below TLH station July 16 – September 2, 2020.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Flora Creek below TLH	July 16, 2020	Deployment	Excellent	Good	Excellent	Excellent	Good
	Sept 2, 2020	Removal	Excellent	Good	Excellent	Excellent	Excellent

- At deployment and removal, all parameters ranked either 'excellent' or 'good'.

Data Interpretation

- The following graphs and discussion illustrate water quality related events from July 16 to September 2 at the station Flora Creek below TLH.
- With the exception of water quantity data (stage), 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.

Flora Creek below TLH

- Water temperature ranged from 11.08 to 22.50°C during this deployment period (Figure 1).
- Water temperature increased until the end of August and then decreased into September, corresponding with ambient air temperature (Figure 1).

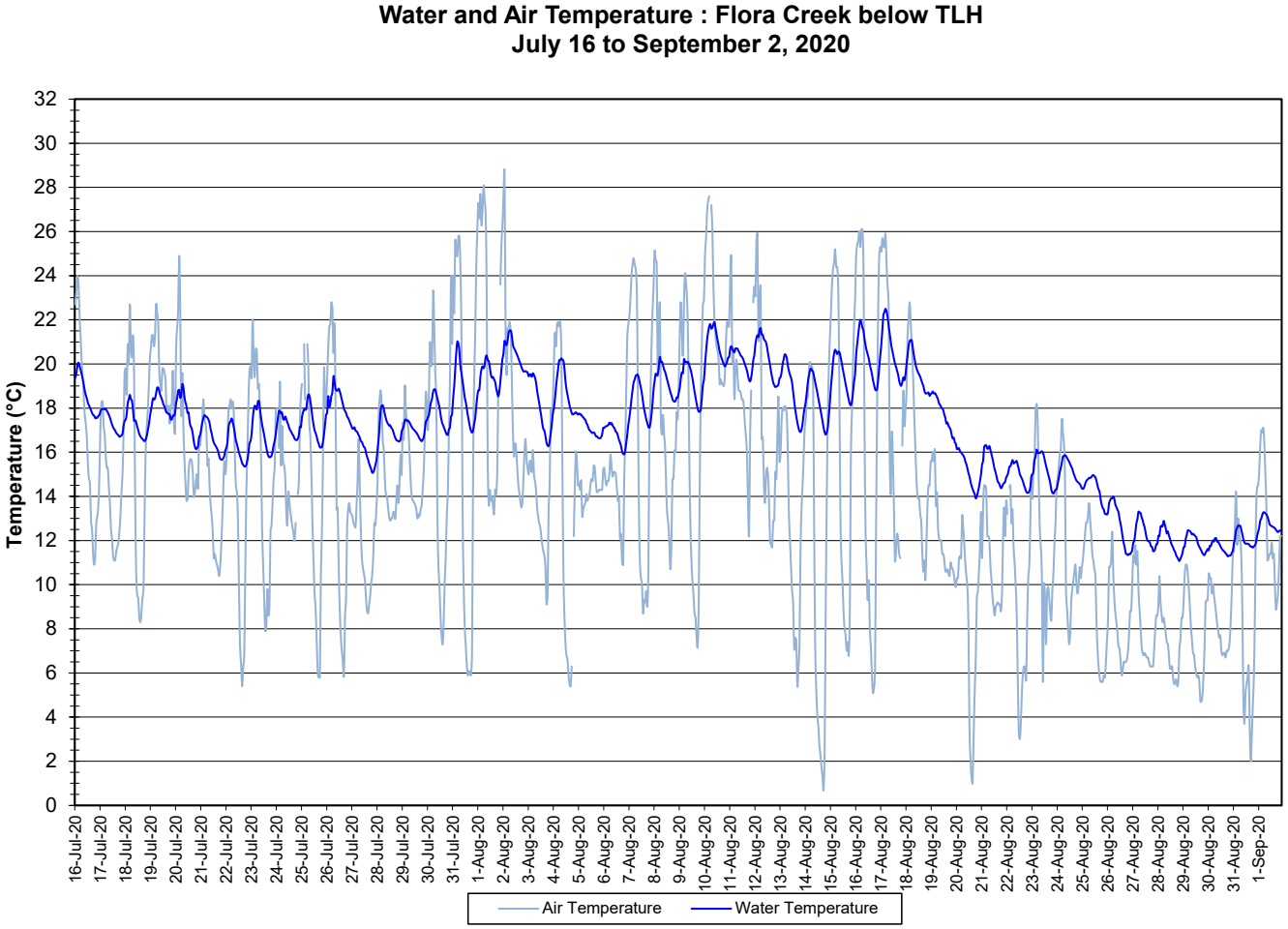

Figure 1: Water and Air Temperature - Flora Creek below TLH

(Weather data collected at Moosehead Lake)

- pH ranged between 7.70 and 8.31 pH units throughout the deployment period, with a median value of 7.94 units (Figure 2).
- 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 during the day and night.

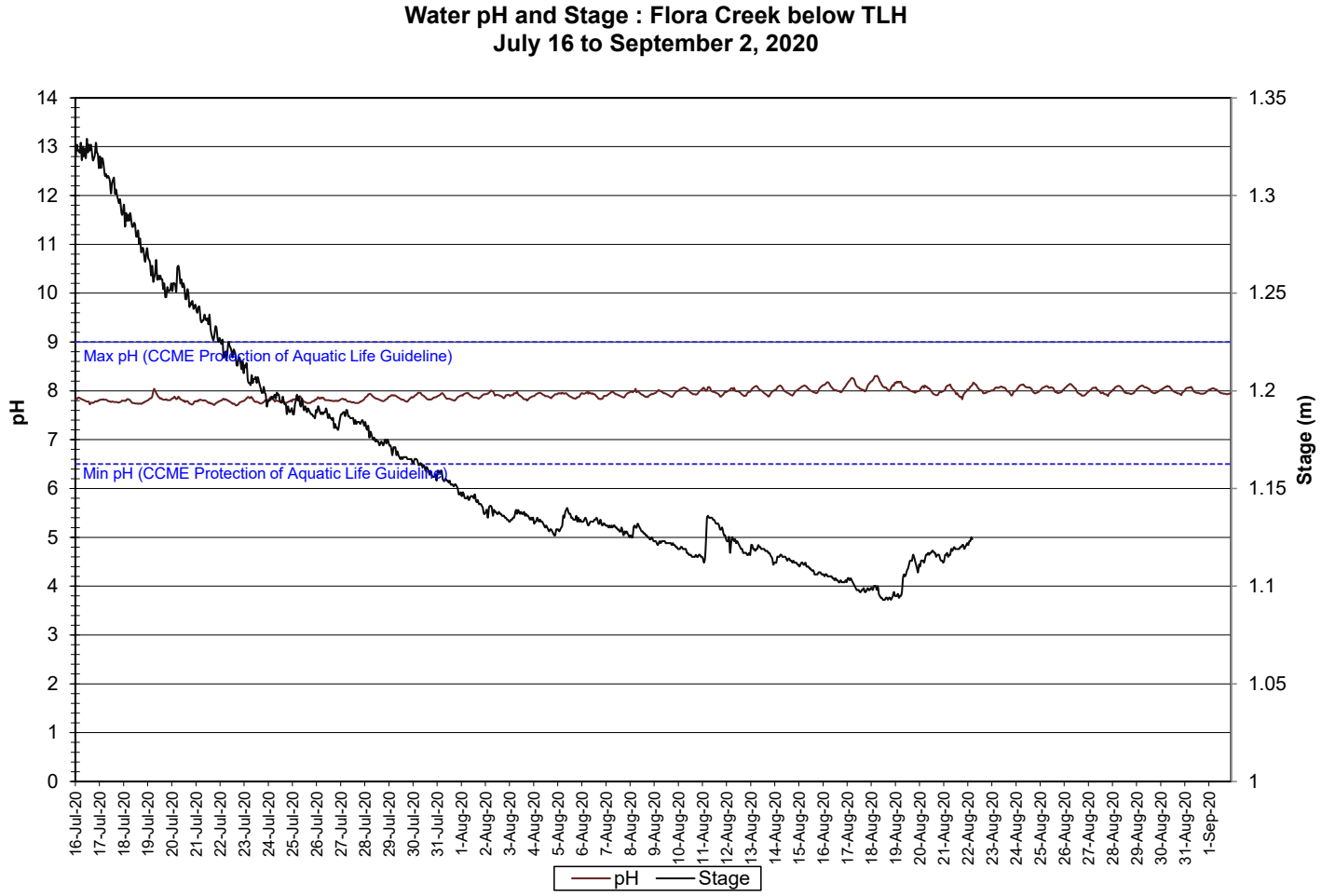

Figure 2: Water pH and Stage - Flora Creek below TLH

- Specific conductivity ranged from 66.1 to 71.7 µs/cm (Figure 3).
- Specific conductivity increased over the course of this deployment period.
- With the exception of water quantity data (stage), 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.

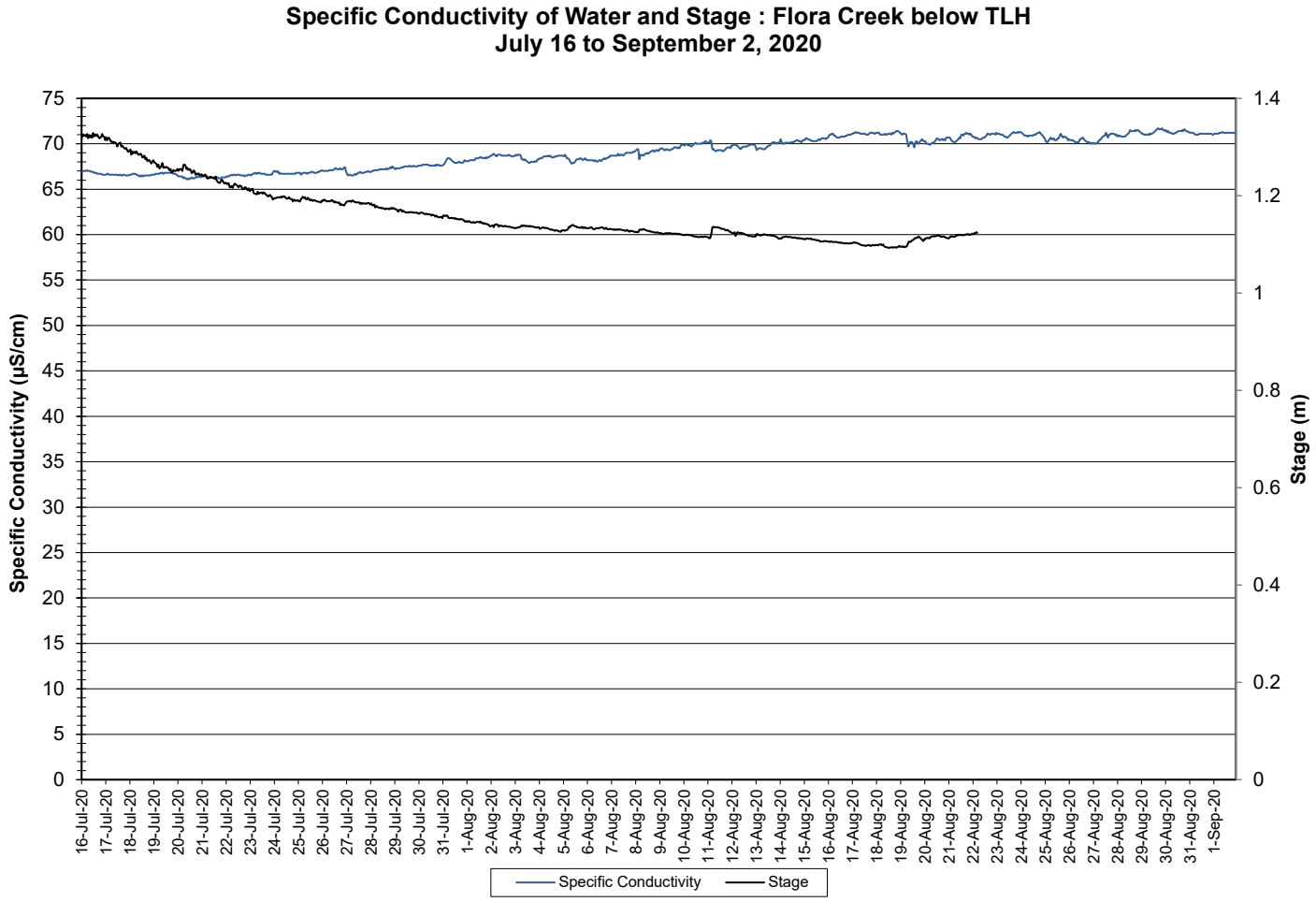

Figure 3: Specific Conductivity of Water and Stage - Flora Creek below TLH

- The saturation of dissolved oxygen ranged from 89.0 to 103.0% and a range of 8.53 to 10.33 mg/l was found for the concentration of dissolved oxygen with a median value of 9.00 mg/l (Figure 4).
- All values were above the minimum CCME Guideline for the Protection of Other Life Stages for Cold Water Biota of 6.5 mg/l. The majority of values were below the minimum CCME Guideline for the Protection of Early Life Stage Cold Water Biota value of 9.5 mg/l. The guidelines are indicated in blue on Figure 4.
- Dissolved oxygen content fluctuates diurnally, displaying the inverse relationship to water temperature. DO increases at the end of the deployment period, due to decreasing water temperatures.

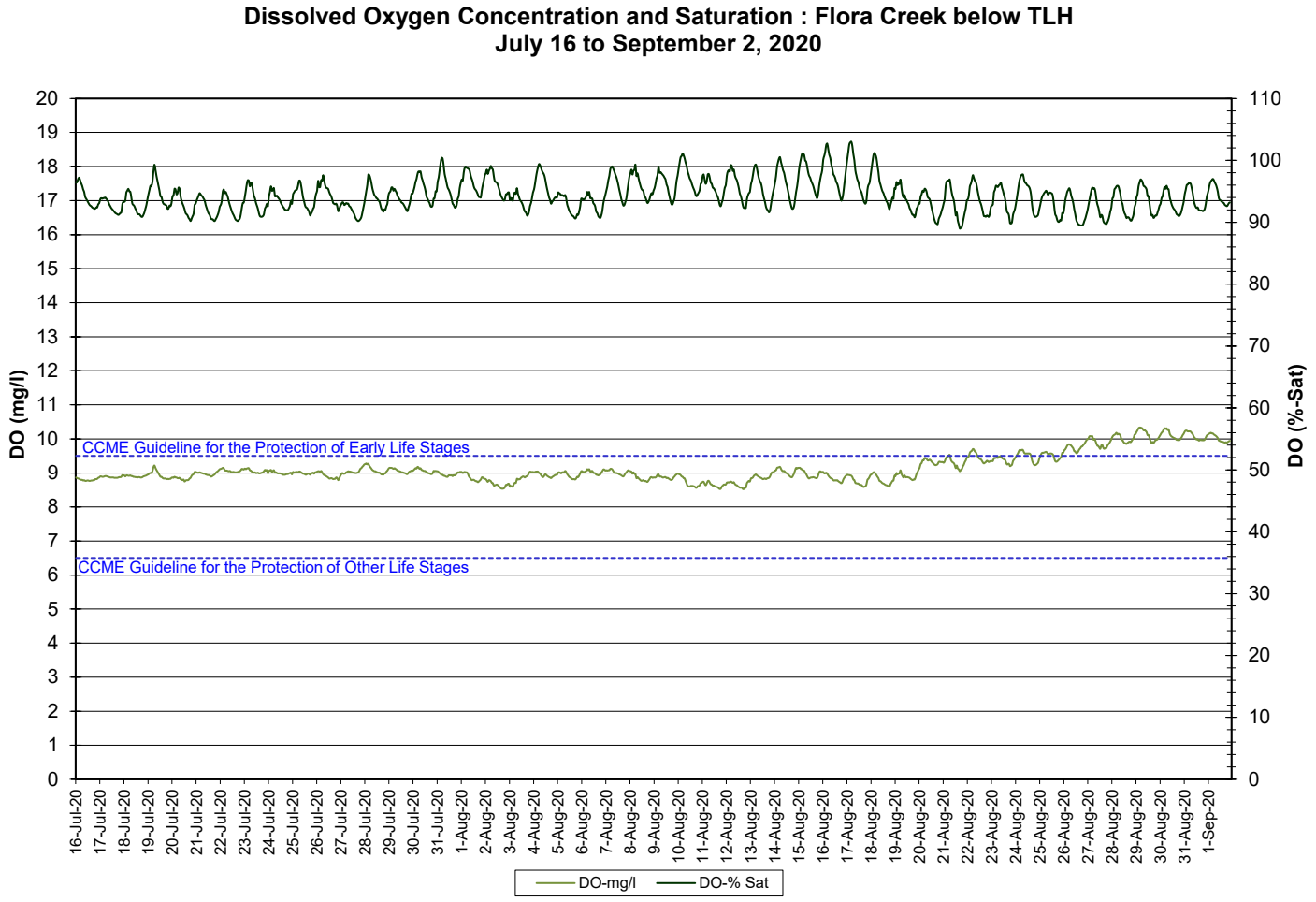

Figure 4: Dissolved Oxygen and Saturation - Flora Creek below TLH

- Turbidity values range from 2.4 NTU to 43.8 NTU with the highest readings recorded at the beginning of the deployment period. Turbidity gradually decreases over the course of the deployment period. Noticeable increases that can be attributed to precipitation events are identified on the graph in red. (Figure 5).
- This site has very turbid water at times. Due to the late start of the deployment season, it is possible that high turbidity values due to the winter/spring freshet were missed.

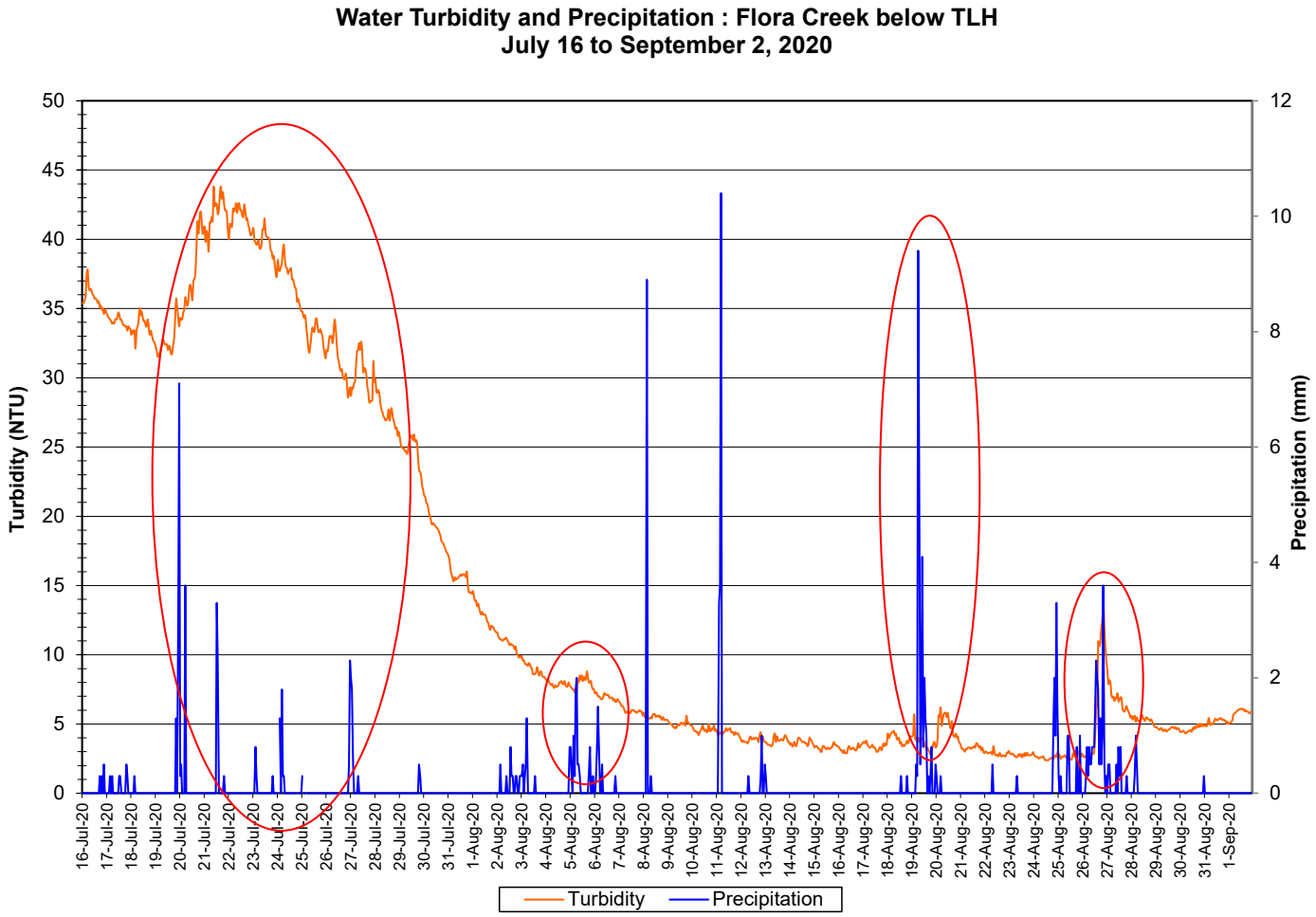

Figure 5: Turbidity - Flora Creek below TLH

- Precipitation and stage during the deployment period are graphed below (Figure 6). Overall, stage decreased during this deployment period.
- With the exception of water quantity data (stage), 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.

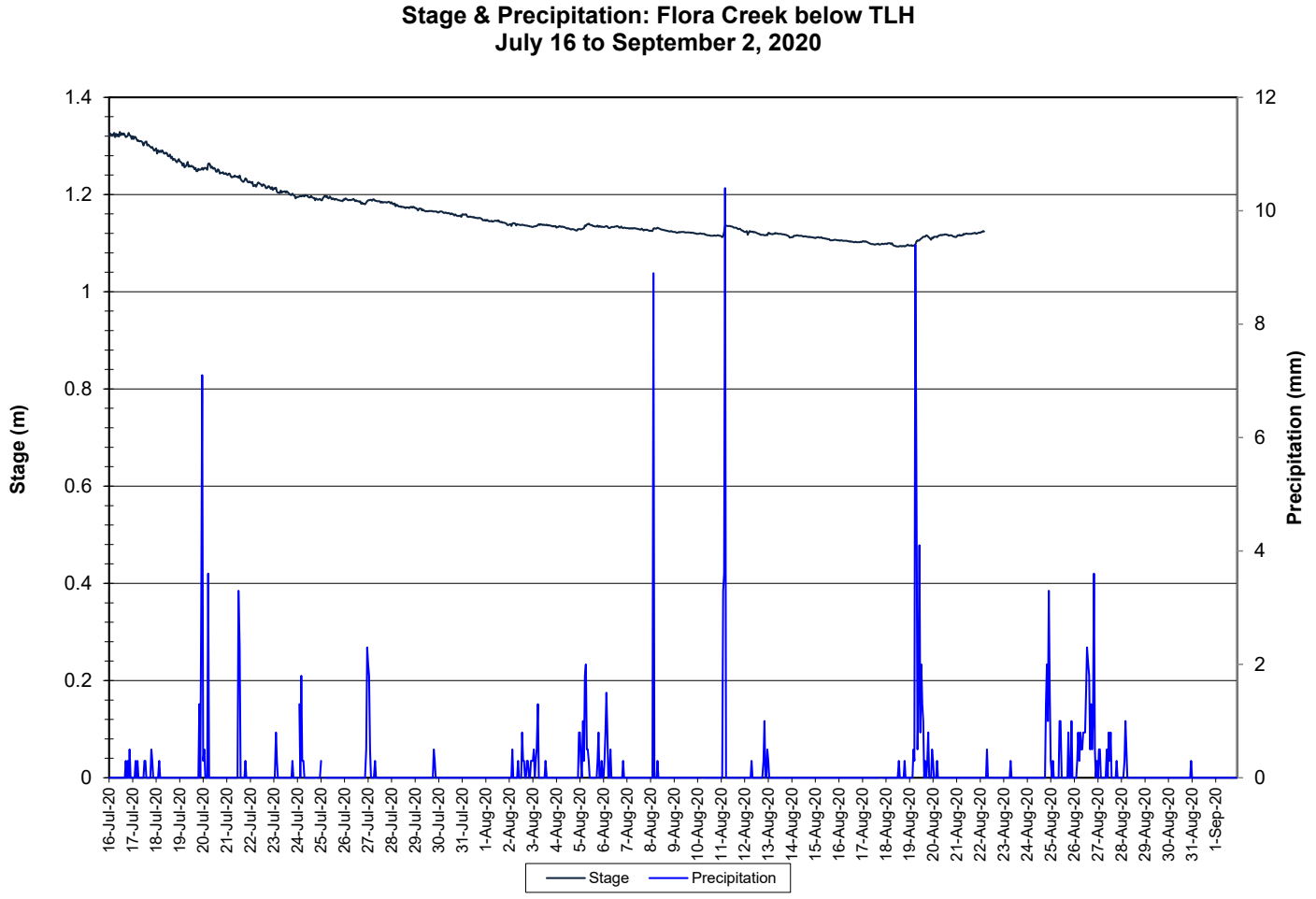

Figure 6: Precipitation and Stage – Flora Creek below TLH

Conclusions

- An instrument was deployed at the Flora Creek below TLH water quality monitoring station on July 16 and removed on September 2, 2020. This was the first deployment for the 2020 field season, this was a late start to the field season, due to the COVID-19 pandemic.
- In most cases, weather related events or increases/decreases in water level explain parameter fluctuations. Almost all values recorded were within ranges as suggested by the CCME Guidelines for the Protection of Aquatic Life for pH and dissolved oxygen.
- Water temperature increased during the deployment period, ranging between 11.08 and 22.50^{o}C.
- pH values were all within the recommended CCME Guidelines for the Protection of Aquatic Life. pH ranged between 7.70 and 8.31.
- Specific conductivity ranged from 66.1 to 71.7 µs/cm.
- 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. The majority of values were below the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Early Life Stages of 9.5 mg/l.
- Turbidity values decreased over the deployment period.
- Stage gradually decreased during the deployment period. There is a portion of stage data missing from the later portion of the deployment period. This was due to a power issue.
- With the exception of water quantity data (stage), 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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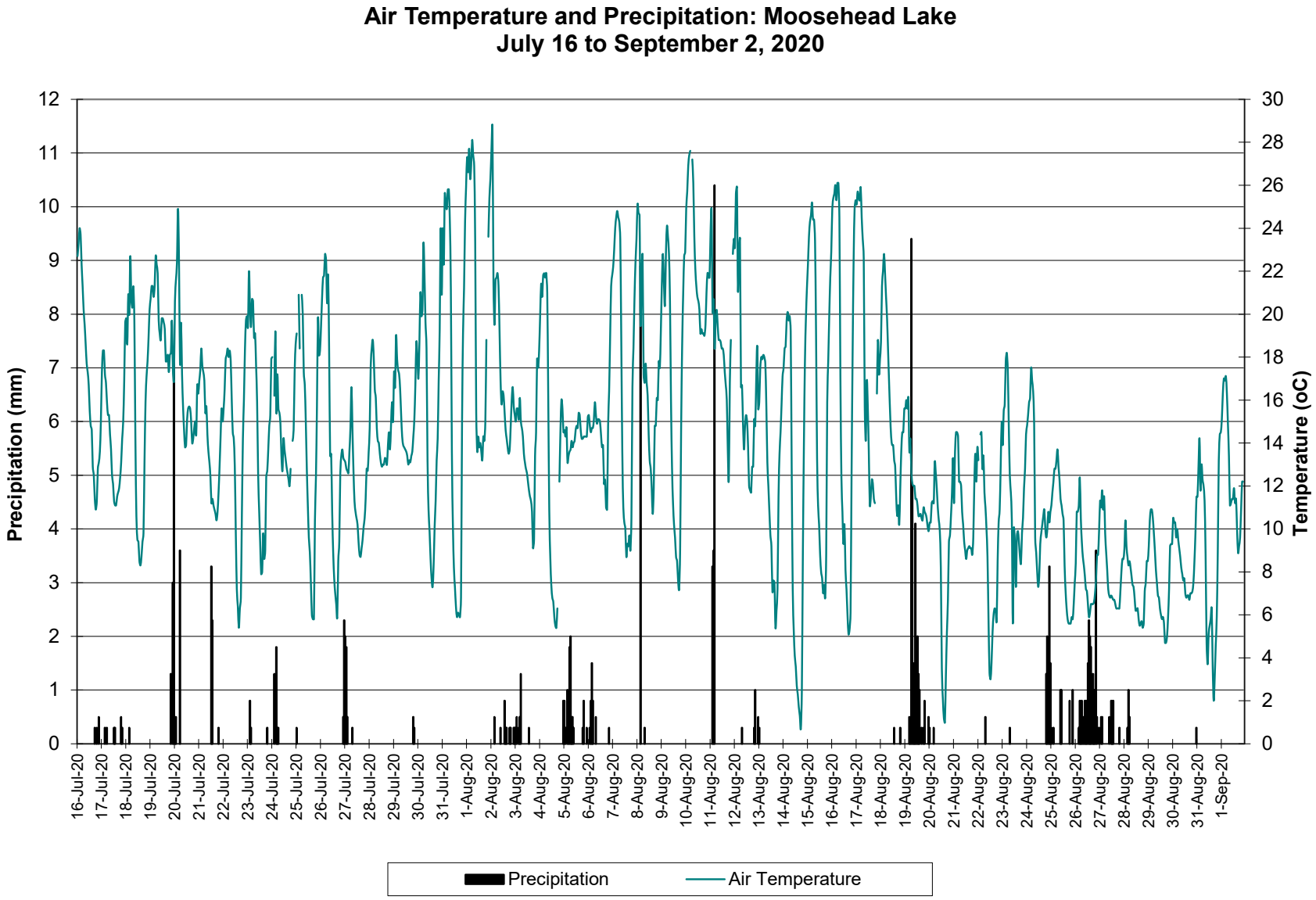
Appendix 1


Air Temperature and Precipitation: Moosehead Lake
July 16 to September 2, 2020
Precipitation (mm)
Temperature (oC)
0
1
2
3
4
5
6
7
8
9
10
11
12
0
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6
8
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28-Aug-20
29-Aug-20
30-Aug-20
31-Aug-20
1-Sep-20
Precipitation
Air Temperature

Appendix 2

QA/QC Grab Sample Results