Real-Time Water Quality Deployment Report

Flora Creek below TLH

July 9 to
August 6, 2014

Newfoundland Labrador

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

Contents

General

- The Water Resources Management Division, in partnership with Cliffs Natural Resources – Wabush Mines, maintains one real-time water quality and water quantity station at Flora Creek.
- This station is situated downstream of the Wabush Mines tailings disposal area, in Flora Lake.
- Water Resources Management Division staff monitors the real-time web pages regularly.
- On July 9, 2014, a real-time water quality monitoring instrument was deployed at the station Flora Creek below TLH. The instrument was deployed for a period of 28 days. The instrument was removed on August 6.

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 9 and August 6, 2014 is summarized in Table 2.

Table 2: Comparison rankings for Flora Creek below TLH station July 9 – August 6, 2014.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Flora Creek below TLH	July 9, 2014	Deployment	Excellent	Good	Poor	Fair	Fair
	Aug 6, 2014	Removal	N/A	N/A	N/A	N/A	N/A

- At deployment, temperature and pH ranked either 'excellent' or 'good'. Conductivity ranked 'poor', the field sonde read a value of 85.7 µs/cm and the QA/QC sonde read a value of 63.4 µs/cm, this is due to the fact that the conductivity sensor needs hours to stabilize. Dissolved oxygen ranked 'fair', the field sonde read a value of 9.41 mg/l and the QA/QC sonde read a value of 8.79 mg/l. Turbidity ranked 'fair', the field sonde read a value of 70.2 NTU and the QA/QC sonde read a value of 80.0 NTU. These rankings could be due to the placement of the QA/QC instrument in relation to the field sonde, or the amount of time the instrument was given to stabilize.

- Comparison rankings are not available at removal due to the EXO2 QA/QC sonde not functioning properly.

Data Interpretation

- The following graphs and discussion illustrate water quality-related events from July 9 to August 6 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 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.

Flora Creek below TLH

- Water temperature ranged from 13.88 to 23.73°C during this deployment period (Figure 1).
- Water temperature increased throughout the first half of the deployment period, it then decreased slightly in the second half of the period (Figure 2).

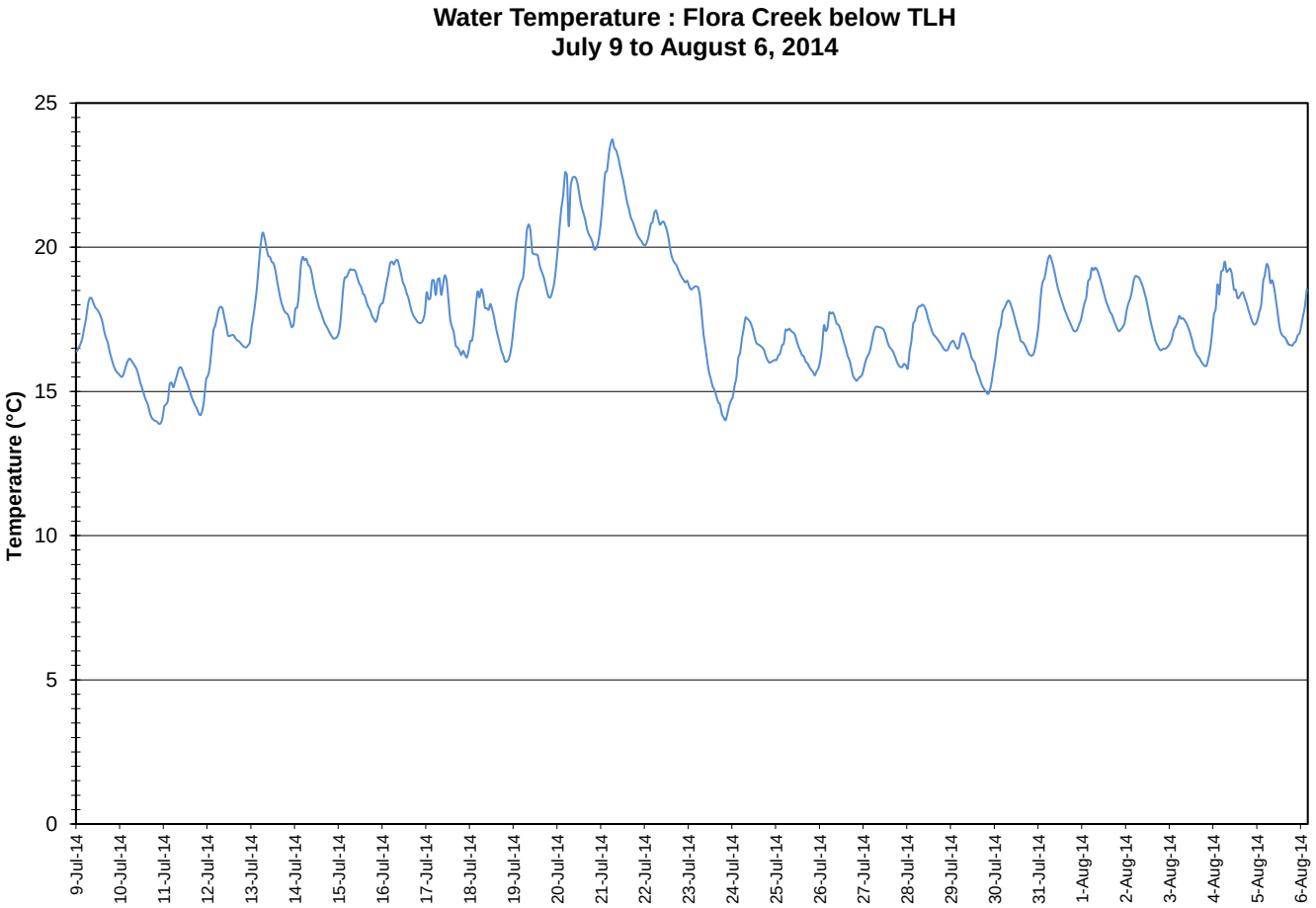

Figure 1: Water temperature at Flora Creek below TLH

Flora Creek below TLH, Newfoundland and Labrador

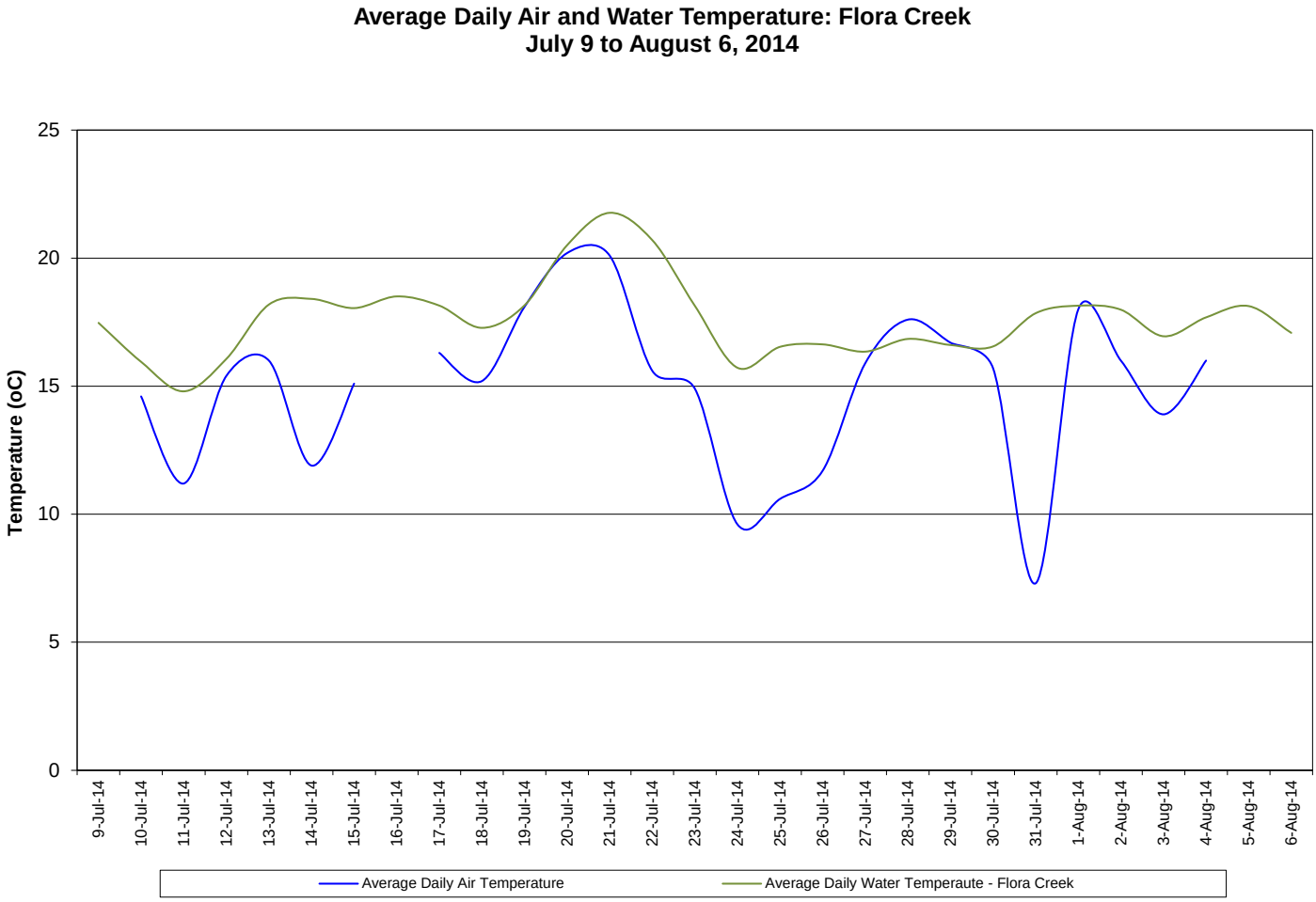

Figure 2: Average daily air and water temperatures at Flora Creek below TLH

Flora Creek below TLH, Newfoundland and Labrador

- pH ranges between 7.41 and 8.00 pH units throughout the deployment period, with a median value of 7.75 units (Figure 3).
- 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.

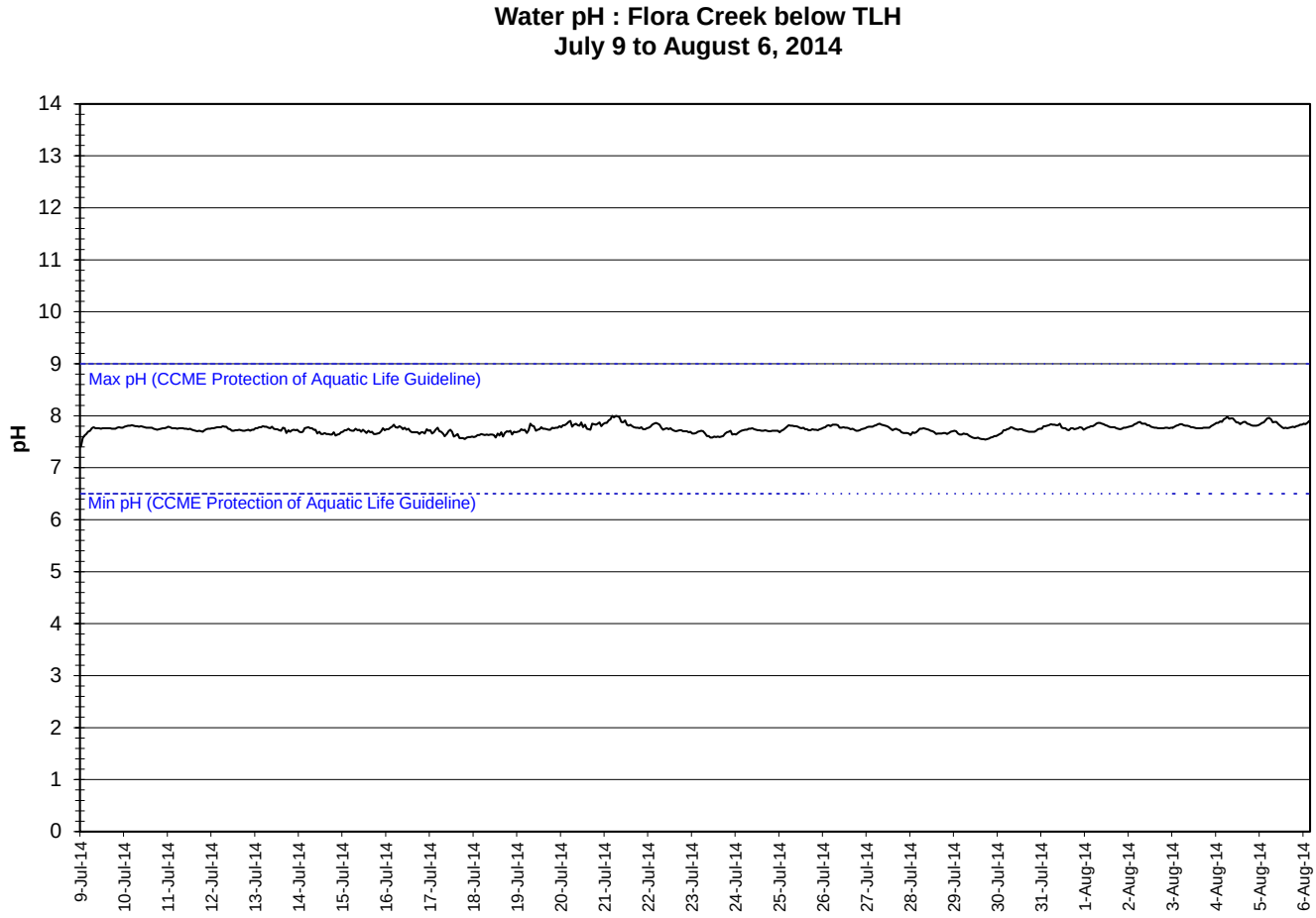

Figure 3: pH at Flora Creek below TLH

- Specific conductivity ranges from 68.5 to 86.8 µs/cm (Figure 4).
- Specific conductivity was relatively stable during the deployment period, slightly increasing during the later portion of the period. Stage data was not available for this period.

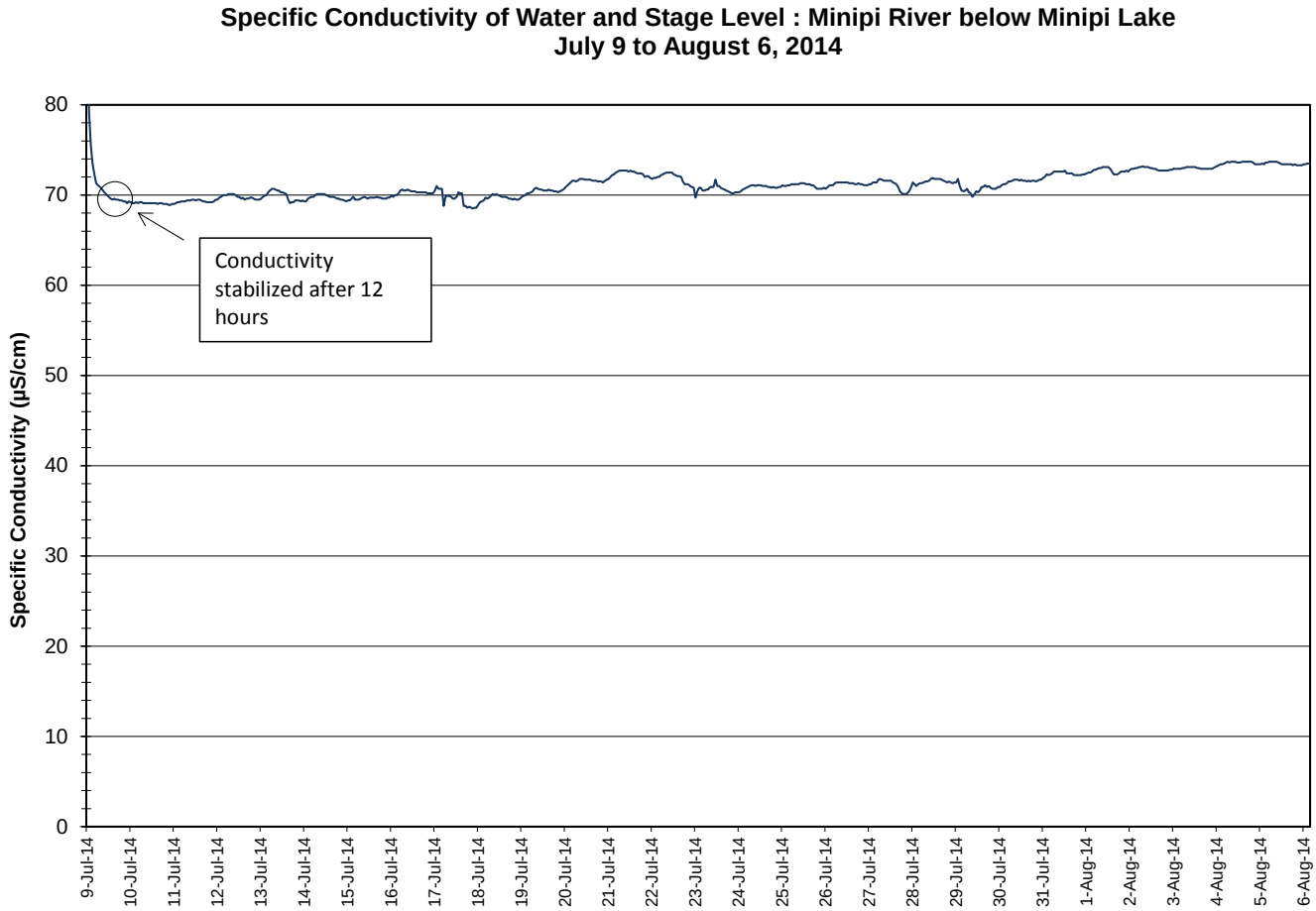

Figure 4: Specific conductivity at Flora Creek below TLH

Flora Creek below TLH, Newfoundland and Labrador

- The saturation of dissolved oxygen ranged from 91.8 to 107.8% and a range of 8.85 to 9.82 mg/l was found in the concentration of dissolved oxygen with a median value of 9.42 mg/l (Figure 5).
- All values were above the minimum CCME Guideline for the Protection of Other Life Stage Cold Water Biota of 6.5 mg/l. Most 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 5.
- Dissolved Oxygen content is relatively stable throughout the deployment period, with slight fluctuations.

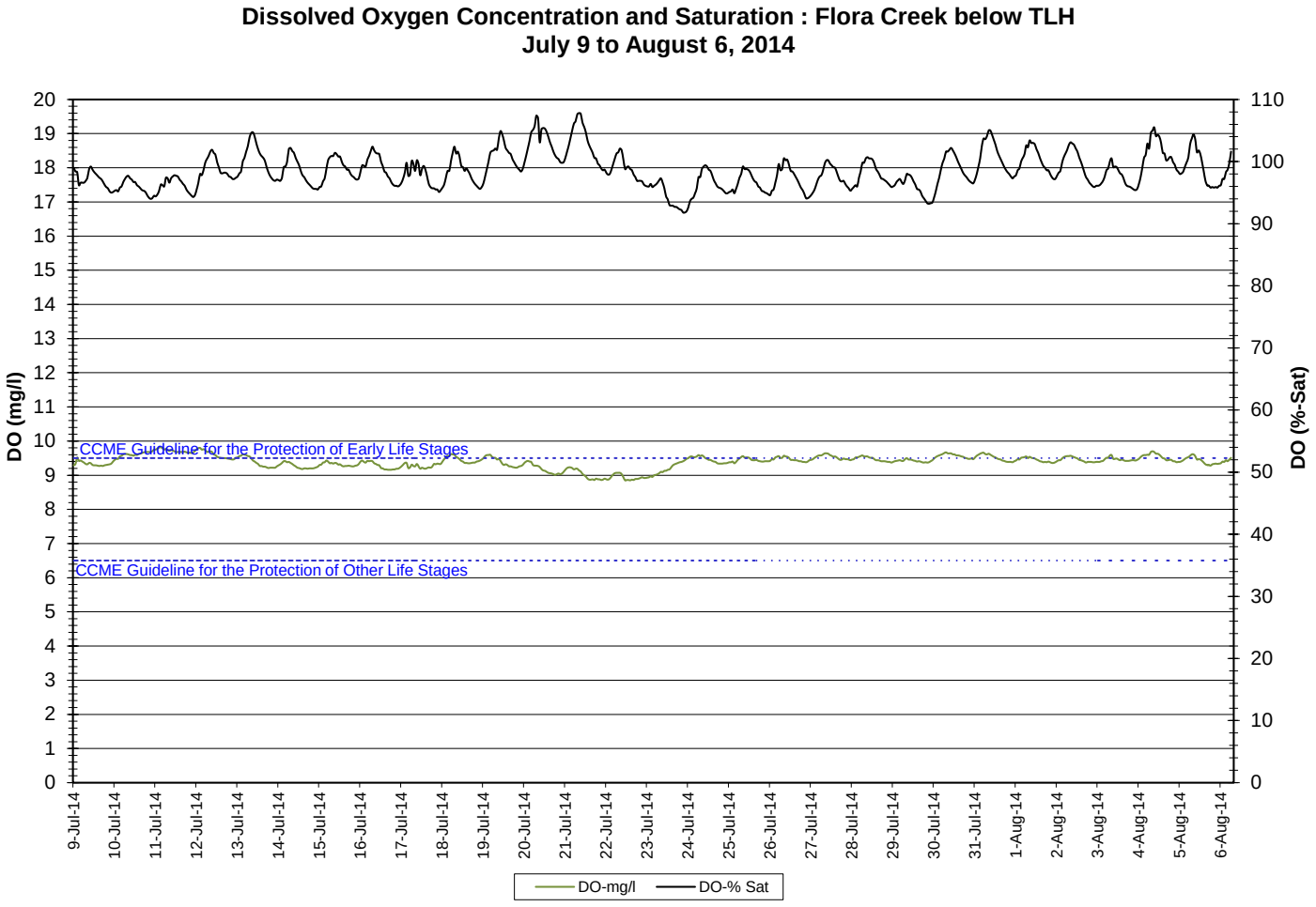

Figure 5: Dissolved oxygen and percent saturation at Flora Creek below TLH

Flora Creek below TLH, Newfoundland and Labrador

- Turbidity values range from 35.5 NTU to 249.0 NTU. Turbidity decreases after the first day of deployment, and then is relatively stable for the remainder of the period (Figure 6).
- There is an increase in turbidity at the beginning of the period. It was raining the day of deployment; this could be the cause for the high readings.

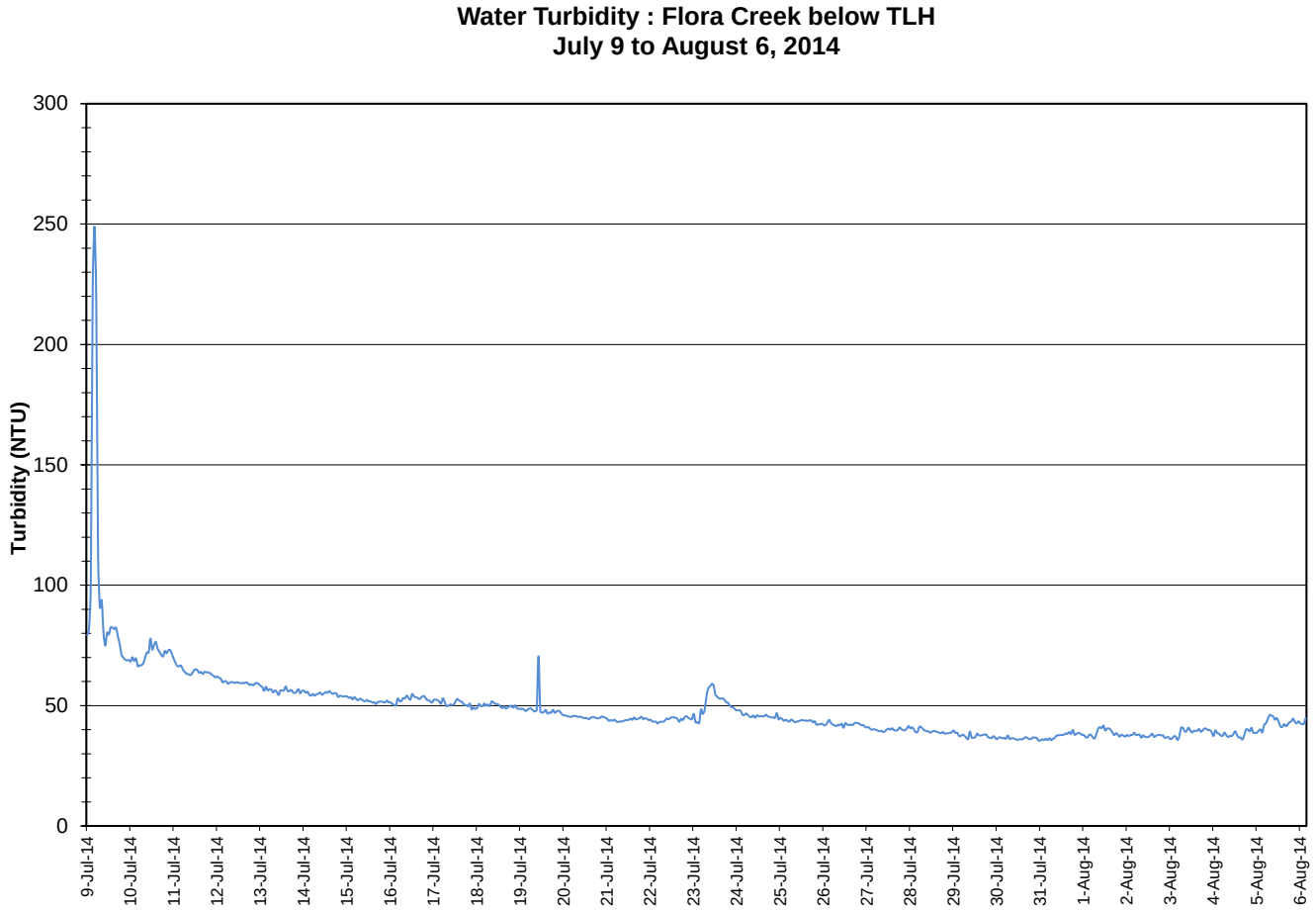

Figure 6: Turbidity at Flora Creek below TLH

Conclusions

- An instrument at the water quality monitoring station on the Flora Creek below TLH station was deployed on July 9 and removed on August 6, 2014.
- In most cases, weather related events or increases/decreases in water level could be used to explain the 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 increased during the majority of the period with a slight decrease towards the end. Water temperature corresponded with air temperature. The temperature typically ranged between 13.88 and 23.73^{o}C.
- pH values were all within the recommended CCME Guidelines for the Protection of Aquatic Life. pH ranged between 7.41 and 8.00.
- Specific conductivity ranged from 68.5 to 86.8 µs/cm. It was noted that the conductivity sensor on this instrument requires a substantial amount of time to stabilize. The sensor stabilized after 12 hours of being in the water.
- 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 and most 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 after the beginning of the deployment period and then were relatively stable.

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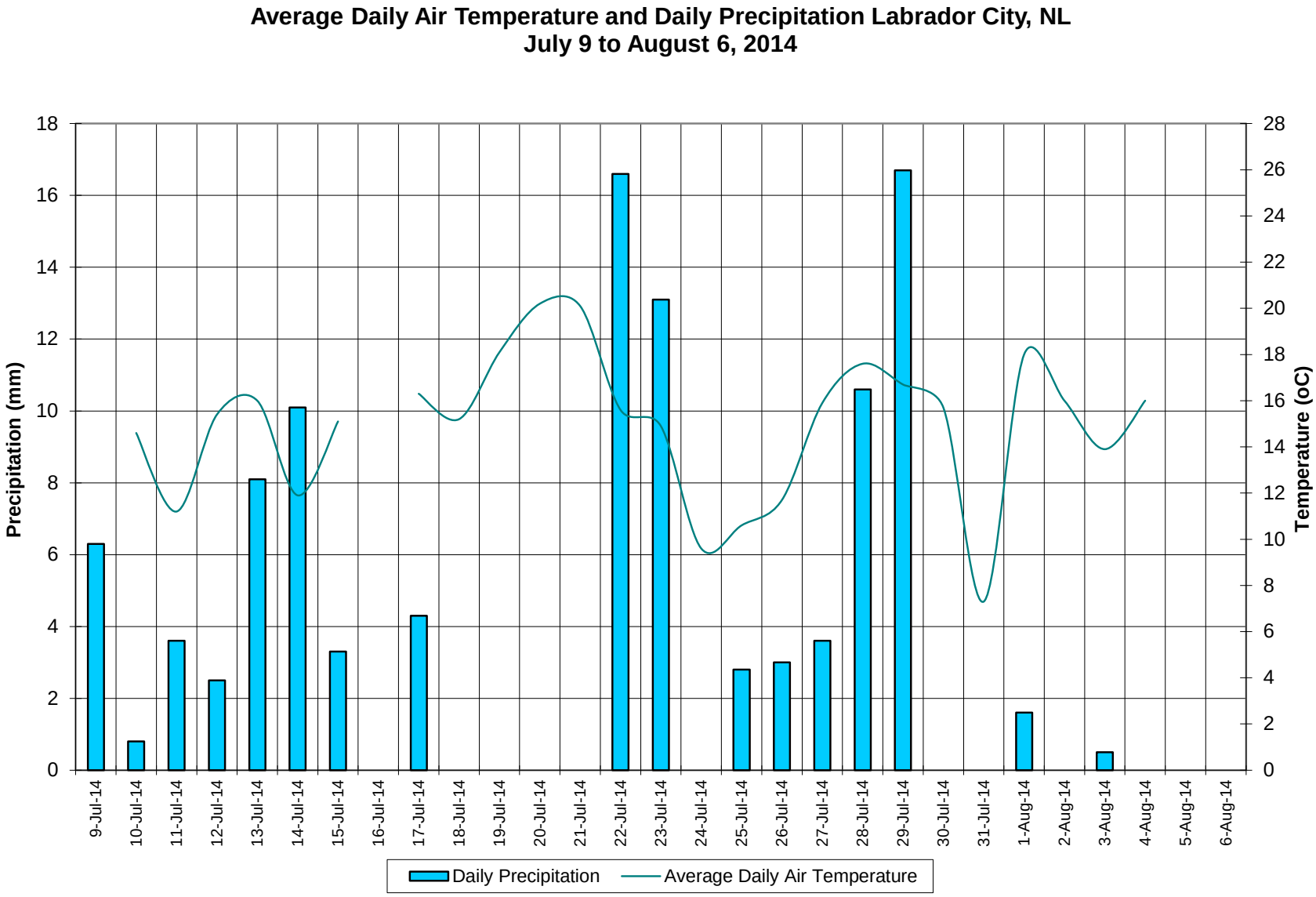
Appendix 1


Average Daily Air Temperature and Daily Precipitation Labrador City, NL
July 9 to August 6, 2014
Precipitation (mm)
Temperature (oC)
0
2
4
6
8
10
12
14
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29-Jul-14
30-Jul-14
31-Jul-14
1-Aug-14
2-Aug-14
3-Aug-14
4-Aug-14
5-Aug-14
6-Aug-14
Daily Precipitation
Average Daily Air Temperature