Real-Time Water Quality Report

Leary's Brook at Prince Philip Drive

Deployment Period
April 18, 2018 to May 15, 2018

Newfoundland Labrador

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

Leary's Brook, Newfoundland and Labrador

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General

- The Water Resources Management Division (WRMD), in partnership with Environment and Climate Change Canada (ECCC), maintains a real-time water quality and water quantity monitoring station at Leary's Brook adjacent to Prince Phillip Parkway.
- The real-time station allows for assessment and management of the water body. This deployment report discusses water quality related events occurring at the Leary's Brook station.
- The purpose of this real-time station is to monitor, process and publish hydrometric (water quantity) and real-time water quality data at the real-time station. Leary's Brook is an urban stream that flows through industrial and commercial areas and adjacent to a major roadway.
- This report covers the period between the deployment on April 18, 2018 and removal on May 15, 2018.

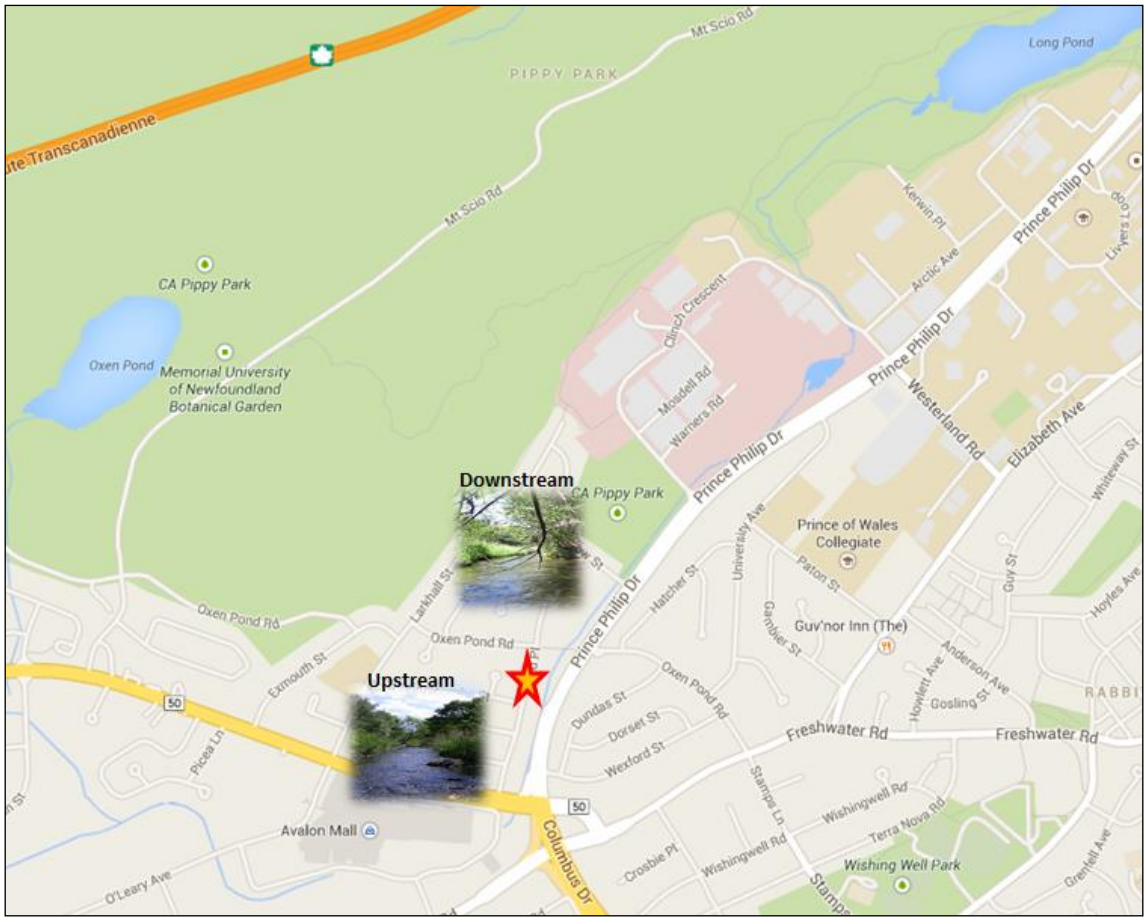

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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 alongside 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 the parameters on 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: Instrument Performance Ranking classifications for deployment and removal

	Rank				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (°C)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	<+/-1
pH (unit)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Sp. Conductance (µS/cm)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Sp. Conductance > 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

- The temperature sensor on any sonde is the most important. All other parameters can be divided into subgroups of: temperature dependent, temperature compensated and temperature independent. Due to the temperature sensor's location on the sonde, the entire sonde must be at a constant temperature before the temperature 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 instrument performance rankings for **Leary's Brook** for this period are summarized in Table 2.

Table 2: Instrument performance rankings for Leary's Brook

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Leary's Brook	April 18, 2018	Deployment	Excellent	Fair	Excellent	Excellent	Excellent
	May 15, 2018	Removal	Excellent	Good	Excellent	Excellent	Excellent

- At the Leary's Brook station at the time of deployment, pH ranked as "Fair" while temperature, conductivity, dissolved oxygen and turbidity ranked as "Excellent".

- At the time of removal, pH ranked as "Good", while temperature, conductivity, dissolved oxygen and turbidity ranked as "Excellent".

Data Interpretation

- The following graphs and discussion illustrate water quality-related events from April 18, 2018 to May 15, 2018 at the Leary's Brook station.
- 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 (WSC) is responsible for QA/QC of water quantity data. Corrected and finalized data may be retrieved from the WSC website (http://www.ec.gc.ca/rhc-wsc/)
- Precipitation data from the deployment period was retrieved from the ECCC weather station at St. John's International Airport.

Leary's Brook

Water Temperature

- Water temperature ranged from 2.13 °C to 14.60 °C during this deployment period (Figure 2).
- Water temperature at Leary's Brook displays a typical variation over the deployment period. Water temperature is influenced by air temperature.
- The water temperature data displayed on Figure 2 is typical of shallow streams and ponds. Shallow water bodies are highly influenced by variations in ambient air temperatures. Water temperature often falls overnight and rises during daylight hours.
- Please note the stage data is raw data that is published on the ECCC web page. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

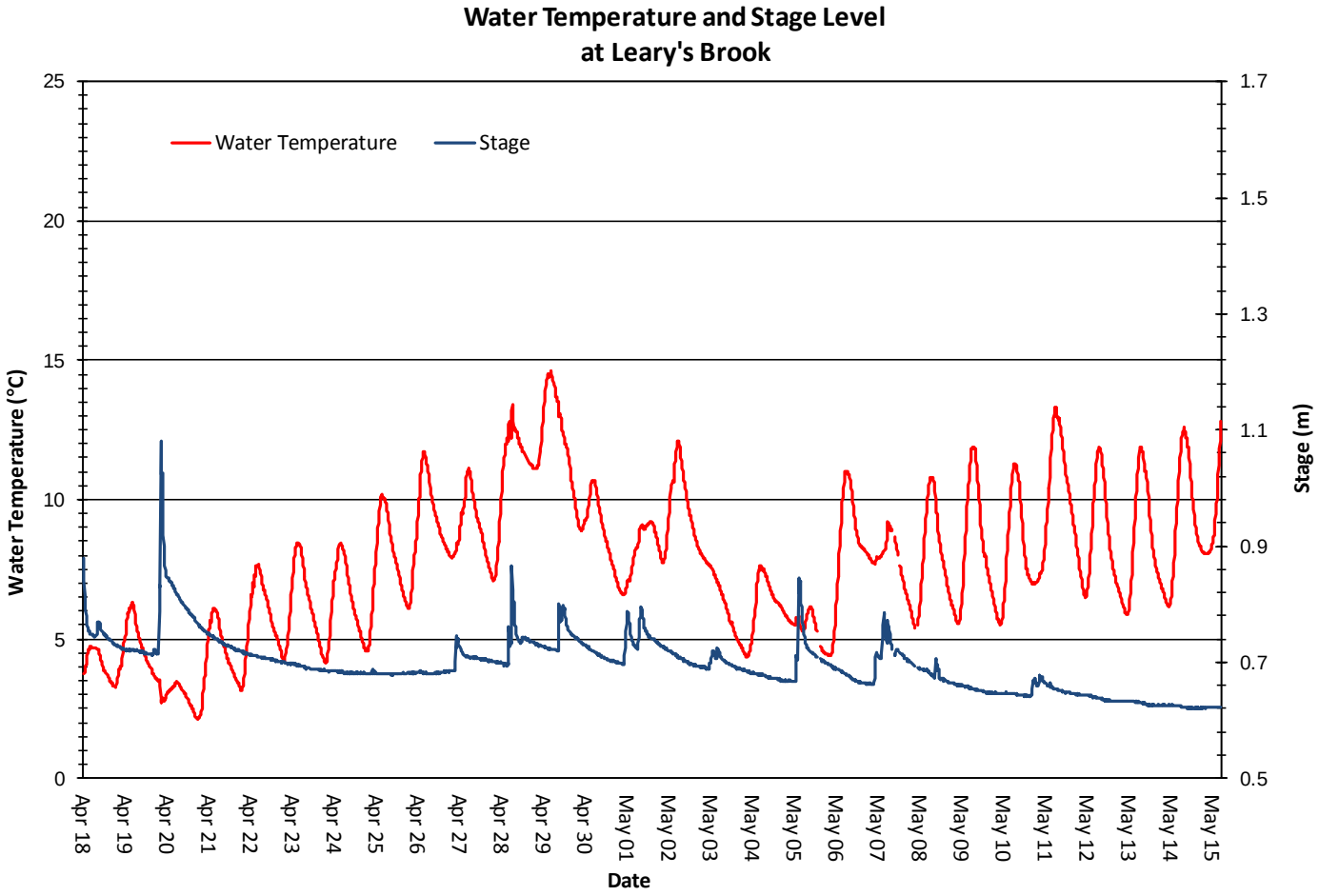

Figure 2: Water Temperature and Stage Level at Leary's Brook

pH

- Throughout this deployment period pH values ranged between 6.29 pH units and 6.66 pH units (Figure 3).
- The CCME guideline provides a basis by which to judge the overall health of the brook. Naturally, all streams and brooks are different. Leary's Brook pH median was 6.68 (pH units) for this deployment period.
- pH typically falls slightly in Leary's Brook (the water becomes more acidic) at the same time as stage and flow are increasing In general, precipitation entering Leary's Brook has a lower pH than local surface water and this causes a reduction in the pH of the brook.
- The pH sensor is believed to have been malfunctioning for the duration of this deployment period resulting in recorded pH values that are lower than actual conditions. Recorded pH values were mostly below the CCME standard that is protective of aquatic life.

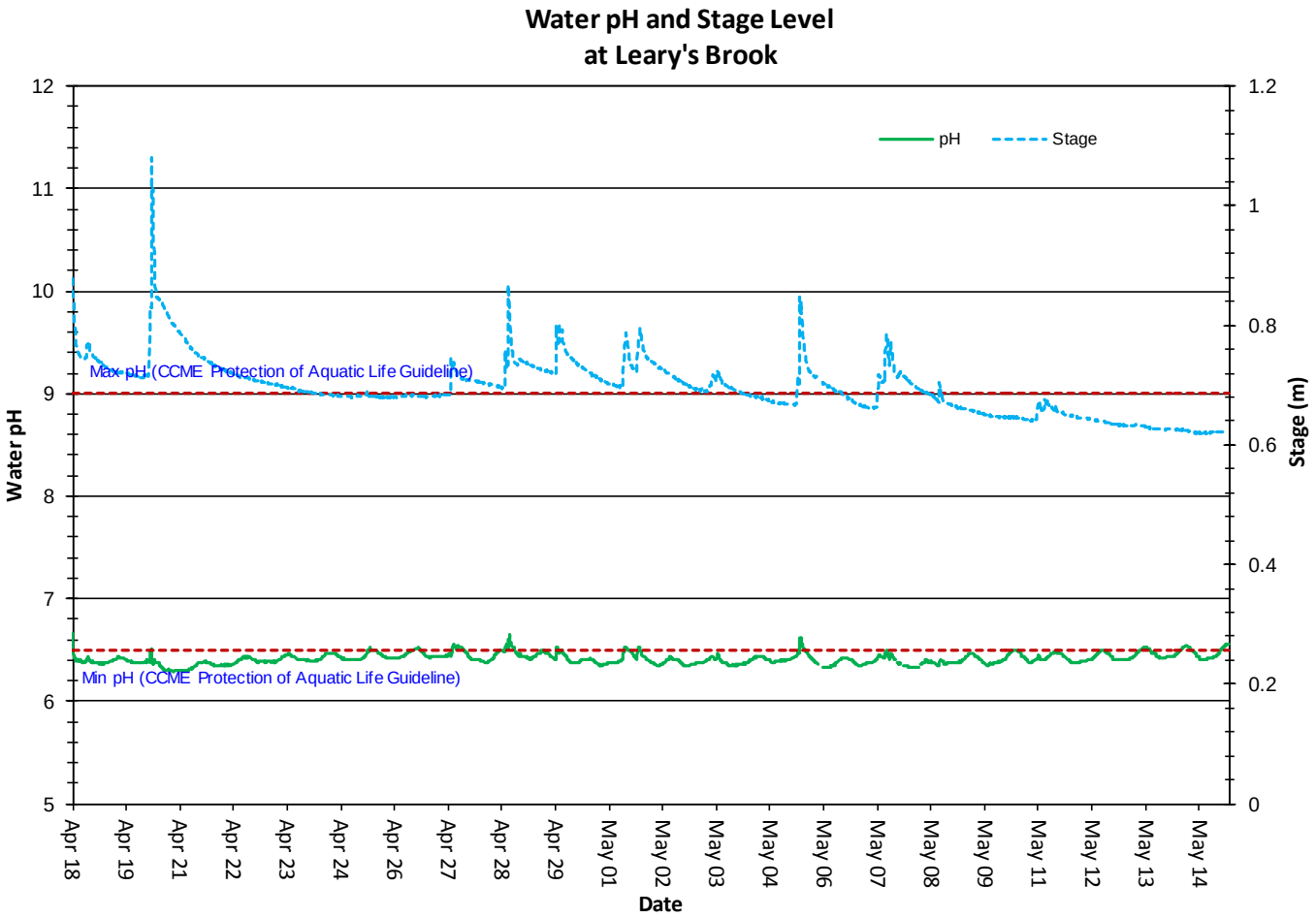

Figure 3: Water pH (pH units) values at Leary's Brook Station

Specific Conductivity

- The conductivity levels ranged between 486.0 µS/cm and 2829.9 µS/cm during this deployment period. The median was 735.0 µS/cm. TDS ranged from 0.3110 g/ml to 1.8100 g/ml. (Figure 4)
- The rapid increases in conductivity seen during the beginning of this deployment period are associated with precipitation runoff carrying road salts into the brook. During the second half of the deployment this pattern was reversed as road salting for ice control is ended. Runoff on May 1st, 5th and 7th caused a dilution of salts already present in the brook and a resulting decrease in conductivity levels.

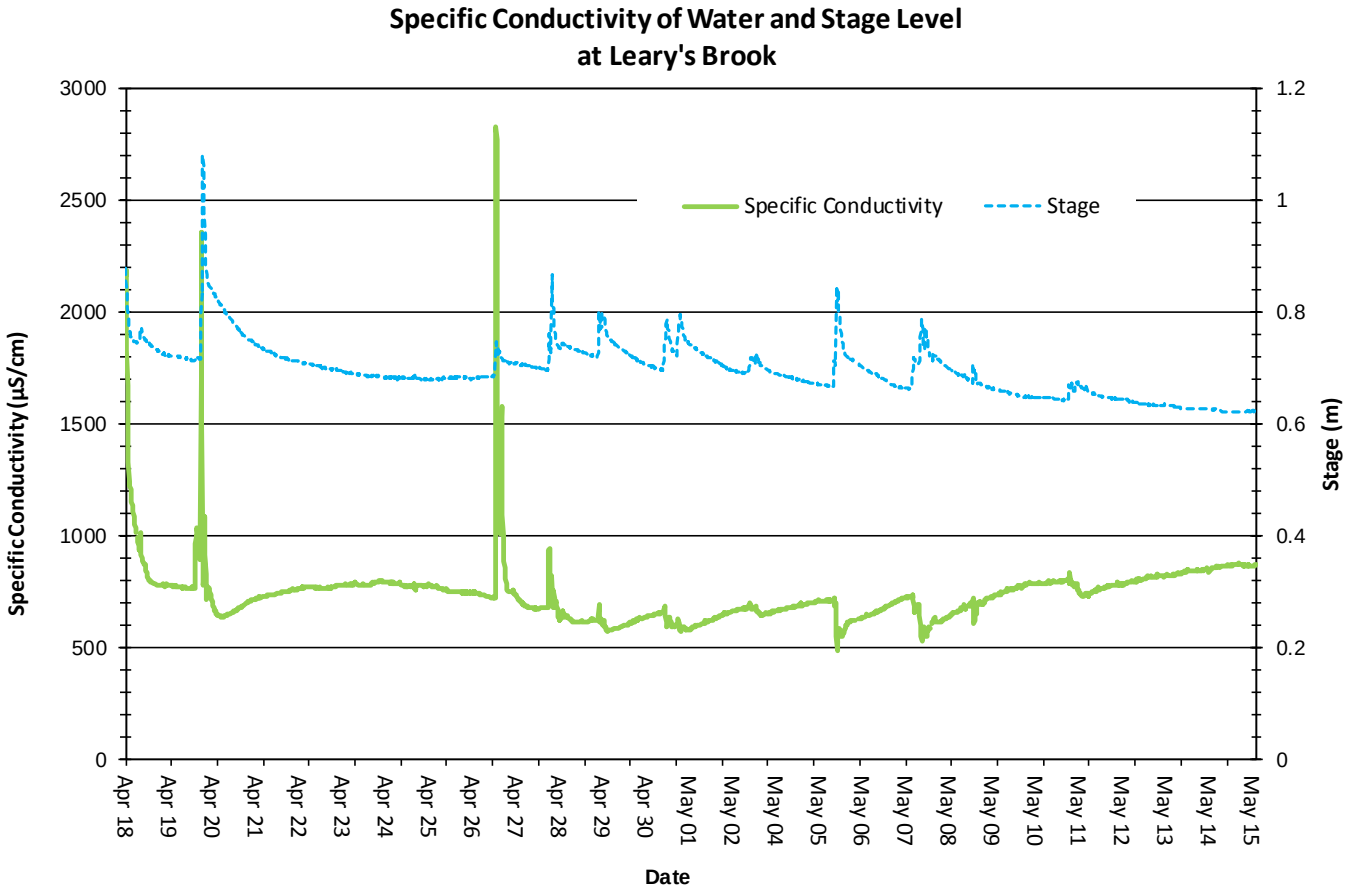

Figure 4: Specific conductivity values at Leary's Brook Station

Dissolved Oxygen

- The instrument measures dissolved oxygen (mg/L) and then calculates the percent saturation (% Sat.).
- The Dissolved Oxygen % Sat levels within this deployment period were between 95.7 % Sat and 101.5 % Sat. Dissolved Oxygen (mg/L) measured between 10.03 mg/L and 13.16 mg/L. (Figure 5)
- The DO mg/L values were above the minimum DO CCME guidelines for the protection of early life stages and other life stages during this deployment period (Figure 5).
- Small decreases in available oxygen are associated with increases in water temperature. Warm water can hold less dissolved oxygen than cooler water.
- The lowest levels of DO correspond with the highest water temperatures recorded during this deployment period.

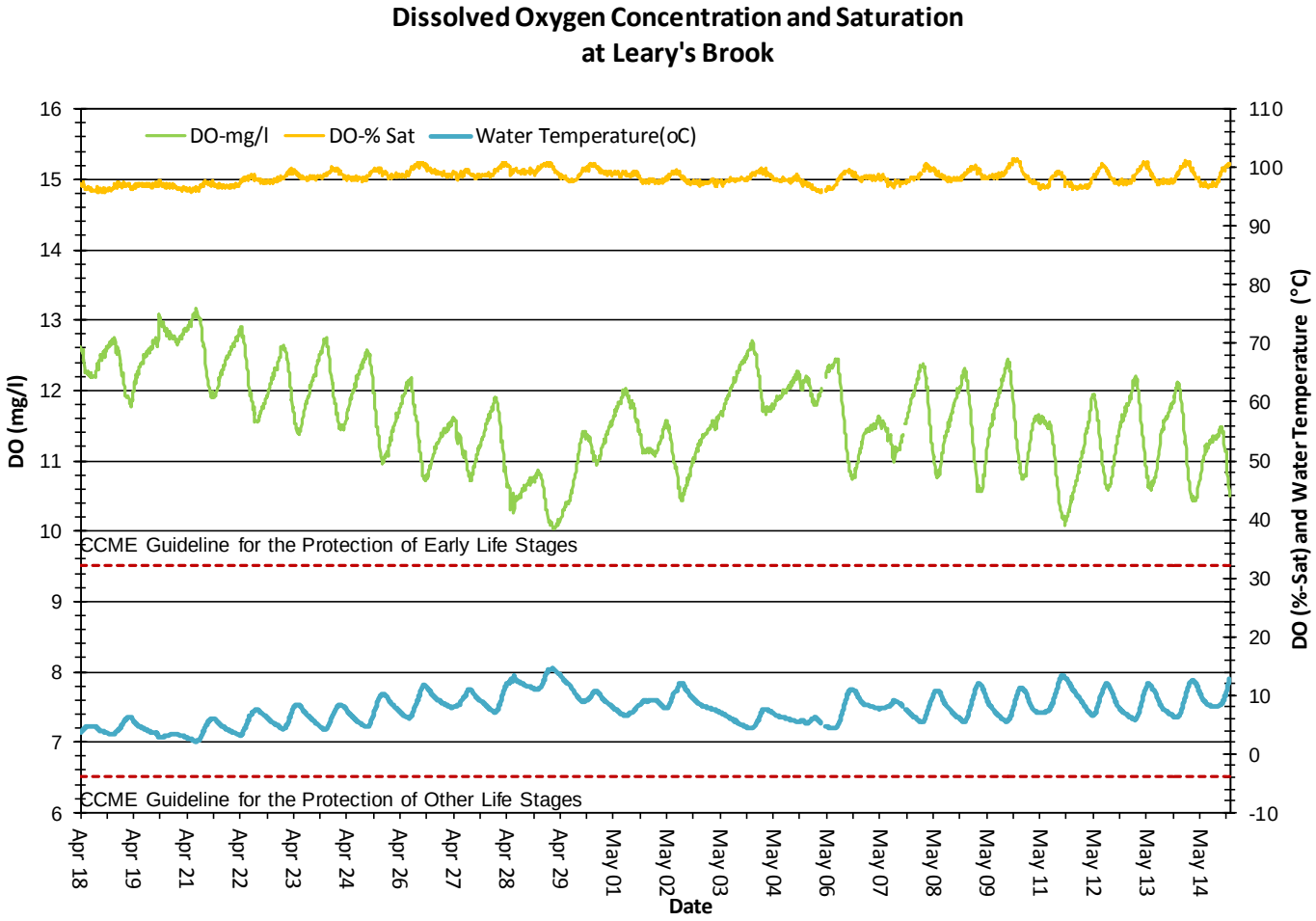

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

- The turbidity sensor records values between 0 NTU and 3000 NTU. A turbidity reading of 3000 NTU is identified as an error and is not a true value. Readings of 3000 NTU should not be included in any statistical analysis.
- The turbidity readings during this deployment ranged between 0.0 NTU to 149.8 NTU (Figure 6).
- Turbidity typically increases in Leary's Brook during the early stages of precipitation events as sediments from the urban environment are carried into the brook by runoff.

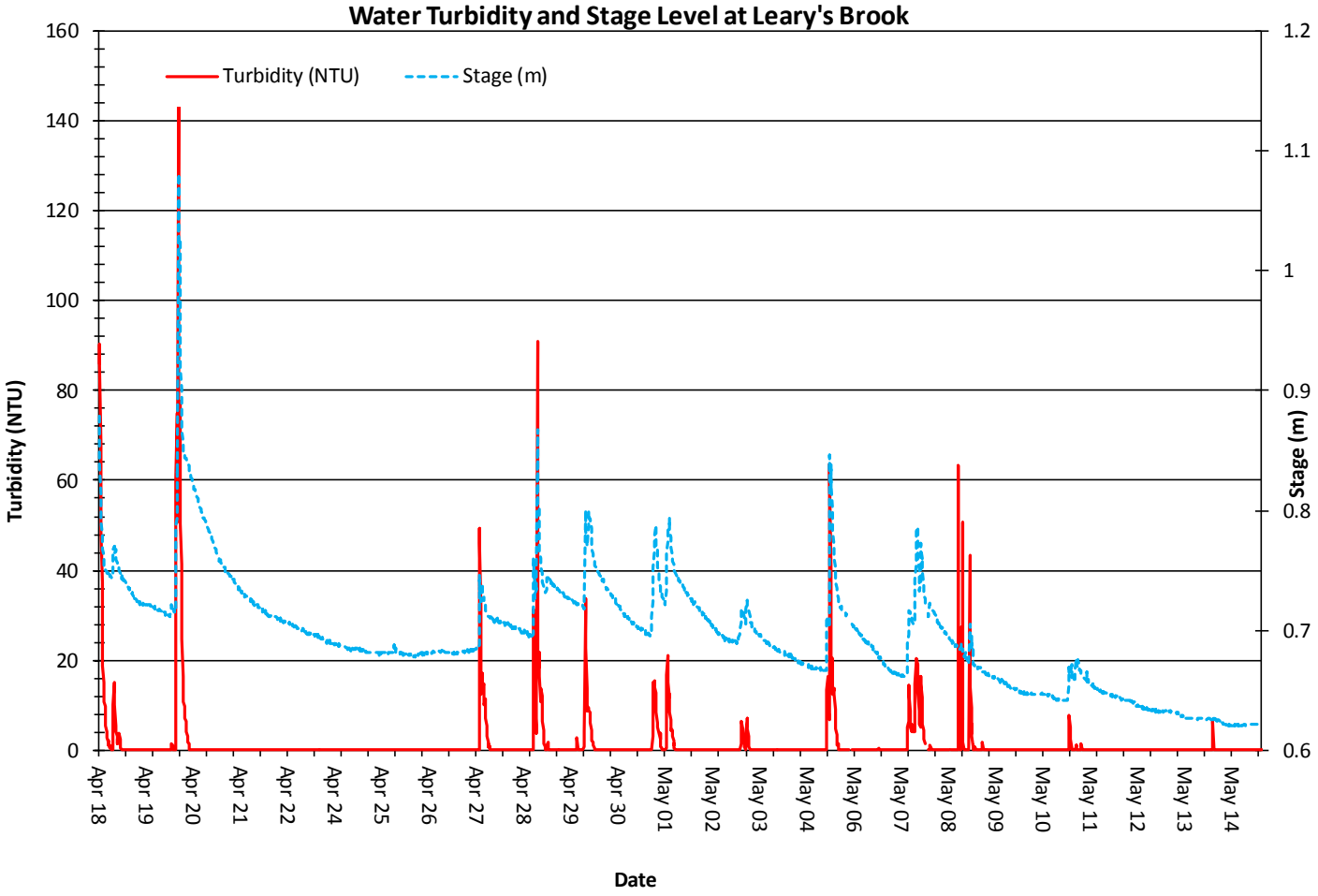

Figure 6: Turbidity (NTU) values at Leary's Brook Station

Stage and Total Precipitation

- The graph below shows daily total precipitation data from St. John's International Airport weather station and the daily average stage (Figure 7). Please note that the stage data in this report is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.
- Stage (and streamflow) usually varies significantly throughout a deployment period in Leary's Brook.

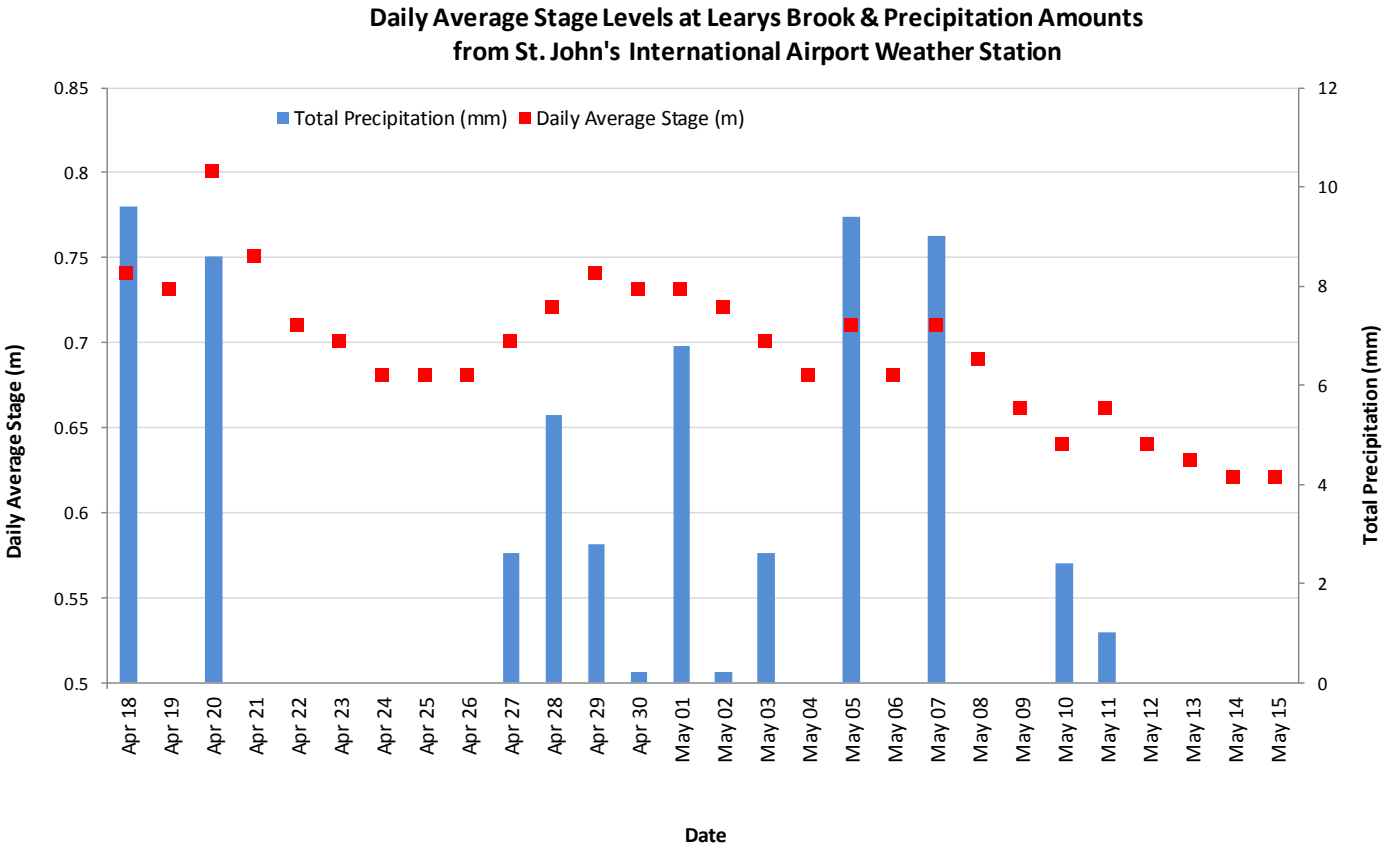

Figure 7: Daily average stage values (m) from Leary's Brook and daily total precipitation values (mm) from St. John's International Airport.

Conclusions

In both natural and urban environments, climate and weather conditions can contribute in large part to variations in water quality. During this deployment it was evident that many of the changes in Leary's Brook water chemistry are related to intermittent precipitation events and small climatic changes of the seasons.

Precipitation and runoff events during the deployment period led to related increases in stage, which thus influenced the values of turbidity, pH, specific conductance, and TDS. Also, when ambient air temperatures increased there were correspondingly warmer water temperatures, which in turn decreased the amount of dissolved oxygen in the water.

During this deployment period the median water temperature at the Leary's Brook station was 1.95°C.

The median pH value for Leary's Brook Station was 6.68 (pH units). The pH level usually decreases at this station during rainfall events and increases during dry periods.

Conductivity had a median value of 1134.0 µS/cm. The maximum conductivity was 8614.9 µS/cm. At this time of year, when road salt is still being used, conductivity usually increases rapidly in Leary's Brook as runoff carries salt laden water into the brook.

Dissolved Oxygen at Leary's Brook had a median of 95.2 %Sat and 12.91 mg/L during the deployment period. Small reductions in DO (mg/L and % Sat) correspond with increases in water temperatures. DO levels remain above the "CCME Guideline for the Protection of Early Life Stages" throughout the deployment period.

Located just downstream of the Avalon Mall/Kenmount Road area, Leary's Brook is adversely impacted by urban runoff. This runoff carries heavy loads of sedimentation and litter into the brook. Monitoring water chemistry captures some impacts of urban runoff, such as elevated conductivity and turbidity, but it does not record the ecological and esthetic impacts of garbage and sediments. The photograph below (Figure 8) was taken just downstream of the monitoring station at Leary's Brook on April 18, 2018.

Leary's Brook, Newfoundland and Labrador

Figure 8: Leary's Brook, St. John's on April 18, 2018