Real-Time Water Quality Report

Leary's Brook at Prince Philip Drive

Deployment Period
September 23, 2015 to October 20, 2015

Newfoundland Labrador

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

Prepared by:

Paul Rideout
Environmental Scientist
Water Resources Management Division
Department of Environment & Conservation
4th Floor, Confederation Building, West Block
PO Box 8700, St. John's NL A1B 4J6
Ph. No.: (709) 729 - 0351
Fax No.: (709) 729 - 0320
paulrideout@gov.nl.ca

General

- The Water Resources Management Division (WRMD), in partnership with Environment Canada, maintain 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 September 23, 2015 and removal on October 20, 2015.

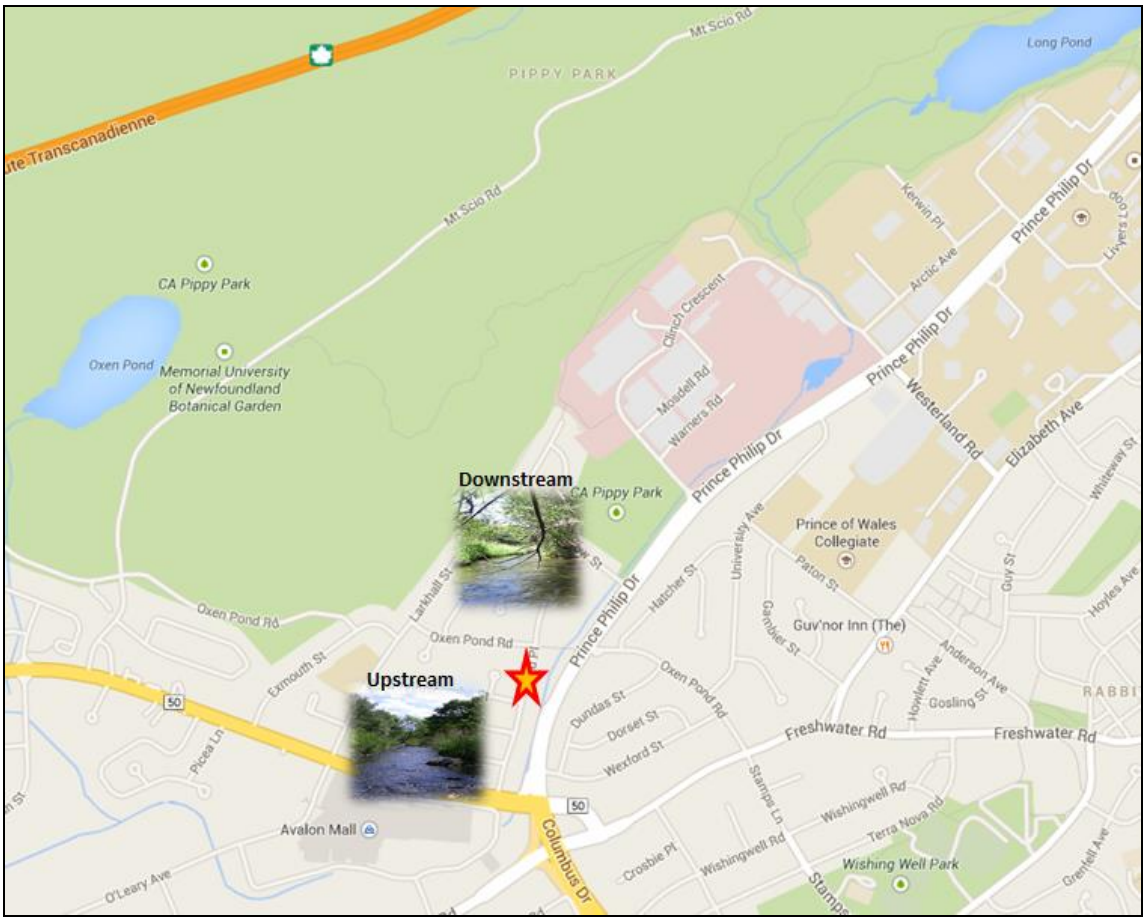

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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 dependant, 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 the period of September 23, 2015 to October 20, 2015 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	**September 23 2015**	**Deployment**	Excellent	Good	Excellent	Excellent	Excellent
	October 20 2015	**Removal**	Excellent	Good	Fair	Fair	Excellent

- At the Leary's Brook station at the time of deployment, the temperature, conductivity, dissolved oxygen and turbidity data all ranked as 'Excellent'. The pH data ranked as "Good." At the time of removal, temperature and turbidity ranked as "Excellent", pH ranked as "Good" and conductivity and dissolved oxygen rated as 'Fair".

Data Interpretation

- The following graphs and discussion illustrate water quality-related events from September 23, 2015 to October 20, 2015 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 is responsible for QA/QC of water quantity data. Corrected and finalized data may be retrieved from the Water Survey of Canada website (http://www.ec.gc.ca/rhc-wsc/)
- Precipitation data from the deployment period was retrieved from the Environment Canada weather station at St. John's International Airport.

Leary's Brook

Water Temperature

- Water temperature ranged from 7.05°C to 16.5°C during this deployment period (Figure 2).
- Water temperature at Leary's Brook displays a typical variation in pattern 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 falls overnight and rises during daylight hours.
- It is evident from the graph below that increases in stage that occurred as a result of precipitation over the October 1-2 period and on October 10 correspond with a decrease in water temperatures.

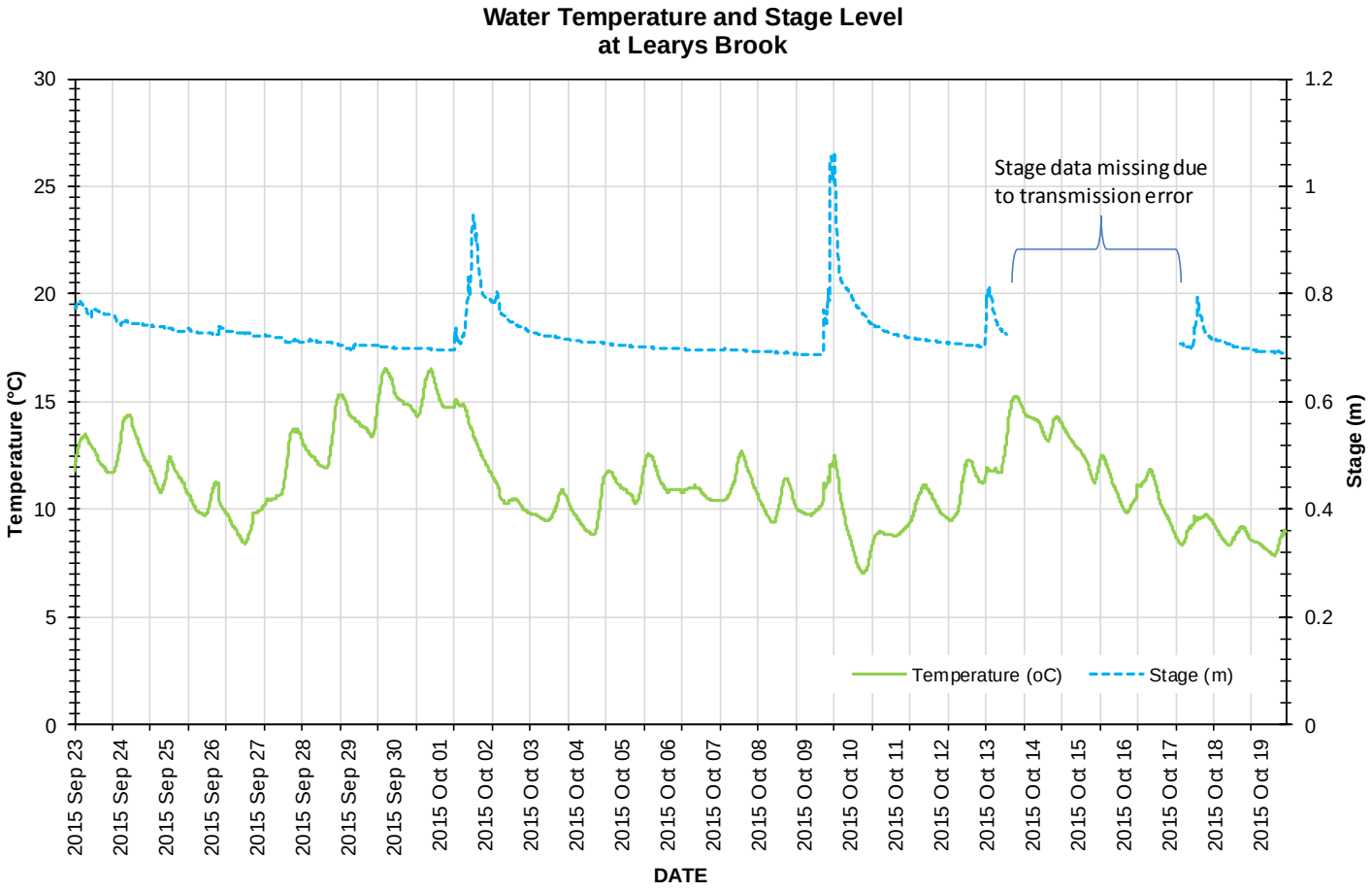

Figure 2: Water temperature (°C) values at Leary's Brook

pH

- Throughout this deployment period pH values ranged between 6.60 pH units and 7.05 pH units (Figure 3).
- During the deployment, pH values were consistently above the minimum CCME Guidelines for the Protection of Aquatic Life (6.5 pH units).
- 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 6.93 (pH units) for this deployment period.

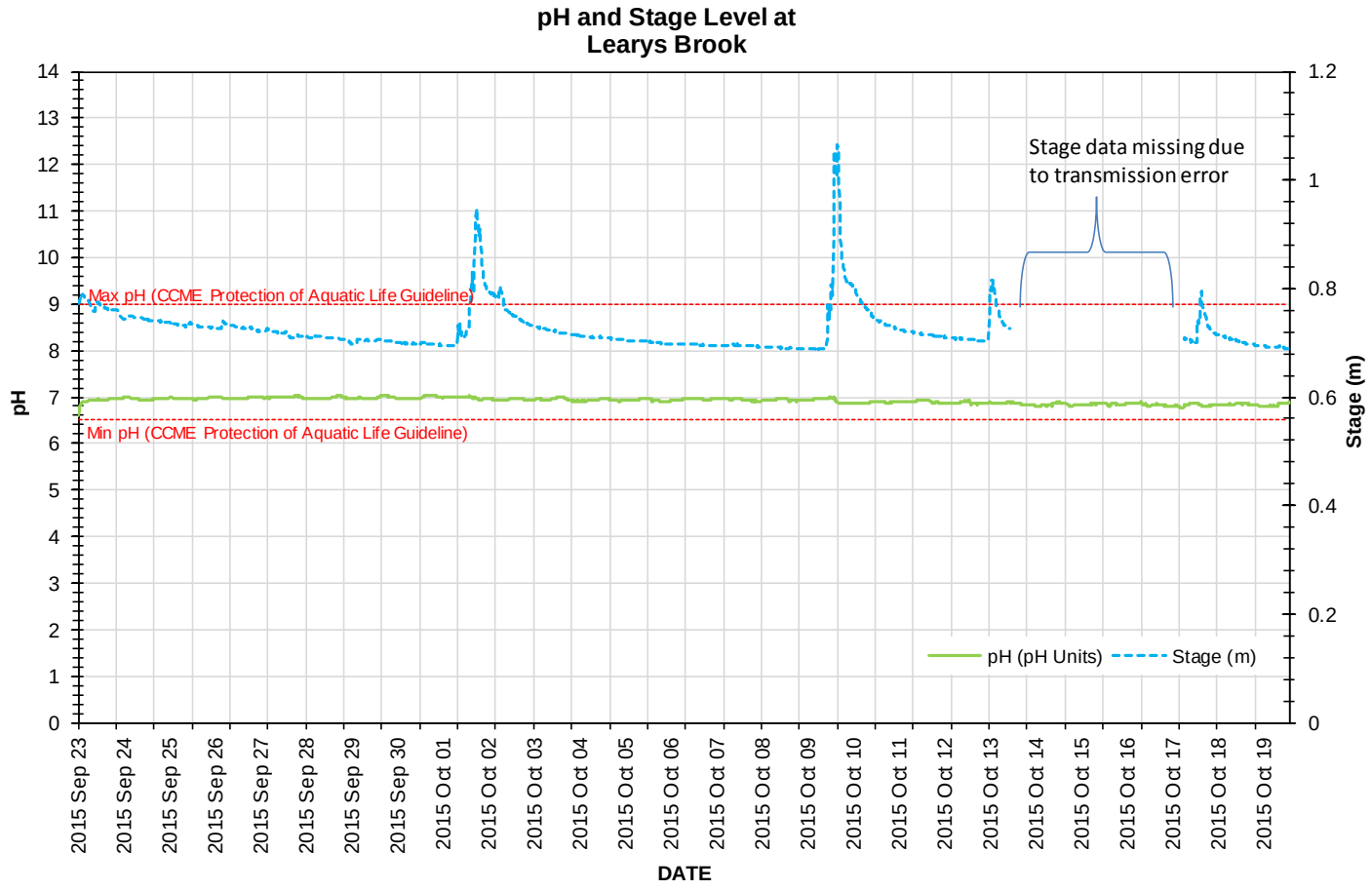

Figure 3: pH (pH units) values at Leary's Brook Station

Specific Conductivity

- The conductivity levels ranged between 109.5 µS/cm and 768.0 µS/cm during this deployment period. The median was 685.0 µS/cm. TDS ranged from 0.0701 g/ml to 0.4910 g/ml.
- During dryer periods, specific conductivity and total dissolved solids (TDS) rise as water levels and flows decrease. With less dilution occurring from runoff (compared to wetter months) concentrations of dissolved solids and specific conductance increase during dry (low stage) periods. Conversely, rainfall events and increased runoff cause TDS levels and specific conductivity to drop as stream water is temporarily diluted.
- Total dissolved solids (TDS) readings for the October 14-18 period are taken from the sonde's internal log and are recorded to one decimal point only.

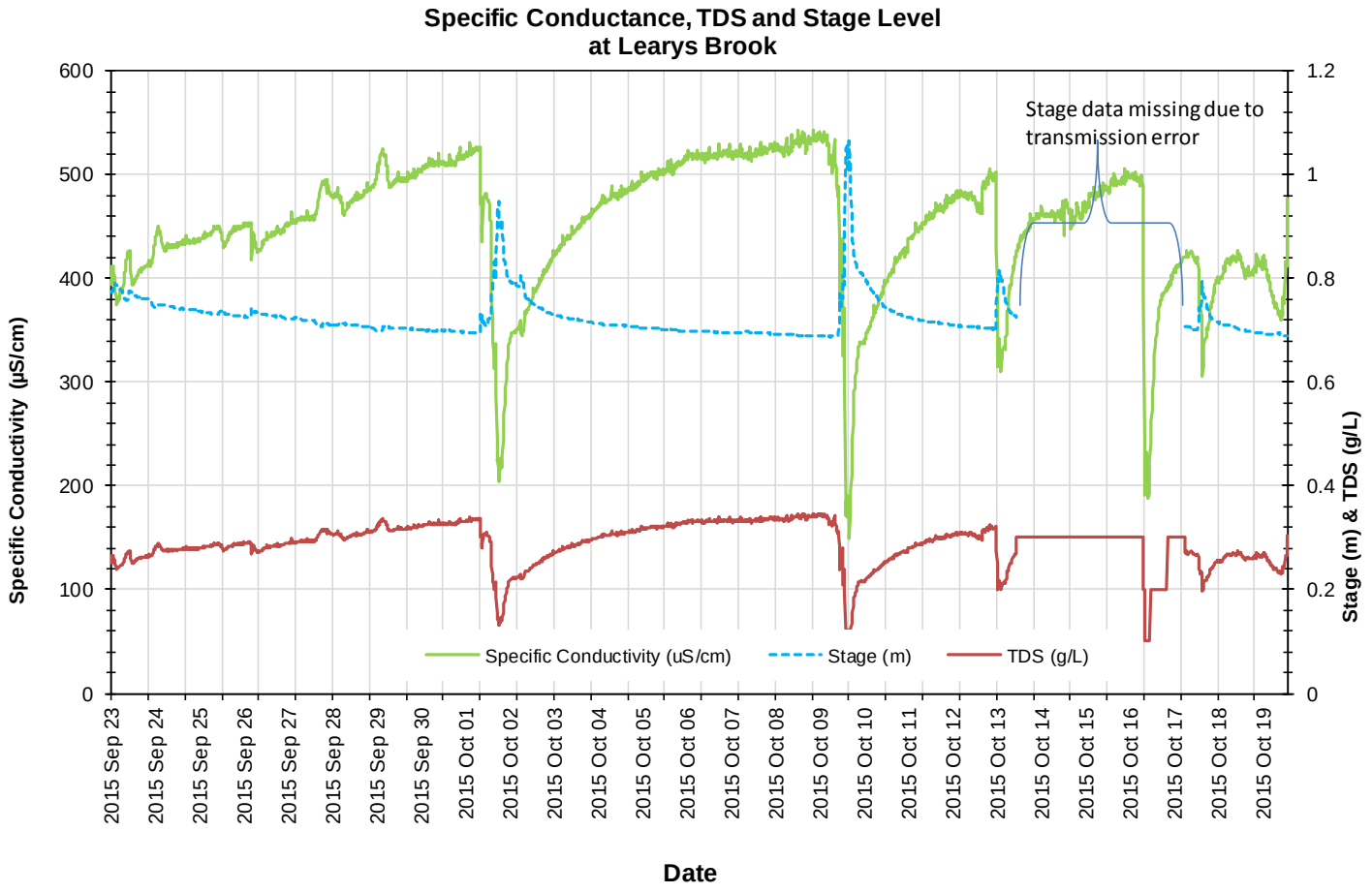

Figure 4: Specific conductivity (µS/cm), TDS (g/L) and stage (m) values at Leary's Brook Station

Dissolved Oxygen

- The instrument measures dissolved oxygen (mg/L) directly then calculates percent saturation (% Sat.).
- The Dissolved Oxygen % Sat levels within this deployment period were between 89.6% Sat and 95.7% Sat. Dissolved Oxygen (mg/L) measured between 8.96 mg/L and 11.23 mg/L.
- The DO mg/L values are generally above the minimum DO CCME guideline for early life stages for the majority of this deployment period (Figure 5).
- There is a slight increase in dissolved oxygen concentration across the deployment period. This is to be expected as the air and water temperatures begin to fall as nights get cooler and fall advances. Cool water can hold more dissolved oxygen than warmer water.

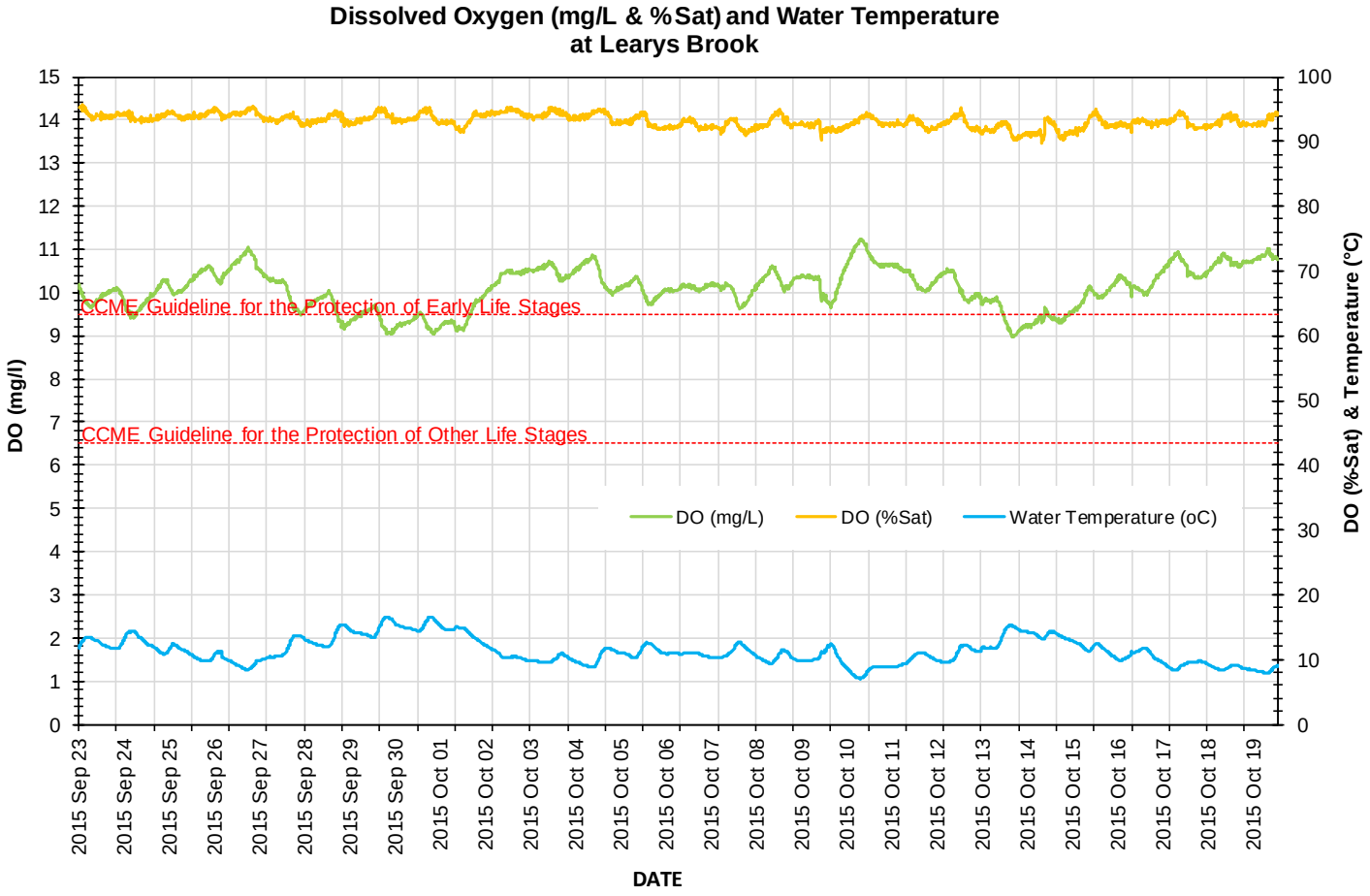

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

- The turbidity sensor records values between 0 NTU and 3000 NTU. A turbidity reading of 3000NTU 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 within 0.0 NTU to 70.5 NTU (Figure 6).
- Higher turbidity values closely correspond with precipitation events and elevated river stage and runoff (Figure 7). Rainfall and subsequent runoff along with increased flow carries road and bank sediment and other material into the brook and this is what the turbidity sensor captures.

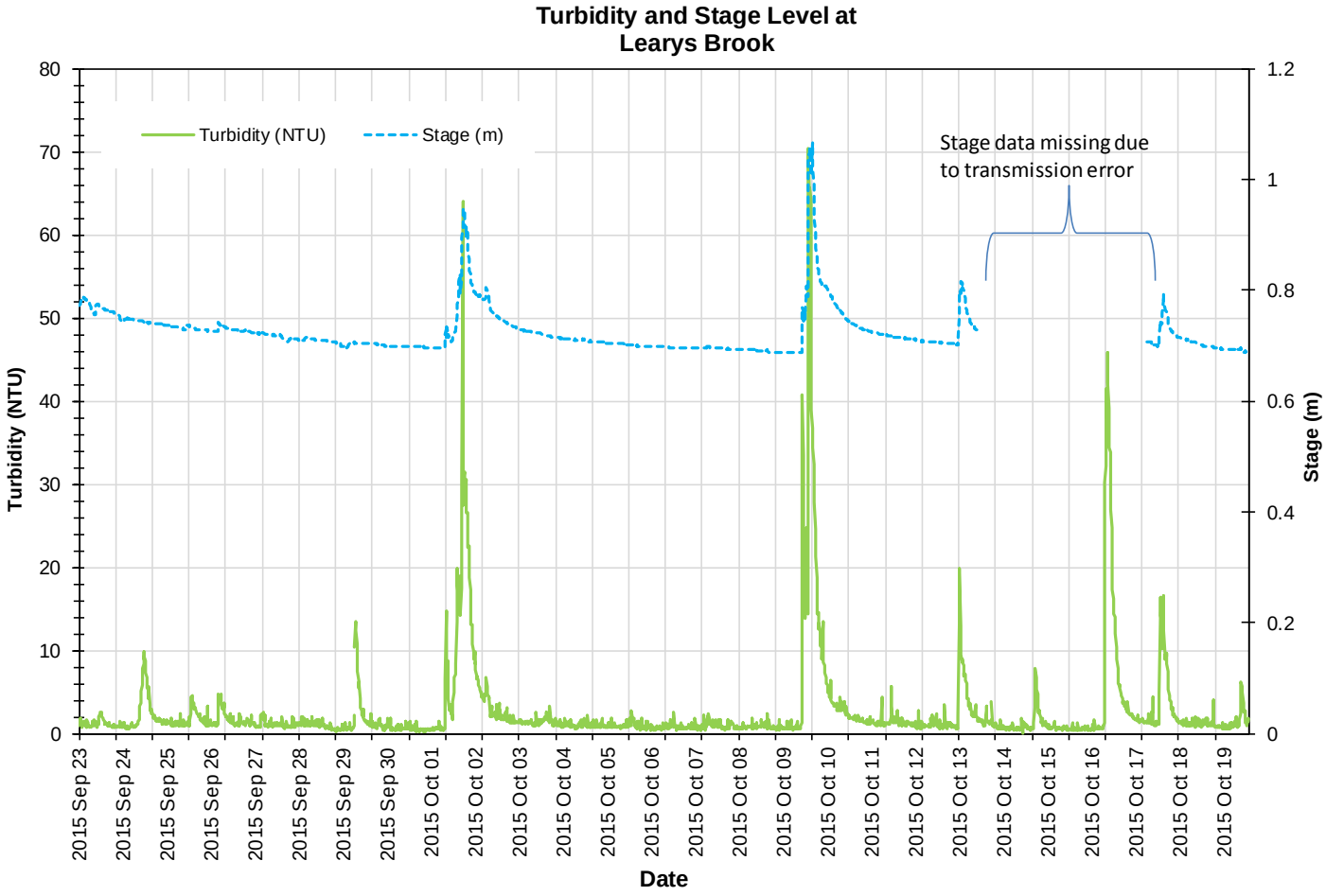

Figure 6: Turbidity (NTU) values at Leary's Brook Station

Stage and Total Precipitation

- The below graph includes daily total precipitation data from St. John's International Airport weather station and the daily average stage. 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 the deployment period in Learys Brook (Figure 7). Stage is directly influenced by rainfall and subsequent runoff from the surrounding environment. Precipitation runoff impacts urban streams relatively quickly as rainfall flows across impervious surfaces such as roads and parking lots and then into storm drains.

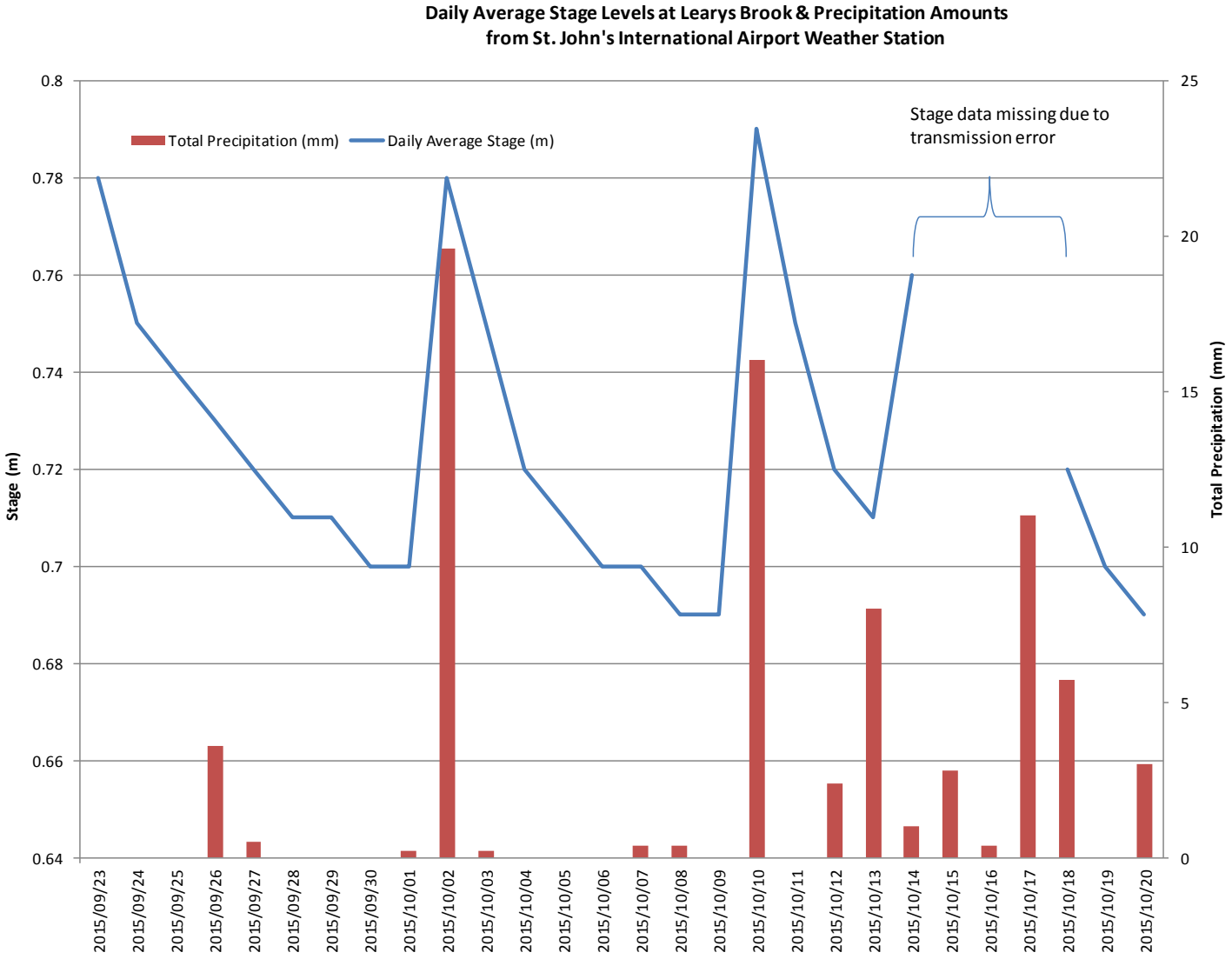

Figure 7: Daily average stage values (m) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

Conclusions

Generally in natural environments, climate and weather conditions contribute in large part to the variation in water quality. During this deployment it was evident that many of the changes displayed on the graphs are related to intermittent precipitation events and small climatic changes of the seasons.

Precipitation events during the deployment period led to related fluctuations in stage, which thus influenced the values of turbidity, pH, specific conductance, and TDS. As average ambient air temperatures decreased, there were correspondingly cooler water temperatures, which in turn slightly increased the amount of dissolved oxygen in the water.

The majority of turbidity events were correlated with increases in stage and thus precipitation events.

Elevated runoff during summer months when road salting is not occurring causes specific conductance and TDS to decrease with the influx of relatively clean rainwater. The specific conductivity median at Leary's Brook was 685.0µS/cm, which is much lower than levels that are measured during road salting season.

During this deployment period the median water temperature at the Leary's Brook station was 15.10°C.

The median pH value for Leary's Brook Station was 6.97 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 95.9 %Sat during the deployment period. The small increases in DO (mg/L and % Sat) correspond with decreases in water temperatures.

The turbidity median value at Leary's Brook during deployment was 1.8 NTU. Increases in stage level can explain most of the peaks in the turbidity values during the deployment period. As organic matter and sediments are washed into the brook, the suspended matter in the water column will increase and the turbidity sensor will detect an increase in water cloudiness.