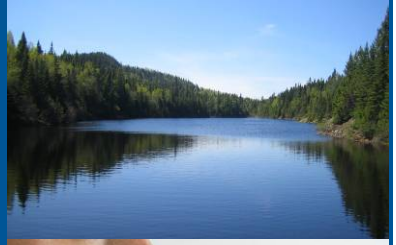







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
October 23, 2014 to November 26, 2014

Newfoundland Labrador

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

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General

The Water Resources Management Division (WRMD), in partnership with Environment Canada, maintain a real-time water quality and water quantity monitoring station along 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 in the vicinity of the Avalon Mall, a highly developed urban area and an extremely busy roadway.

This report covers the deployment on October 23, 2014 until removal on November 26, 2014.

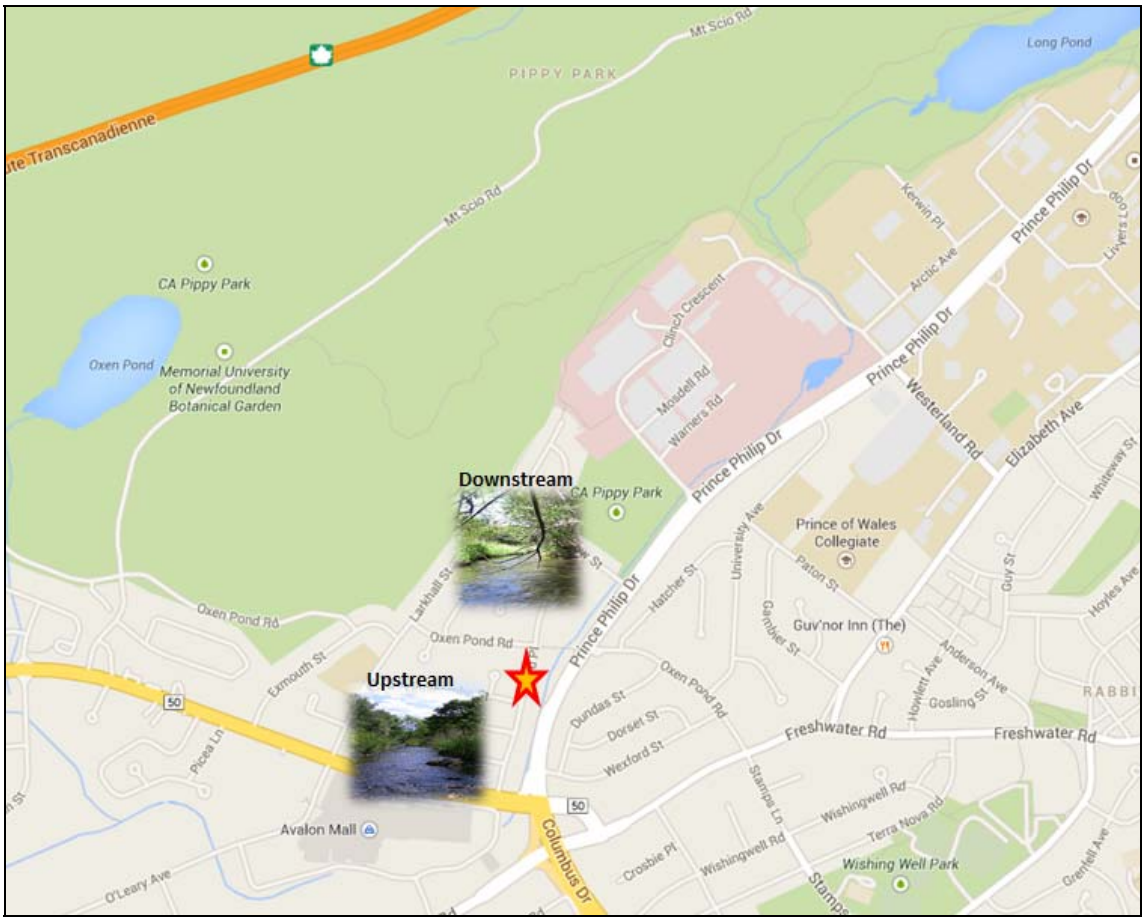

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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

It should be noted that 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 October 23, 2014 through to November 26, 2014 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	**Oct 23 2014**	**Deployment**	Excellent	Good	Excellent	Excellent	Excellent
	Nov 26 2014	**Removal**	Excellent	Excellent	Poor	Excellent	Poor

At deployment the data compared against a QAQC sonde ranked as 'Excellent' for all parameters except pH which ranked as 'Good'. This is acceptable ranking for the water quality parameters for the beginning of the deployment period.

At removal, parameter data for temperature, pH and dissolved oxygen ranked as 'Excellent' when compared against the QAQC sonde. The conductivity and turbidity data ranked as 'Poor' at the end of the deployment period. This is likely a result of fouling from sediment and gravel; these sensors are sensitive to sediment as it can directly block the sensors ability to take an accurate reading.

Deployment Notes

Please note that stage and streamflow data included in this report, is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Precipitation data from the deployment period was retrieved from the Environment Canada's weather station at St. John's International Airport.

Leary's Brook

Water Temperature

Water temperature ranged from 2.70°C to 12.70°C during this deployment period (Figure 2).

Water temperature at this brook displays a typical variation in pattern over the deployment period. Water temperature is influenced by air temperature. The air temperature is now dropping as winter approaches.

Water temperature can also be influenced by precipitation and stage increases. Significant peaks in stage can cause increases in water temperature for a short period of time. As the air temperatures decrease there is a corresponding decrease with the water temperatures.

Please note that stage data is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

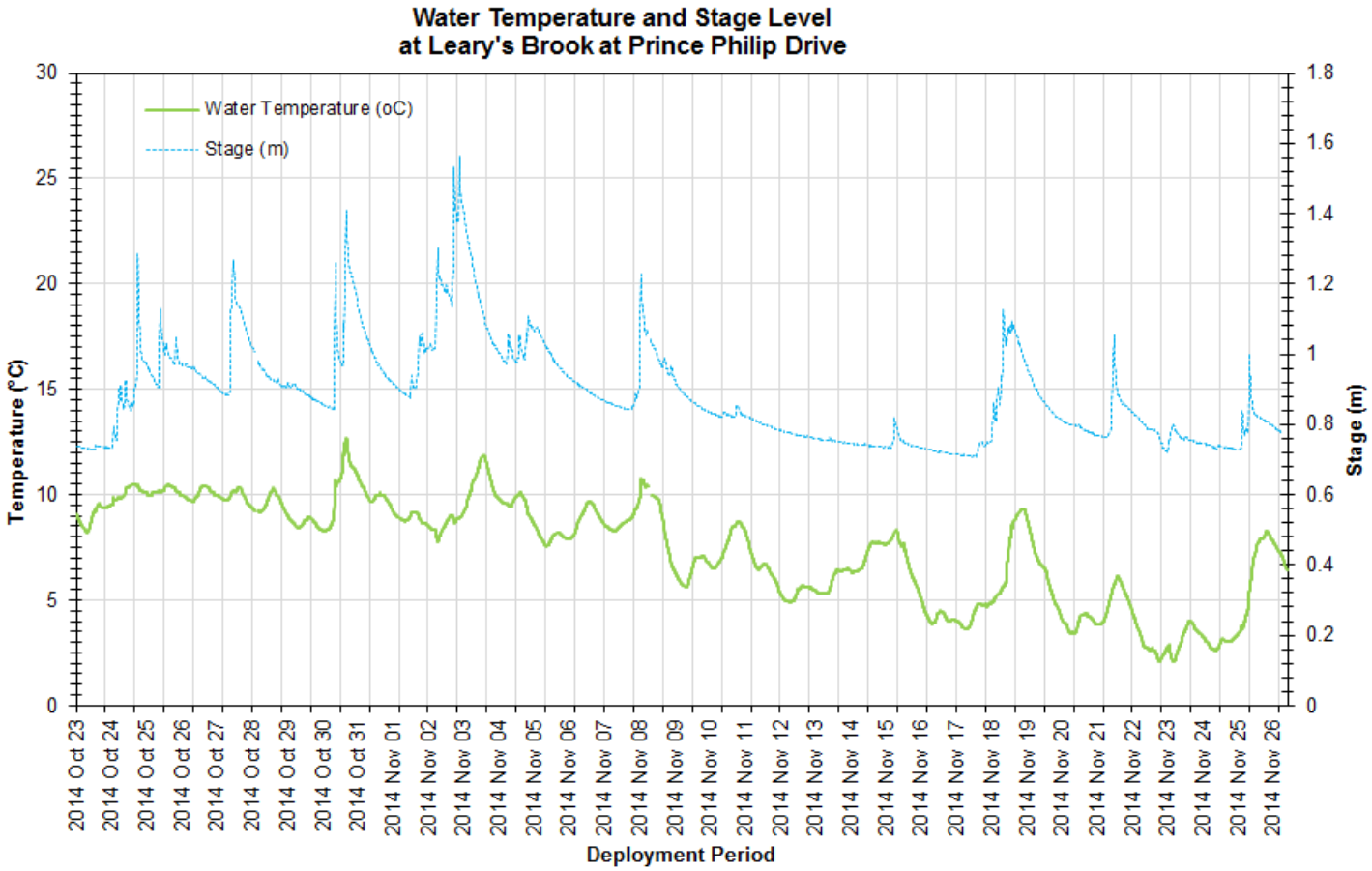

Figure 2: Water temperature (°C) and Stage (m) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 6.46 pH units and 6.98 pH units (Figure 3).

For the majority of the deployment the pH levels remained within the CCME guidelines for the protection of aquatic life. The pH levels dipped once below the guideline on November 3rd, 2014 after a large stage increase however the pH returned to within the CCME guidelines shortly after.

Please note that stage data in this report is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

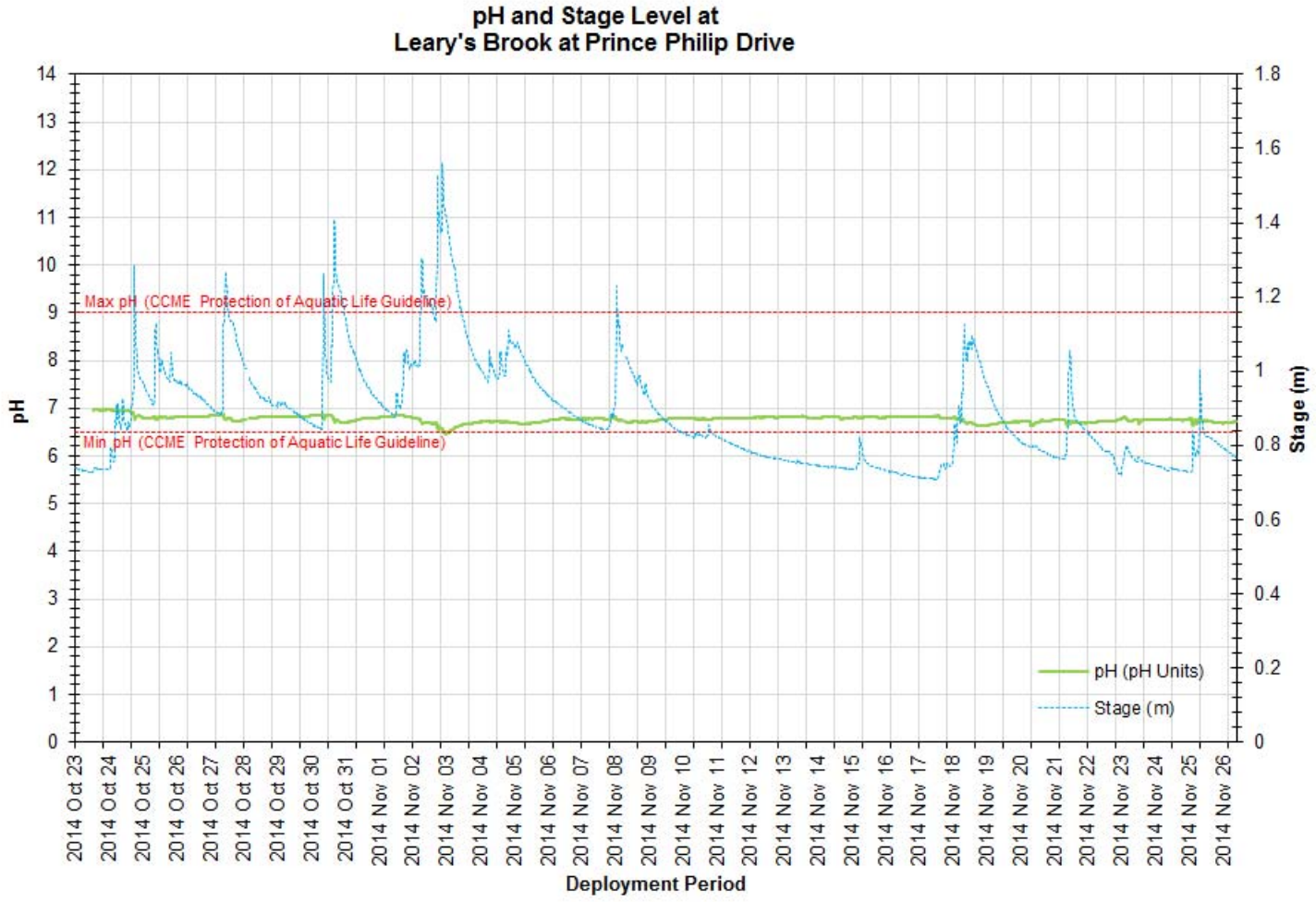

Figure 3: pH (pH units) and Stage (m) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 41.1 µS/cm and 825 µS/cm during this deployment period. TDS ranged from 0.0263 g/L to 0.529 g/L.

The natural relationship between conductivity and increased stage level is evident during the early deployment data. As the stage increases it flushes the suspended solids through the brook and the conductivity levels decrease. As the stage level settles the conductivity levels increase slightly as particles, sediment and minerals are naturally added to the brook (i.e. wind, runoff).

From November 18th, 2014 onward to the end of the deployment, there is a corresponding reaction when the stage levels peak so too does the conductivity levels, unlike what was occurring earlier on in the deployment. These conductivity increases are likely due to road salting on the nearby urban roadways due to cooler air temperatures.

Please note the stage data included in this report is raw data. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

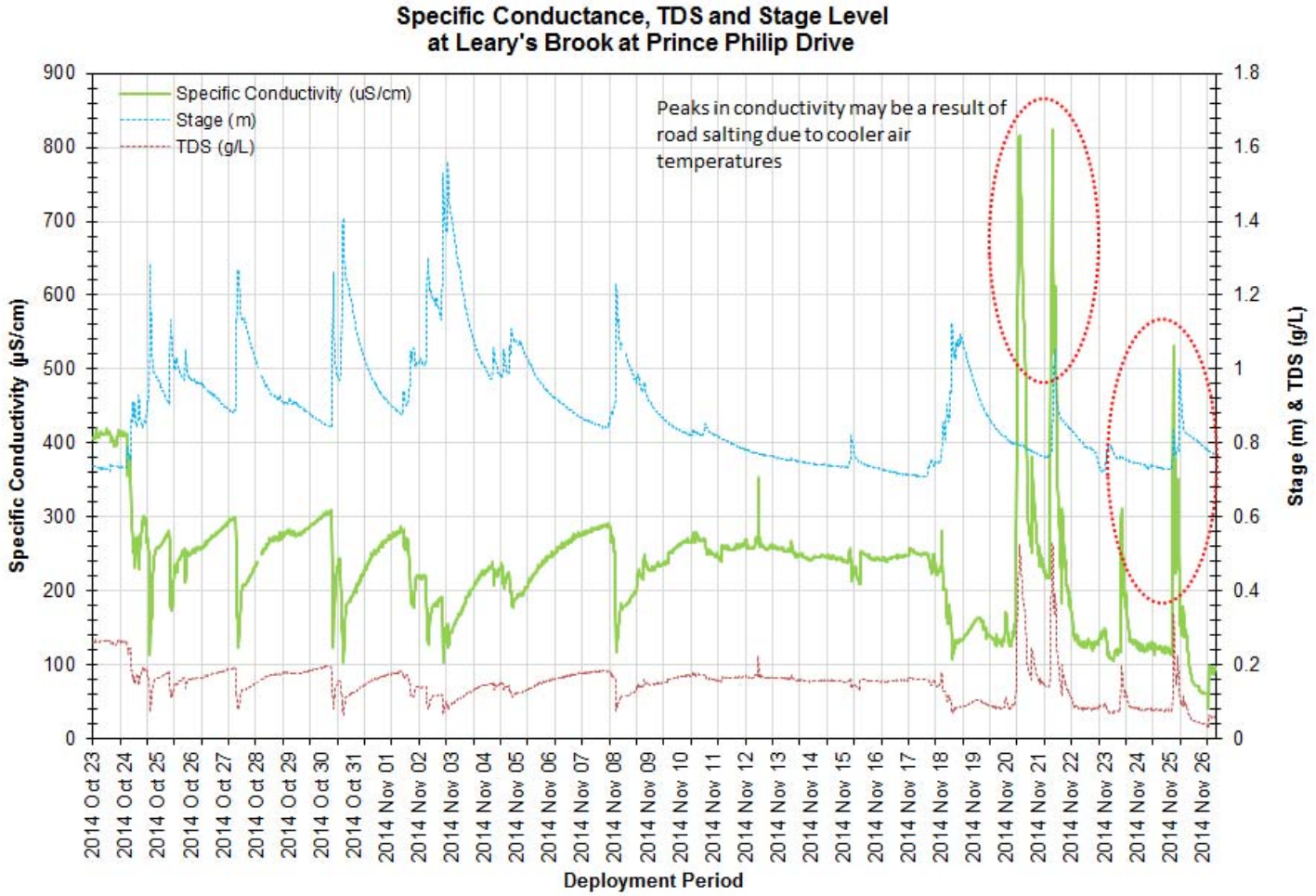

Figure 4: Specific conductivity (µS/cm), TDS (g/L) and stage (m) values at Leary's Brook Station

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 within 93.9% Sat and 100.4% Sat. Dissolved Oxygen (mg/L) measured 10.4 mg/L to 13.62 mg/L.

Naturally as the months get cooler the Dissolved Oxygen present in the water will increase overall (Figure 5). This is evident as the Dissolved Oxygen levels increase over the deployment period corresponding with the cooler water temperatures. Daily Dissolved Oxygen levels will still be influenced by temperatures, rainfall and sunlight hours.

During this deployment the Dissolved Oxygen did not drop below the CCME guidelines for the protection of early life stages.

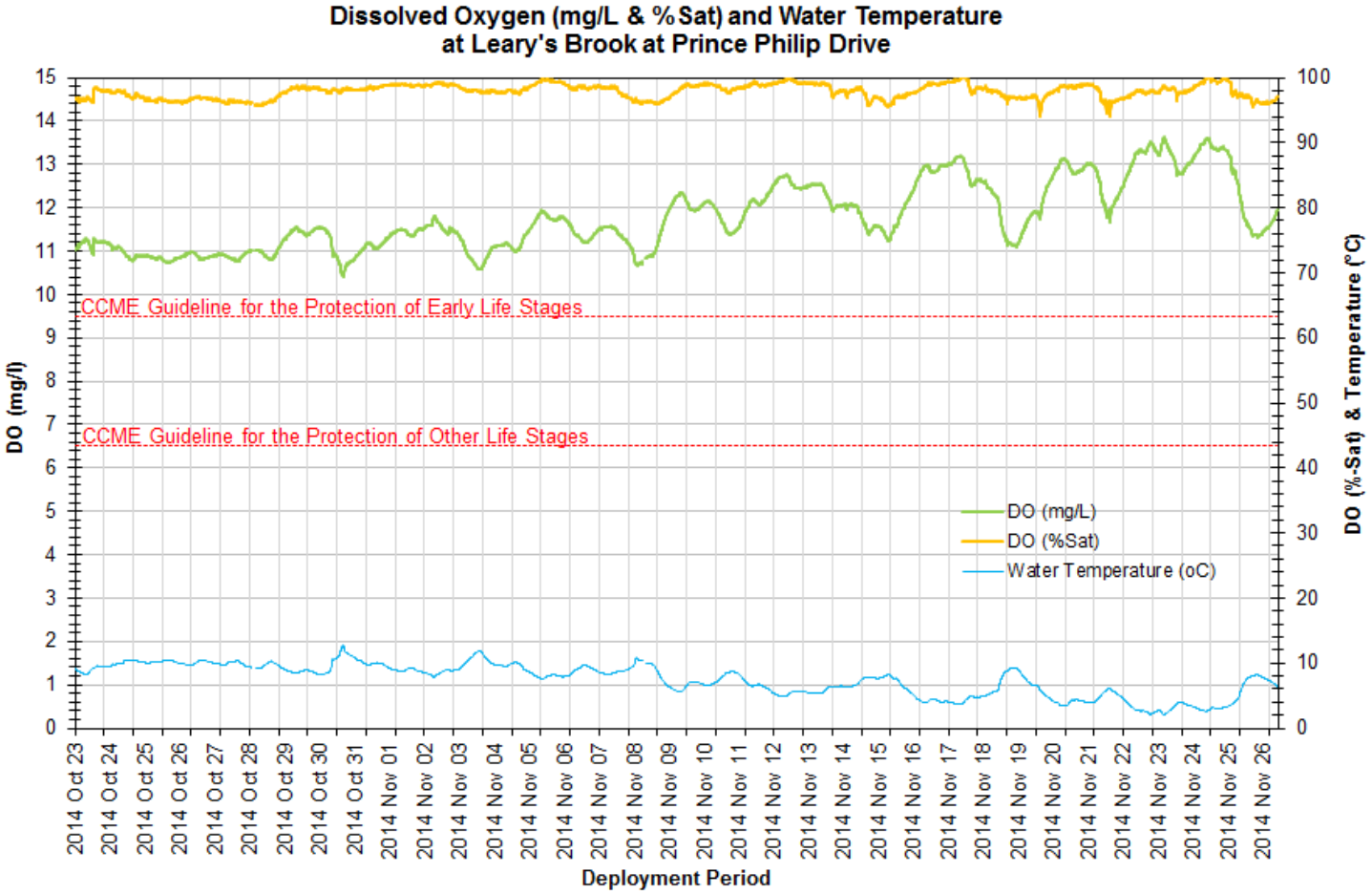

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

The turbidity readings during this deployment ranged within 0.0 NTU to 258.1 NTU (Figure 6).

The turbidity events evident on the graph in Figure 6 correspond with precipitation events. This particular brook is influenced by the surrounding urban environment and is very flashy during rainfall events. During rainfall and then the subsequent runoff comes an increase in sediment and material flowing into the brook and this is what is captured by the turbidity sensor.

This instrument can be impacted by the increased sediment in the brook, sediment packs around the sensors and sometimes can cause irregular readings. The turbidity data was removed from November 3rd, 2014 onwards as it was not representing the waterway.

The highest turbidity noted during this deployment period of 258.1 NTU was on October 27th, 2014. This event coincides with rainfall on that day.

Please note the stage data is raw data that is included in this report. It has not been corrected for backwater effect. Water Survey of Canada (WSC), Environment Canada (EC) is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

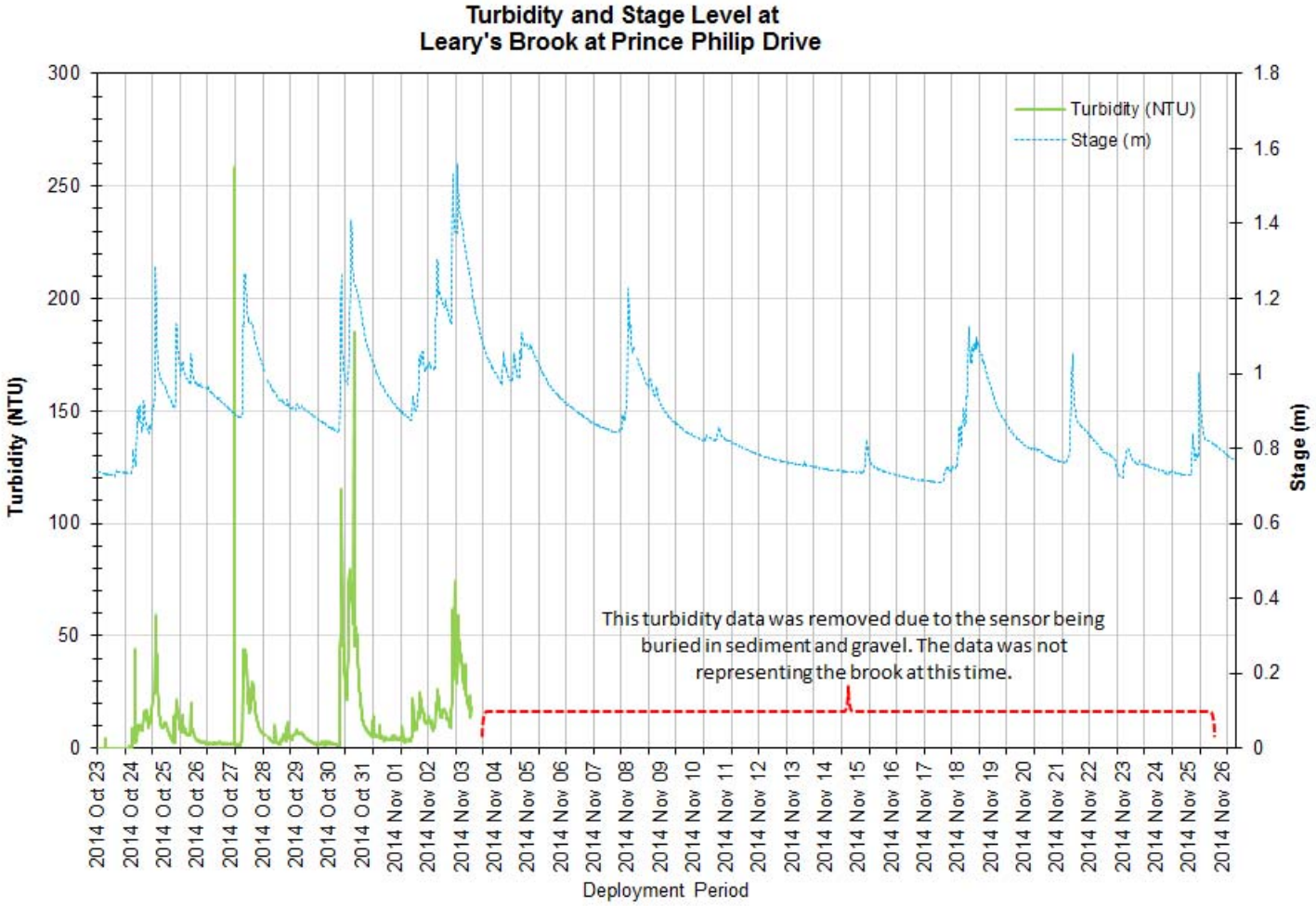

Figure 6: Turbidity (NTU) and Stage (m) values at Leary's Brook Station

Stage, Stream flow and Total Precipitation

The below graph includes precipitation data from St. John's International Airport weather station and the stage and stream flow data recorded at Leary's Brook Station. Please note that stage and stream flow data is raw data and 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 stream flow can provide an explanation of the events that are occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). It is not unusual to see stage and stream flow vary throughout the deployment period (Figure 7). These water quantity parameters are directly influenced by rainfall and subsequent runoff from the surrounding environment.

The highest precipitation was recorded on November 2nd, 2014 at 43.2mm total for that day, during this event there are corresponding stage and stream flow increases.

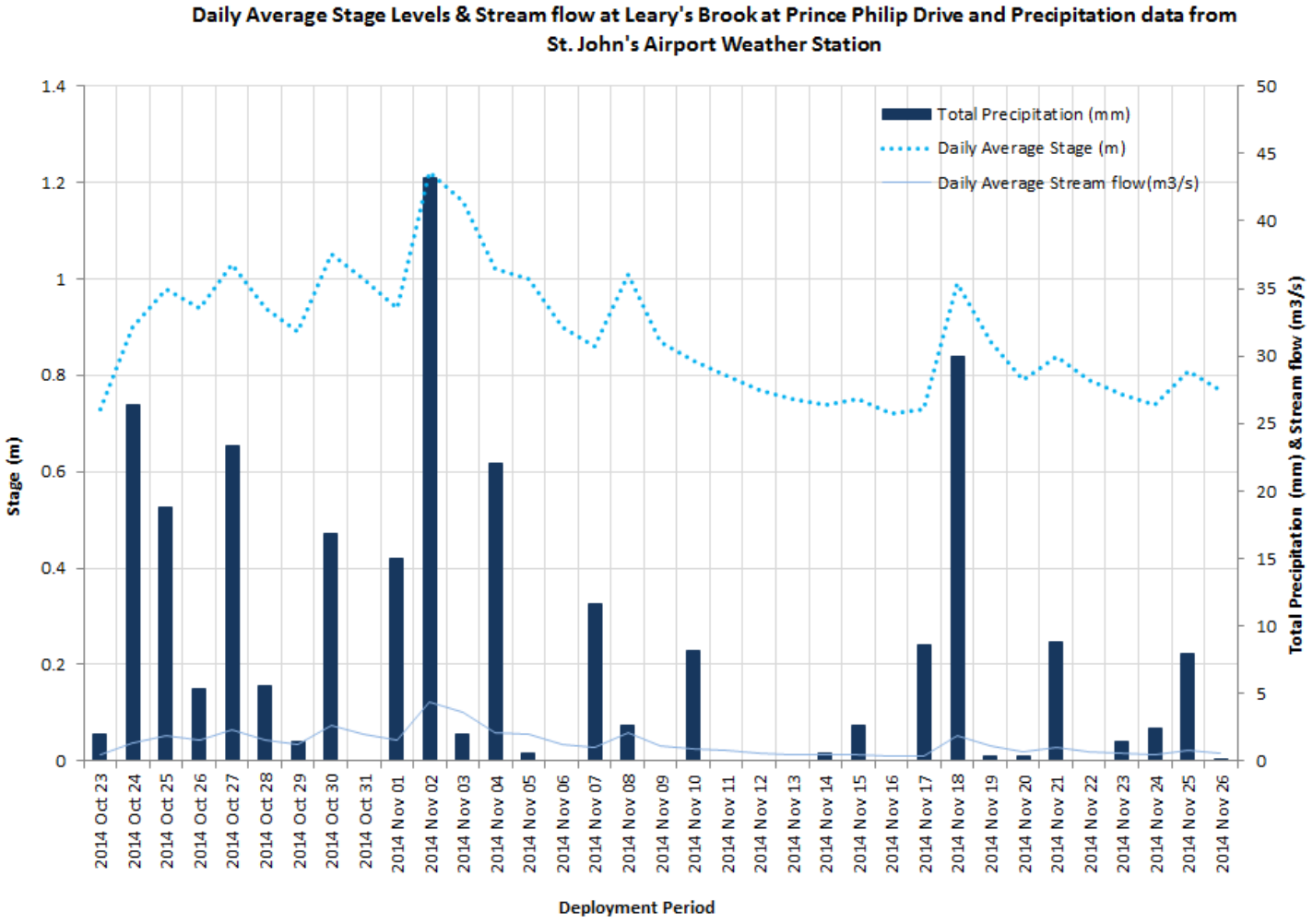

Figure 7: Stage (m) and Stream flow (m3/s) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

Conclusions

Generally in natural environments, climate and weather conditions contribute in large part to the variation in water quality parameters. During this deployment it was evident that many of the changes in the parameter data displayed on the graphs, was related to the intermittent precipitation events and small climatic changes of the seasons (i.e. temperature decreases).

Precipitation events during the deployment period led to related fluctuations in stage and streamflow, which thus influenced the values of turbidity, pH, specific conductance, and TDS. During the cooler water temperatures there are increases in the amount of dissolved oxygen in the water.

During this deployment period the median water temperature at the Leary's Brook station was 8.06°C, slightly lower than previous deployment month. Water temperature will continue to vary as it is influenced by the winter air temperatures.

The Specific Conductivity median at Leary's Brook was 245 µS/cm. This conductivity median was lower than the previous deployment.

The median pH value for Leary's Brook Station was 6.78 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 98 % Sat during the deployment period. This is a slightly higher median than the previous deployment period, as to be expected with the cooler water temperatures.

The turbidity spikes correlated with increases in precipitation and coinciding stage increases. The turbidity median value at Leary's Brook during deployment was 5.6 NTU.

Overall the data provided for Leary's Brook at Prince Philip Drive coincided with what would be expected of an urban brook.