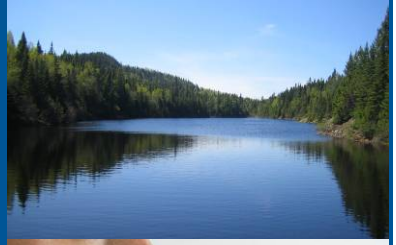







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
August 8, 2014 to September 16, 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 August 8, 2014 until removal on September 16, 2014.

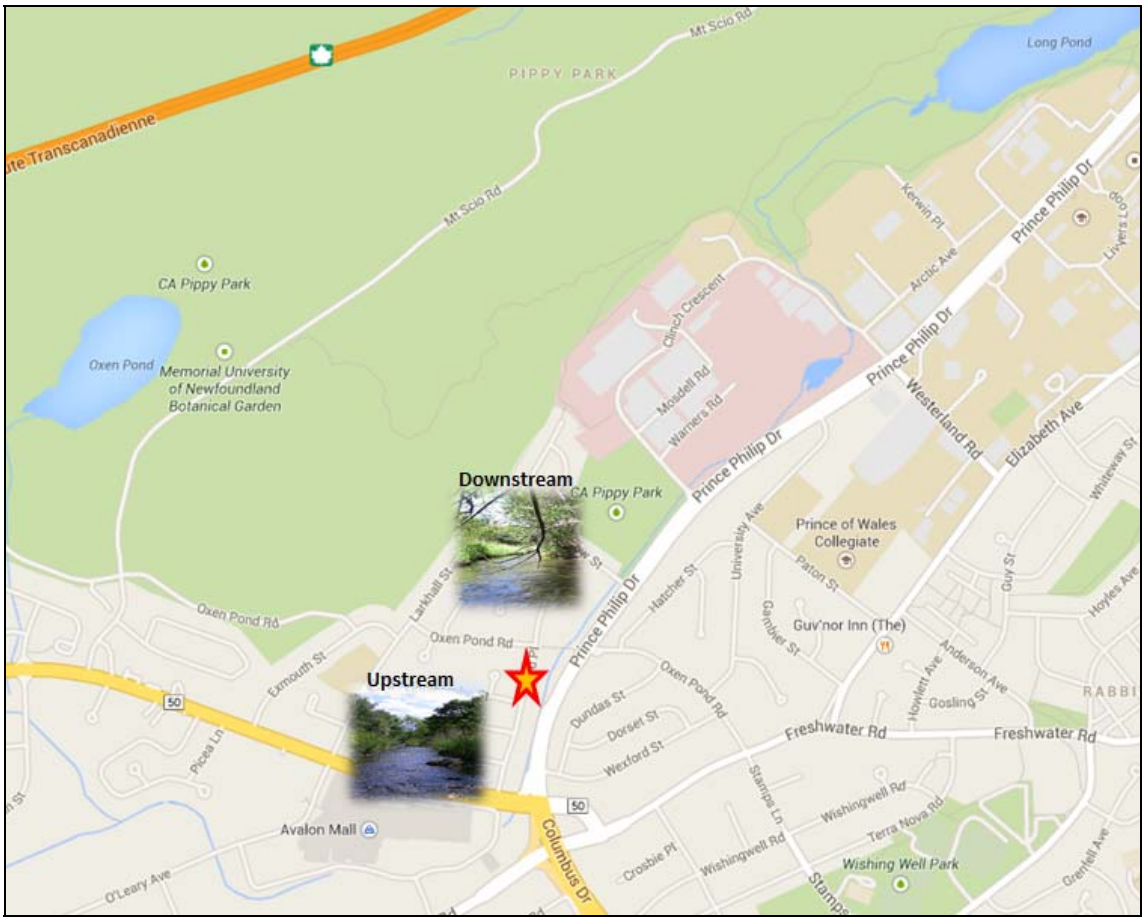

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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 August 8, 2014 through to September 16, 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	**Aug 8 2014**	**Deployment**	Good	Fair	Good	Good	Excellent
	Sept 16 2014	**Removal**	Excellent	Excellent	Excellent	Excellent	Poor

At the Leary's Brook station at the point of deployment, the water temperature, conductivity and dissolved oxygen (mg/L) ranked as 'Good'. pH data ranked as 'Fair' at deployment. With turbidity data ranking as 'Excellent' for deployment of the field sonde.

At removal, the temperature, pH, specific conductivity and dissolved oxygen (mg/L) data all ranked as 'Excellent'. Turbidity data was ranked as 'Poor' at removal. At removal of the instrument it was discovered that large gravel and sediment was impeding the turbidity sensor and the turbidity wiper was unable to clean the lens on the sensor.

Deployment Notes

Please note the 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.

Please note due to a buildup of sediment and gravel inside the protective cage around the sensors. The turbidity sensor was unable to perform correctly. The turbidity wiper was unable to clean the turbidity lens due to the amount of sediment. Therefore the turbidity data was removed from this report as it cannot be of use in any statistical analysis of Leary's Brook nor does it represent the brook for the deployment month of August 8th to September 16th, 2014.

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

Leary's Brook

Water Temperature

Water temperature ranged from 11.20°C to 19.20°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. As the seasonal air temperatures stabilize the water temperatures do the same.

During the stage increases during the deployment period, the water temperature decreased slightly before returning to the natural diurnal pattern after a day or so. The precipitation graph in Figure 6 displays high rainfall during that time frame.

Please note the 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.

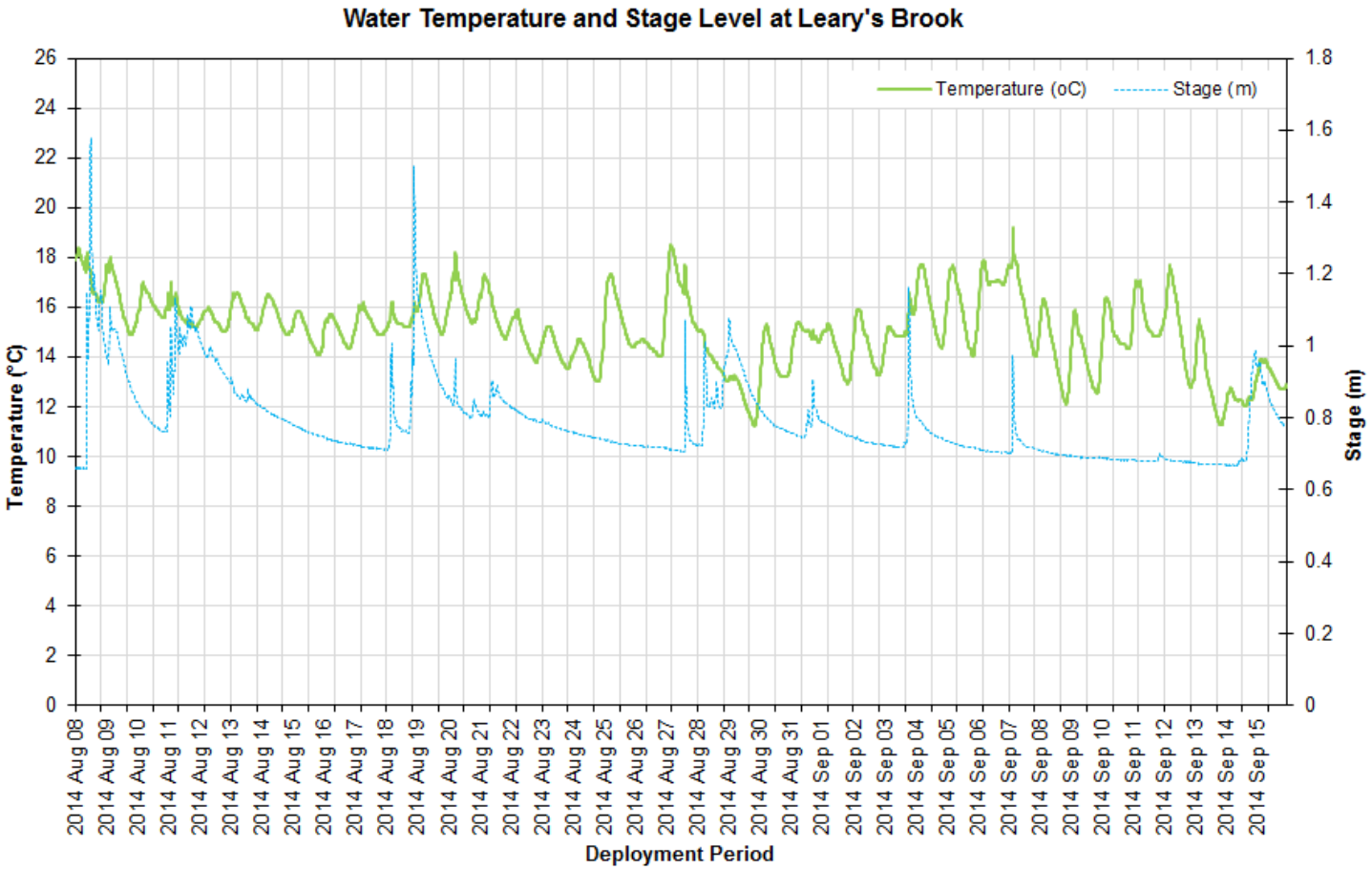

Figure 2: Water temperature (°C) and Stage (m) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 6.65 pH units and 7.29 pH units (Figure 3).

The pH levels remain within the CCME guidelines for the protection of aquatic life. The pH levels decrease slightly as the deployment period continues however do not dip below the minimum guideline.

Increases in stage level can influence the pH levels in the brook to decrease for a short period of time. This is a natural occurrence and pH values readjust after the stage level settles down.

At the beginning of the deployment period stage is high and pH is reading higher values (highlighted in red). It is likely a result of the increase stage in the brook. The precipitation graph in Figure 6 displays high rainfall during that time frame.

Please note the 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.

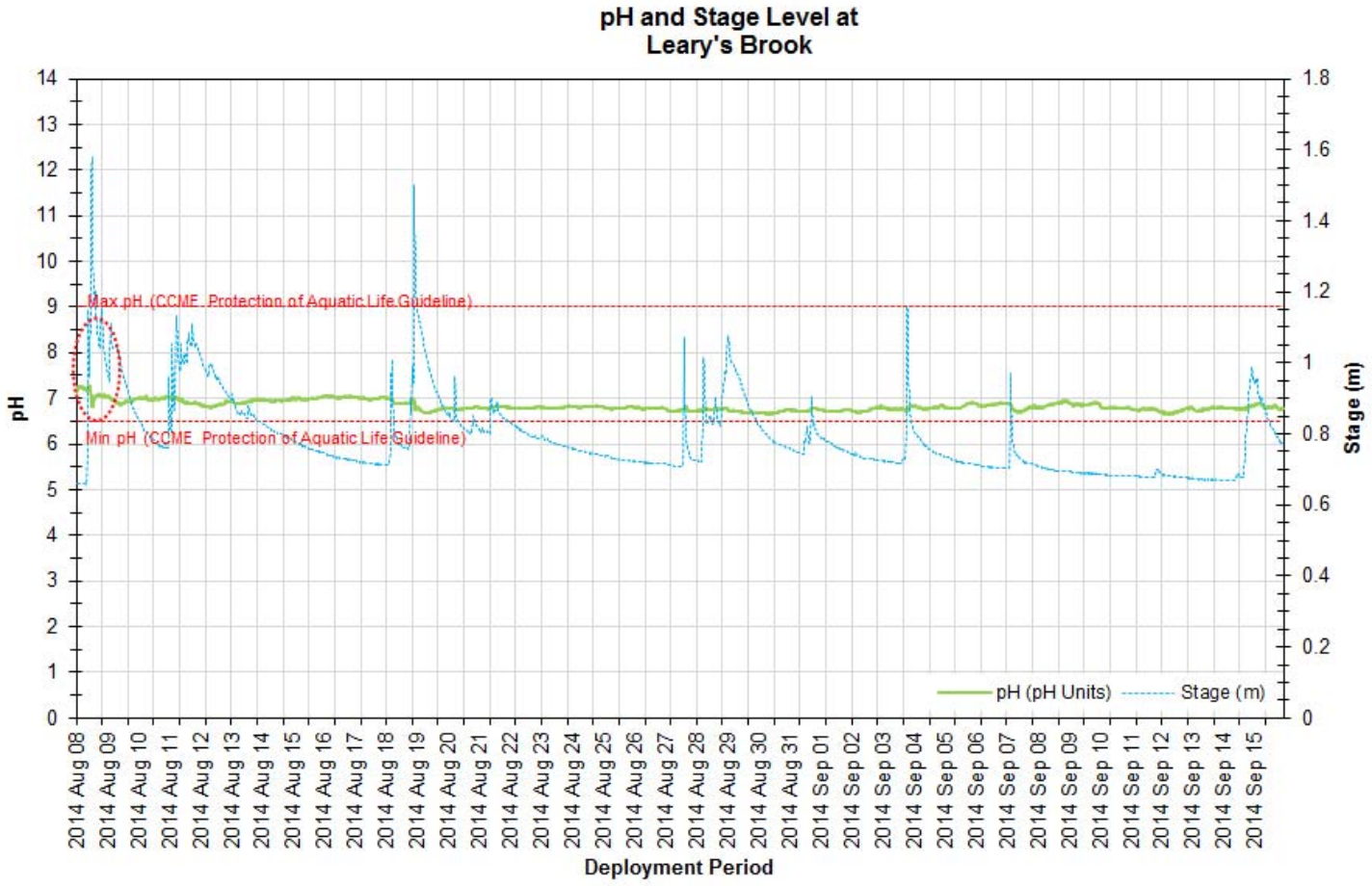

Figure 3: pH (pH units) and Stage (m) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 85.1 µS/cm and 895.0 µS/cm during this deployment period. TDS ranged from 0.0545 g/L to 0.5730 g/L.

The natural relationship between conductivity and increased stage level is evident during this deployment. As the stage level increases (rainfall) flushing the suspended solids through the brook the conductivity levels decrease.

There is an increase in conductivity (circled in red) that also corresponds with an increase in stage level at the beginning of the deployment period. This is likely a result of rainfall around this time frame.

Please note the 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.

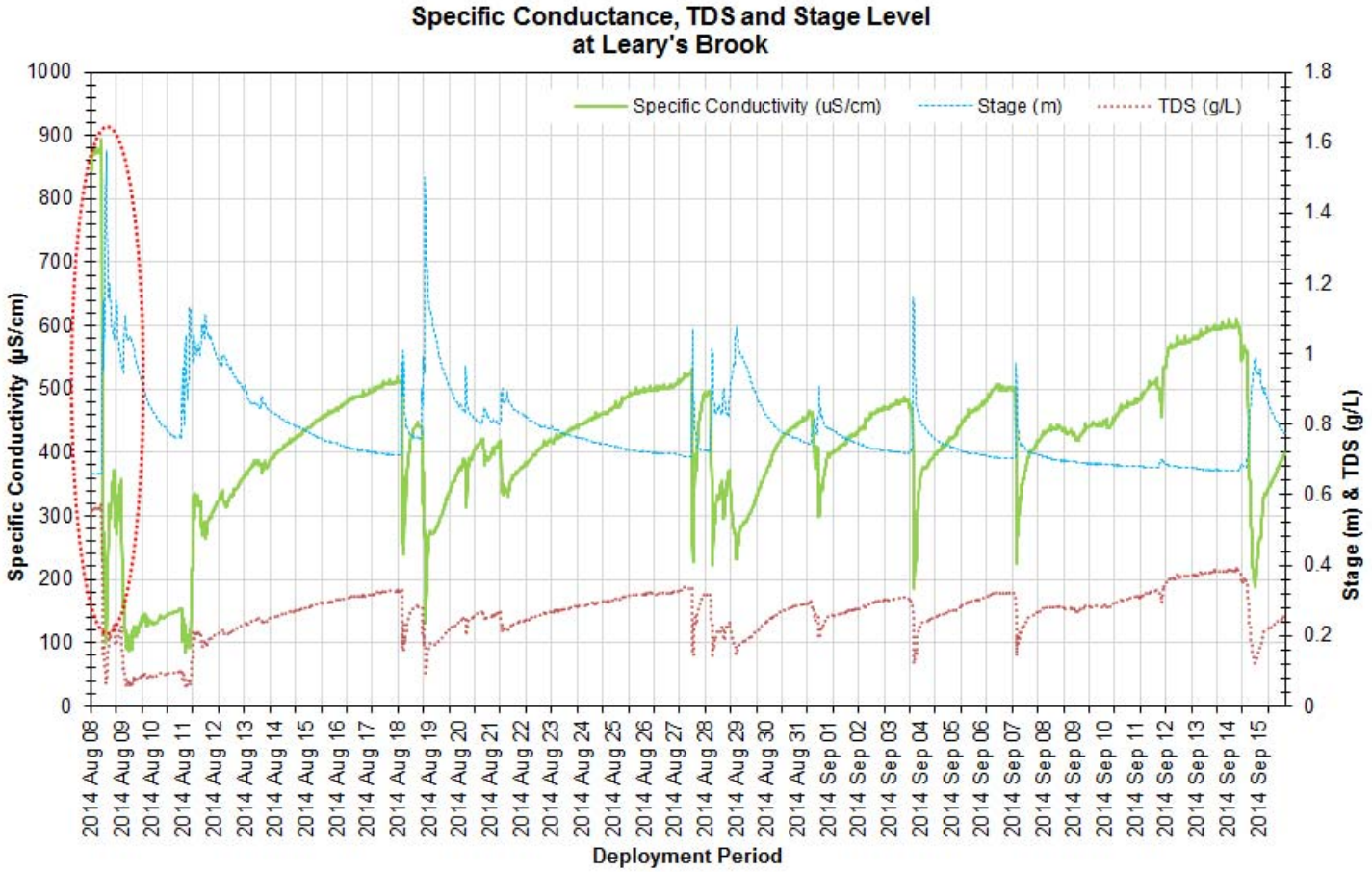

Figure 4: Specific conductivity (µS/cm), TDS (g/L) and stage (m) values at Leary's Brook Station

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 99.2% Sat and 87.5% Sat. Dissolved Oxygen (mg/L) measured 8.28 mg/L to 10.53 mg/L.

Naturally in the warmer months the Dissolved Oxygen present in the water will decrease. While the Dissolved Oxygen mg/L values were above the minimum Dissolved Oxygen CCME guideline for other life stages throughout this deployment period (Figure 5) they dipped below the CCME guidelines for the protection of early life stages on several incidences.

The Dissolved Oxygen data displays a short event on August 8th as displayed on the pH and conductivity graphs. DO values dip for a short period of time and then adjust. Weather also influences dissolved oxygen; rainfall can decrease water temperature and in return increase dissolved oxygen concentration.

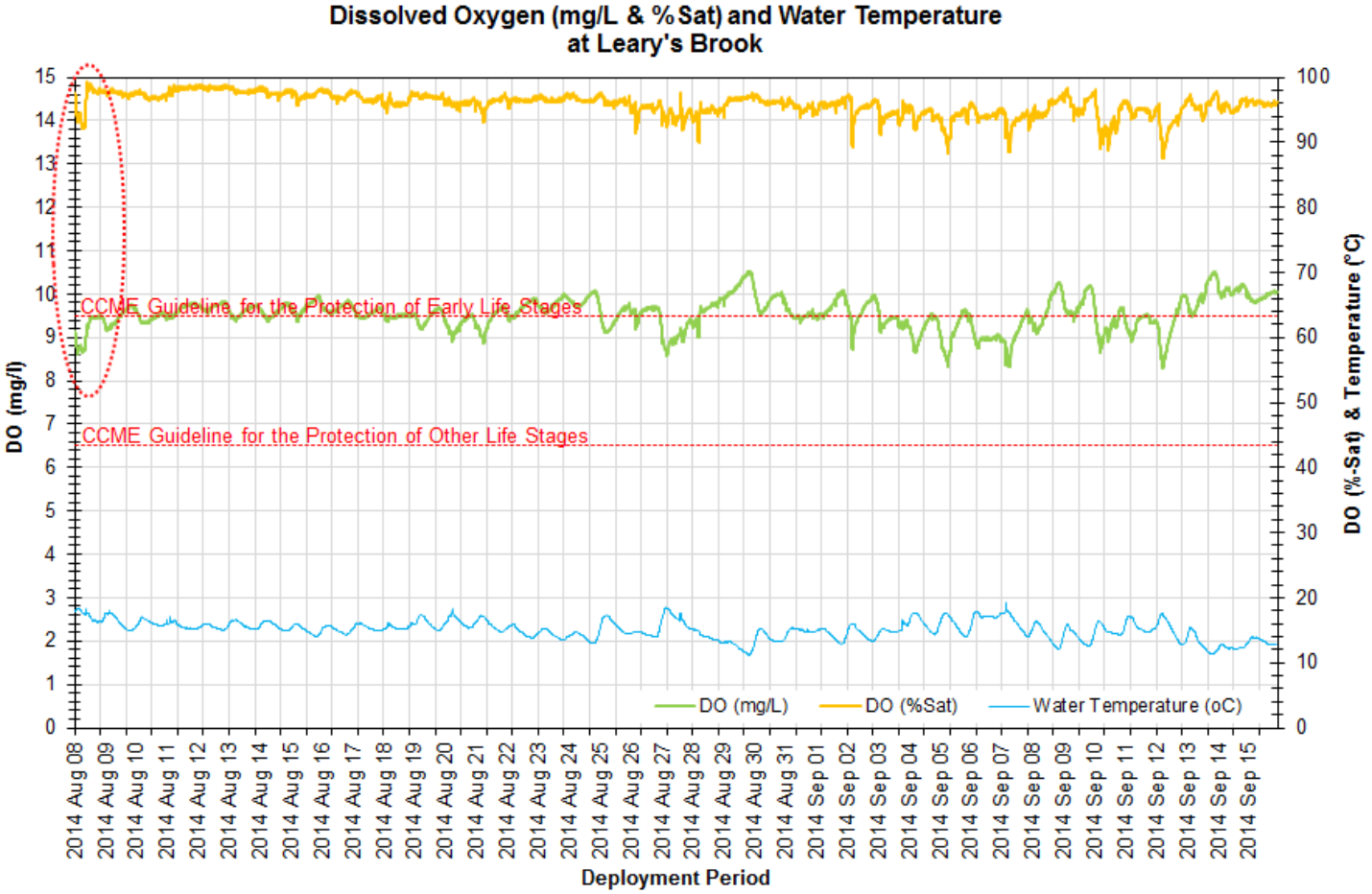

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

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 the stage and stream flow 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.

Stage and stream flow can provide an explanation of some 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 6). These water quantity parameters are directly influenced by rainfall and subsequent runoff from the surrounding environment.

The highest precipitation was recorded on August 8th 2014 at 51.8mm total for that day. This deployment period saw a total of 231 mm of rainfall, and there is only ~12 days that didn't see any rainfall.

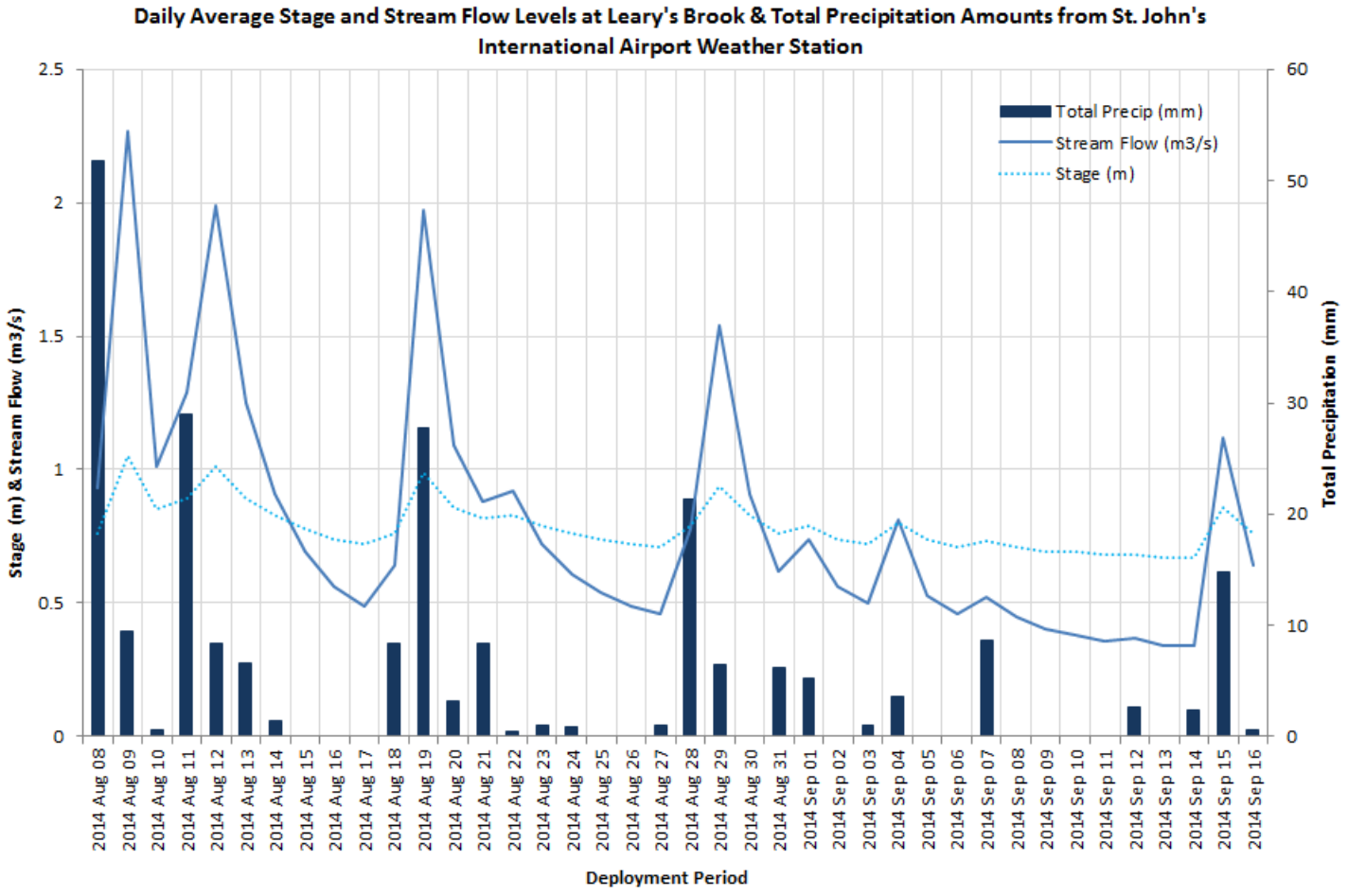

Figure 6: Stage values (m) and Streamflow (m3/s) values from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

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, which thus influenced the values of pH, specific conductance, dissolved oxygen. During this deployment period the median water temperature at the Leary's Brook station was 15.10°C.

The Specific Conductivity median at Leary's Brook was 430.0µS/cm. The dips in conductivity correspond with the larger rainfall events for this timeframe.

The median pH value for Leary's Brook Station was 6.80 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 96.1 % Sat during the deployment period. The small dips in DO (mg/L and % Sat) correspond with water temperatures. The larger dips in DO (mg/L and %Sat) at Leary's Brook correspond with large rainfall events.

Turbidity data was not included in this report due to data inaccuracies. The sensor was unable to perform due to large amounts of siltation and gravel around the probe.

It can be determined that the events in the data for pH, conductivity and dissolved oxygen were likely a result of the rainfall that occurred on August 8th, 2014. This was the largest amount of rainfall recorded during this deployment period.