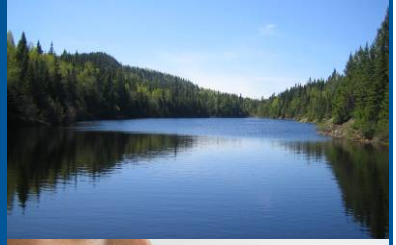







Real-Time Water Quality Report

Leary's Brook Network

Deployment Period
May 14, 2014 to June 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 May 14, 2014 until removal on June 16, 2014.

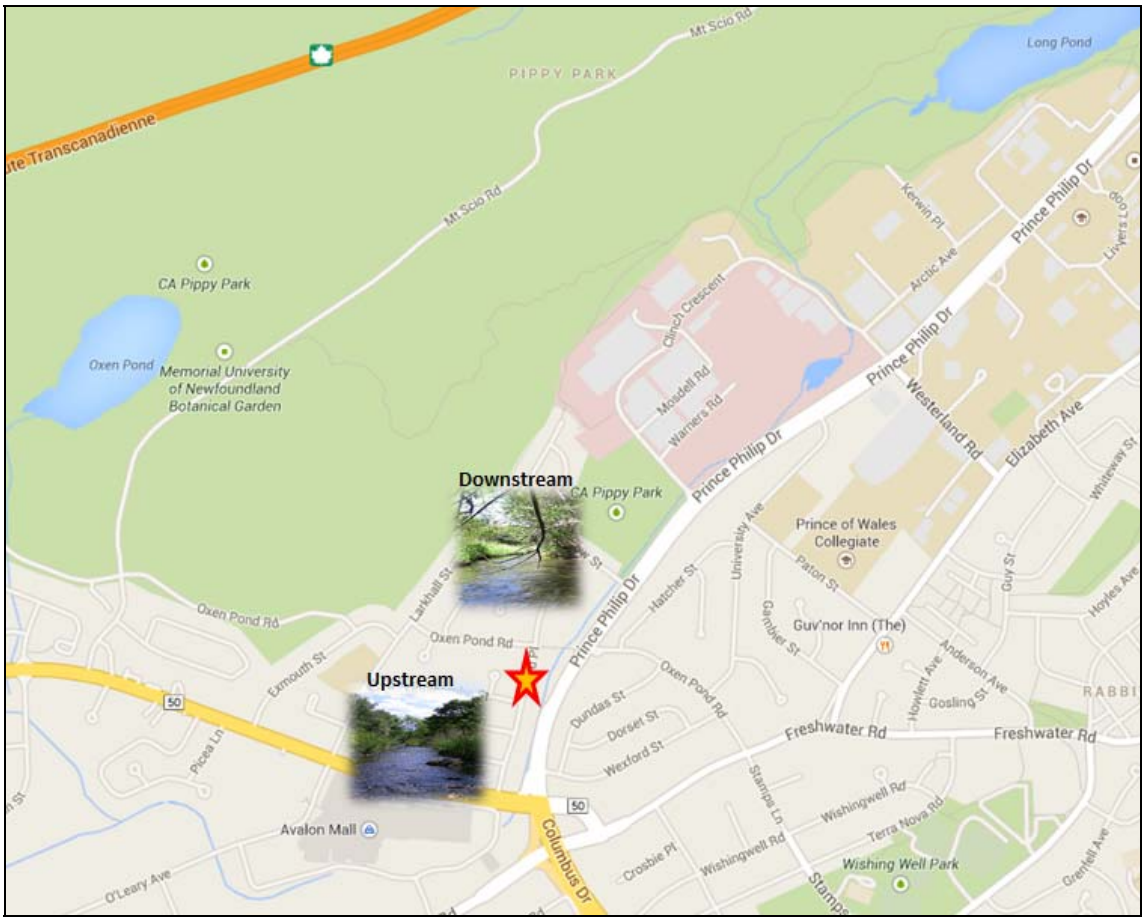

Figure 1: Leary's Brook Real-Time Water Quality and Quantity Station.

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 May 14, 2014 through to June 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	**May 14 2014**	**Deployment**	Excellent	Good	Good	Fair	Excellent
	June 16 2014	**Removal**	Excellent	Excellent	Poor	Good	Poor

At the Leary's Brook station at the point of deployment, the water temperature and turbidity data ranked as 'Excellent'. The pH and conductivity reading for deployment ranked as 'Good'. The dissolved oxygen data comparison ranked the data as 'Fair' during initial deployment; it is possible that the dissolved oxygen probe wasn't stabilized during the reading.

At removal, the temperature and pH ranked 'Excellent'. The dissolved oxygen ranked as 'Good'. Conductivity and turbidity ranked as 'Poor' at removal. The 'Poor' ranking may be a result of the buildup of sediment and sand that occurs in the protective cage around the instrument. Occasionally during removal the instrument can be buried in sediment and gravel that flushes through the brook.

Deployment Notes

Please note that 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 that stage data was not able to be included in the individual parameter graphs for this deployment period.

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 4.51°C to 17.10°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 start to increase there is an overall increase in the water temperature as the deployment period continues.

There are two significant dips in water temperature on May 27th and again around June 7th, 2014 for a couple of days before the temperatures start to increase again.

The water temperature displayed on Figure 2 is typical of shallow streams and ponds. Shallow water bodies are highly influenced by variations in ambient air temperatures.

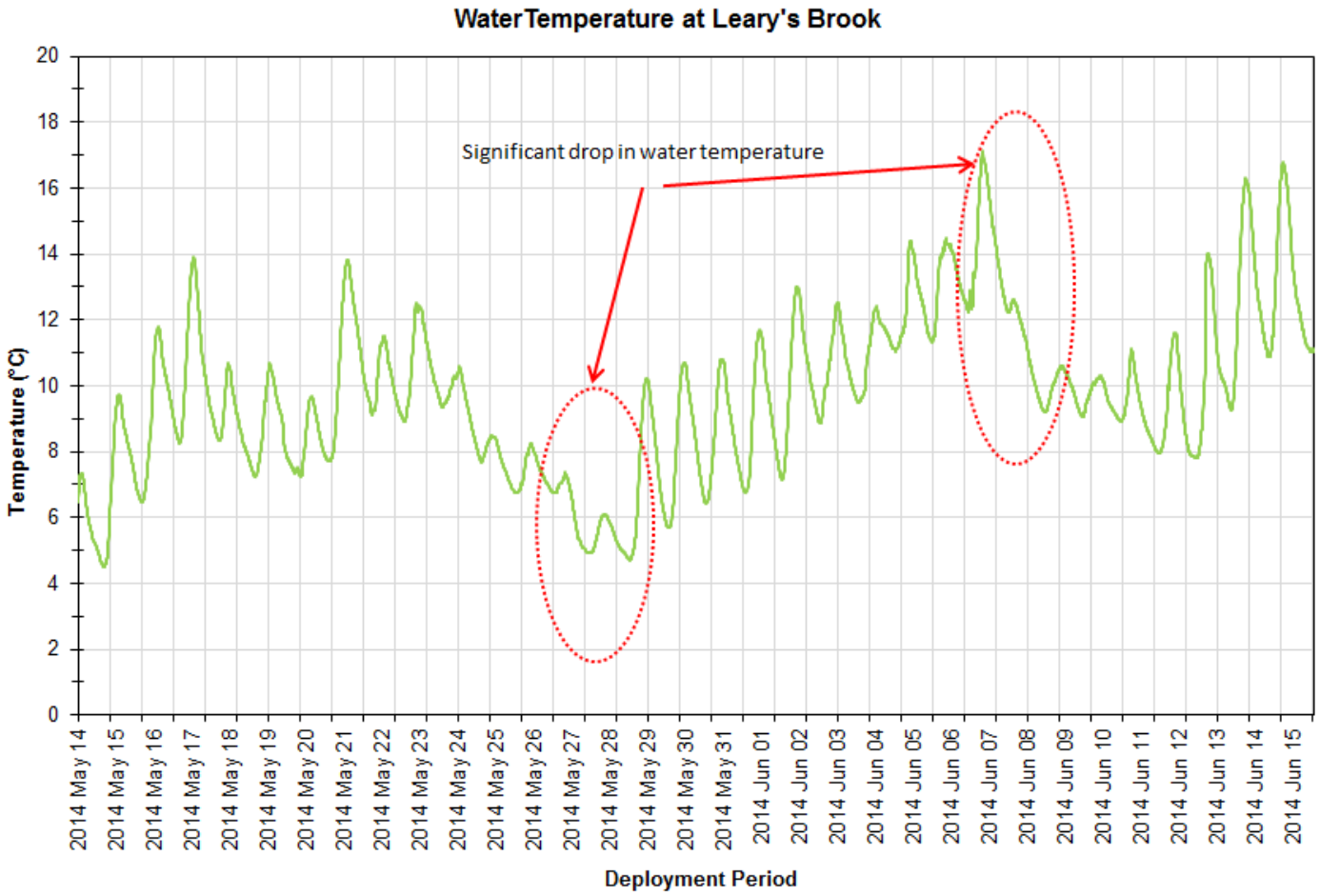

Figure 2: Water temperature (°C) values at Leary's Brook

pH

Throughout this deployment period pH values ranged between 6.50 pH units and 7.28 pH units (Figure 3).

During the deployment, the pH values were between the minimum and maximum CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). During high stage periods, the pH values will dip sometimes lower than the guideline. The slight changes in pH (circled in red) correspond with rainfall (displayed on Figure 7) occurring around the same time frame.

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 6.86 (pH units) for this deployment period.

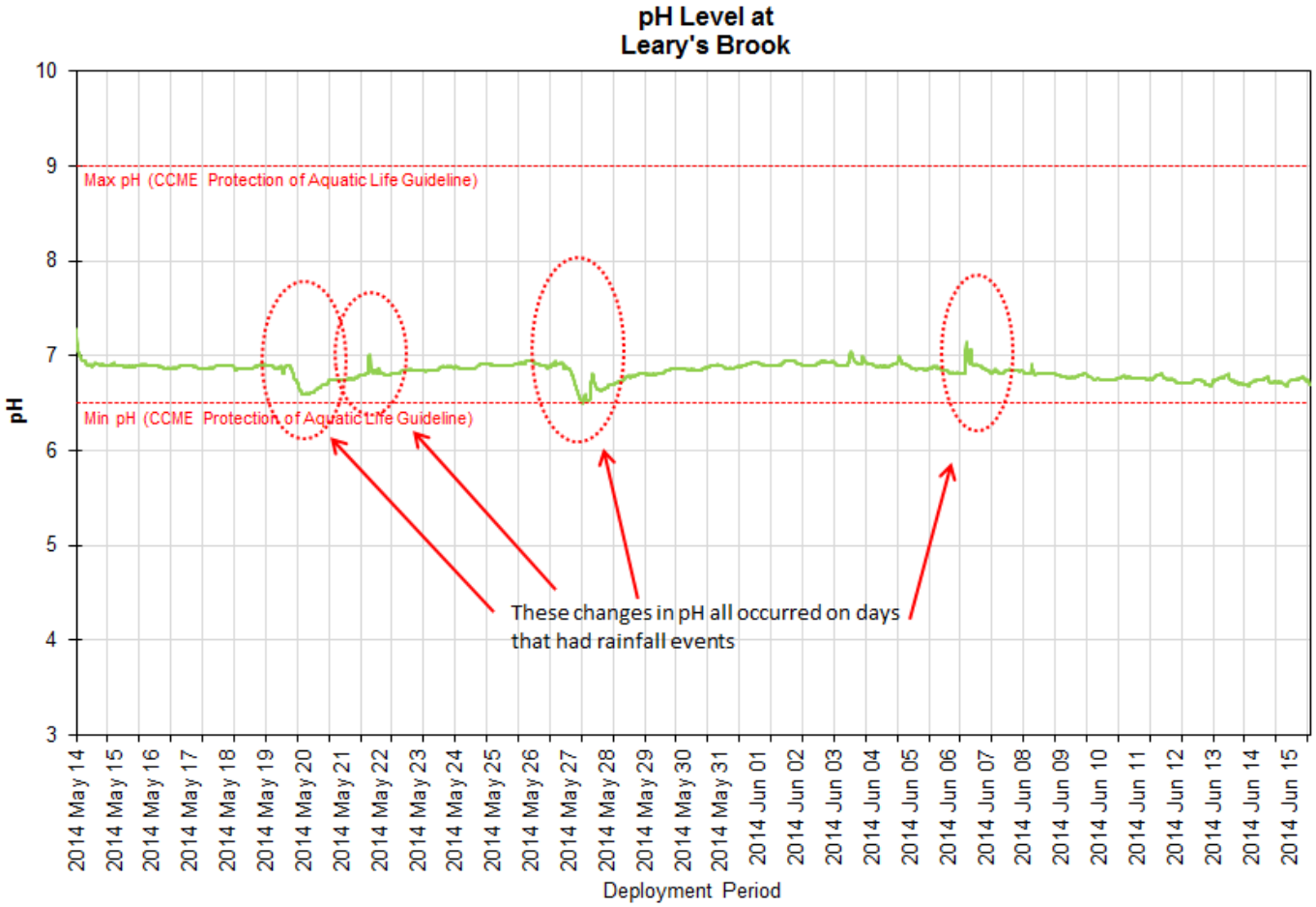

Figure 3: pH (pH units) values at Leary's Brook Station

Specific Conductivity

The conductivity levels were within 48.8 µS/cm and 1532.9 µS/cm during this deployment period. TDS ranged from 0.0312 g/L to 0.9800 g/L.

During the beginning of the deployment the peak in conductivity is likely a result of runoff from spring thaw into through the brook (Figure 4). As the temperatures increase and the water levels in the brook stabilize the conductivity reduces to lower levels.

The highlighted events in conductivity (circled in red) correspond with rainfall events on the same days. It is likely that the rainfall flushed the brook creating lower conductivity readings at this time.

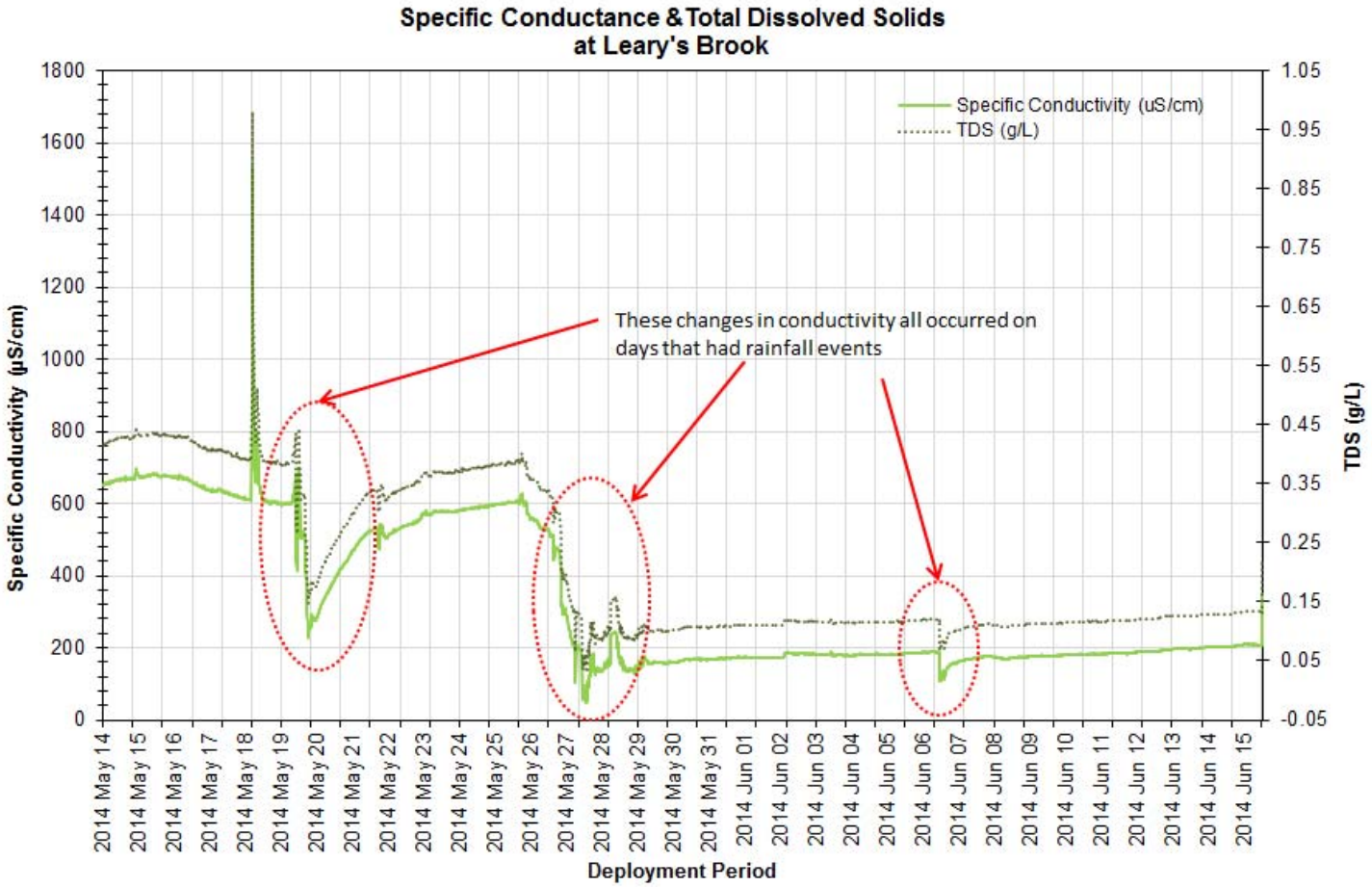

Figure 4: Specific conductivity (µS/cm) and TDS (g/L) values at Leary's Brook Station

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 94.4% Sat and 100.1% Sat. Dissolved Oxygen (mg/L) measured 9.31 mg/L to 12.63 mg/L.

The Dissolved Oxygen mg/L values were above the minimum Dissolved Oxygen CCME guideline for other life stages throughout this deployment period (Figure 5), although dipped slightly below the CCME guidelines for the protection of early life stages on June 6th, 2014. The dip in Dissolved Oxygen (mg/L) can be linked to increases in water temperature and rainfall.

The other slight change in Dissolved Oxygen mg/L on May 27th to May 29th (circled in red) correspond with rainfall events (displayed on Figure 7) that were occurring around the same time.

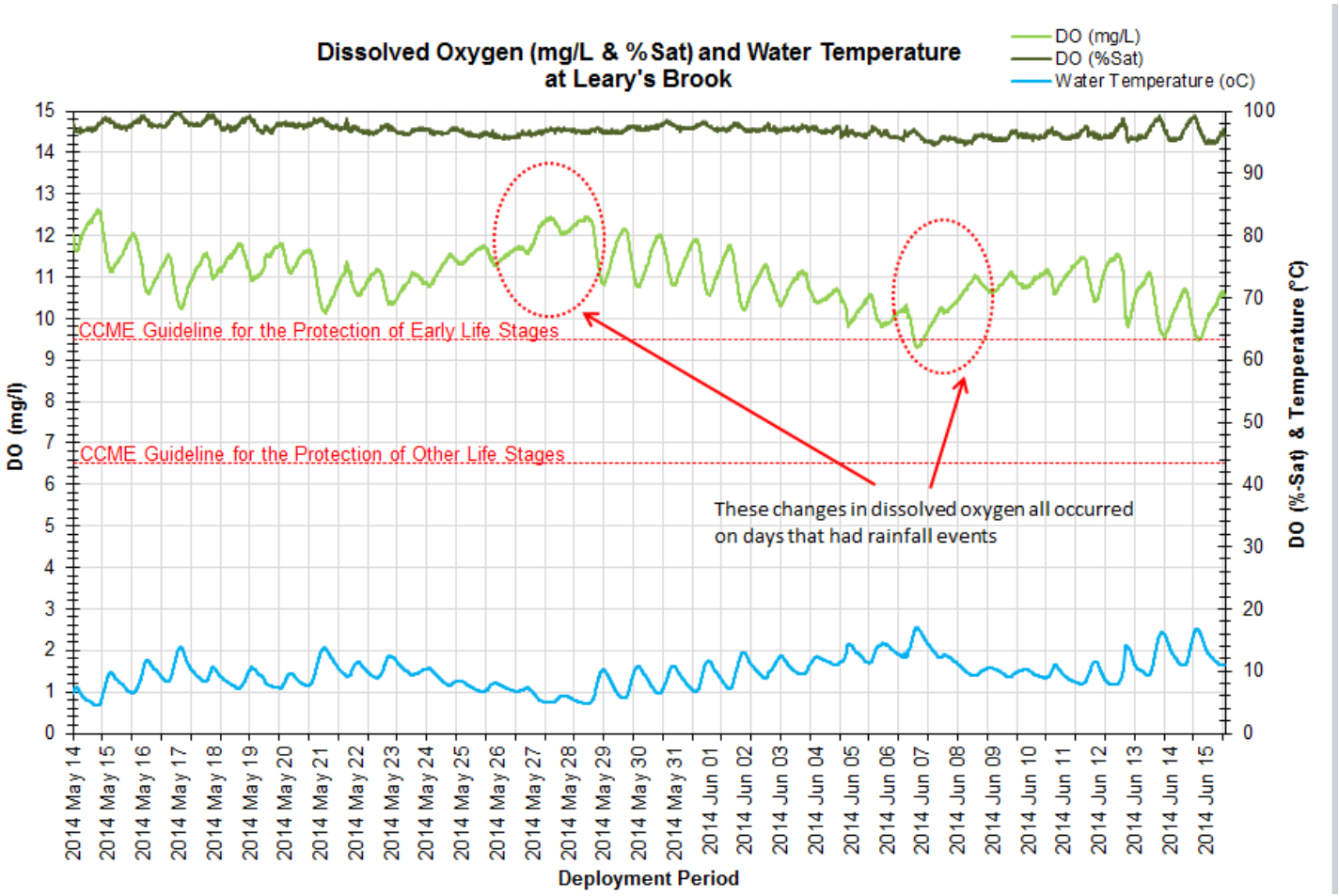

Figure 5: Dissolved oxygen (mg/L & % sat) and water temperature (°C) values at Leary's Brook Station

Turbidity

The turbidity readings during this deployment ranged within 0.0 NTU to 1562.0 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 and spring thaw events. During heavy rainfalls and 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 June 7th onwards as it was not representing the waterway at that time.

The highest turbidity noted during this deployment period (circled in red) on May 27th to May 28th, 2014 this event also coincides with a rainfall event.

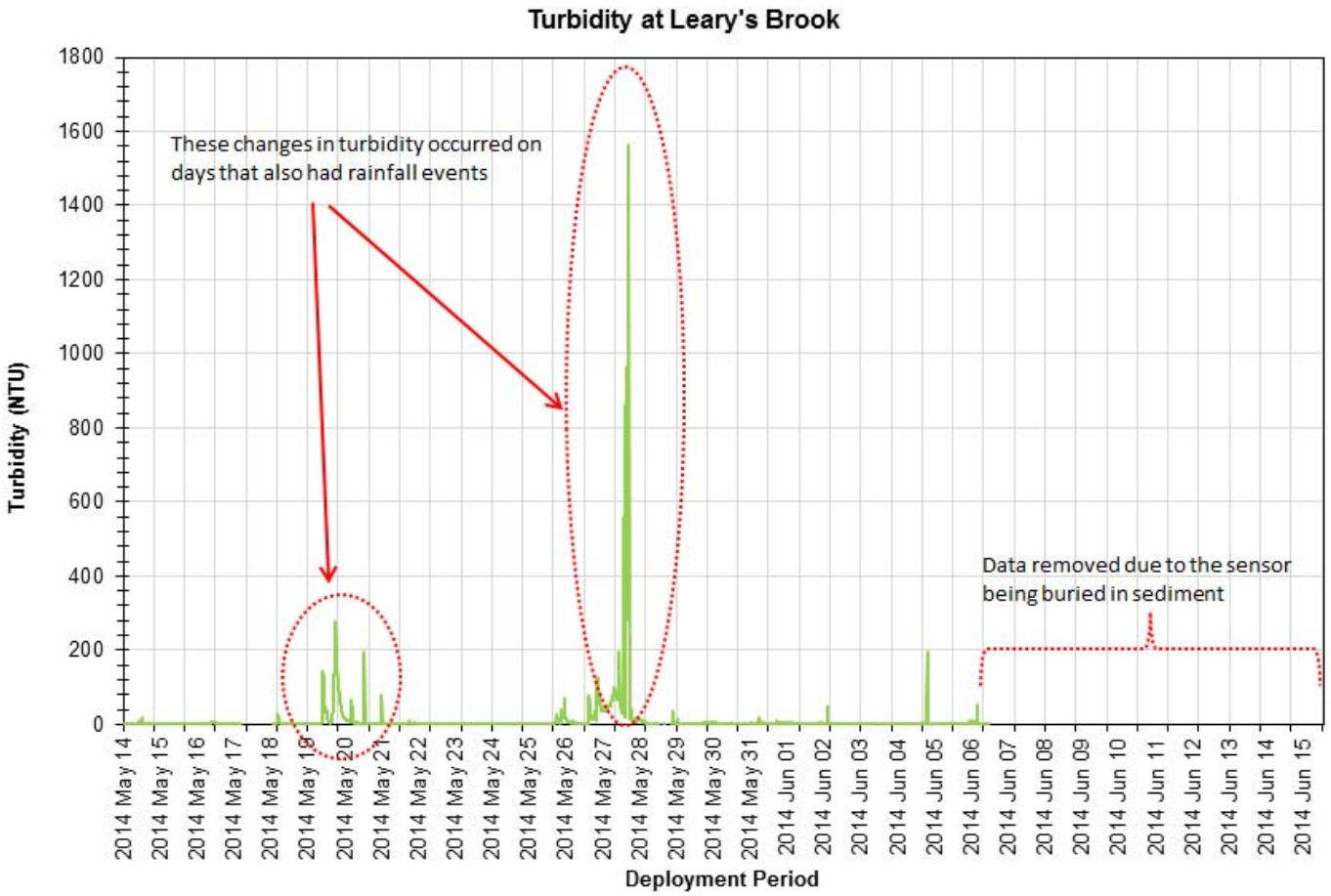

Figure 6: Turbidity (NTU) values at Leary's Brook Station

Stage and Total Precipitation

The below graph includes precipitation data from St. John's International Airport weather station and the stage data recorded at Leary's Brook Station. 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 is important to display as it provides an estimation of water level at the station and can explain some of the events that are occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). It is not unusual to see stage vary throughout the deployment period (Figure 7). Stage is directly influenced by rainfall and subsequent runoff from the surrounding environment.

The highest precipitation was recorded on May 27th 2014 at 71.6mm total for that day. The rainfall on May 27th was likely the influence to all other parameters for the same time frame. Stage level increased during this time frame.

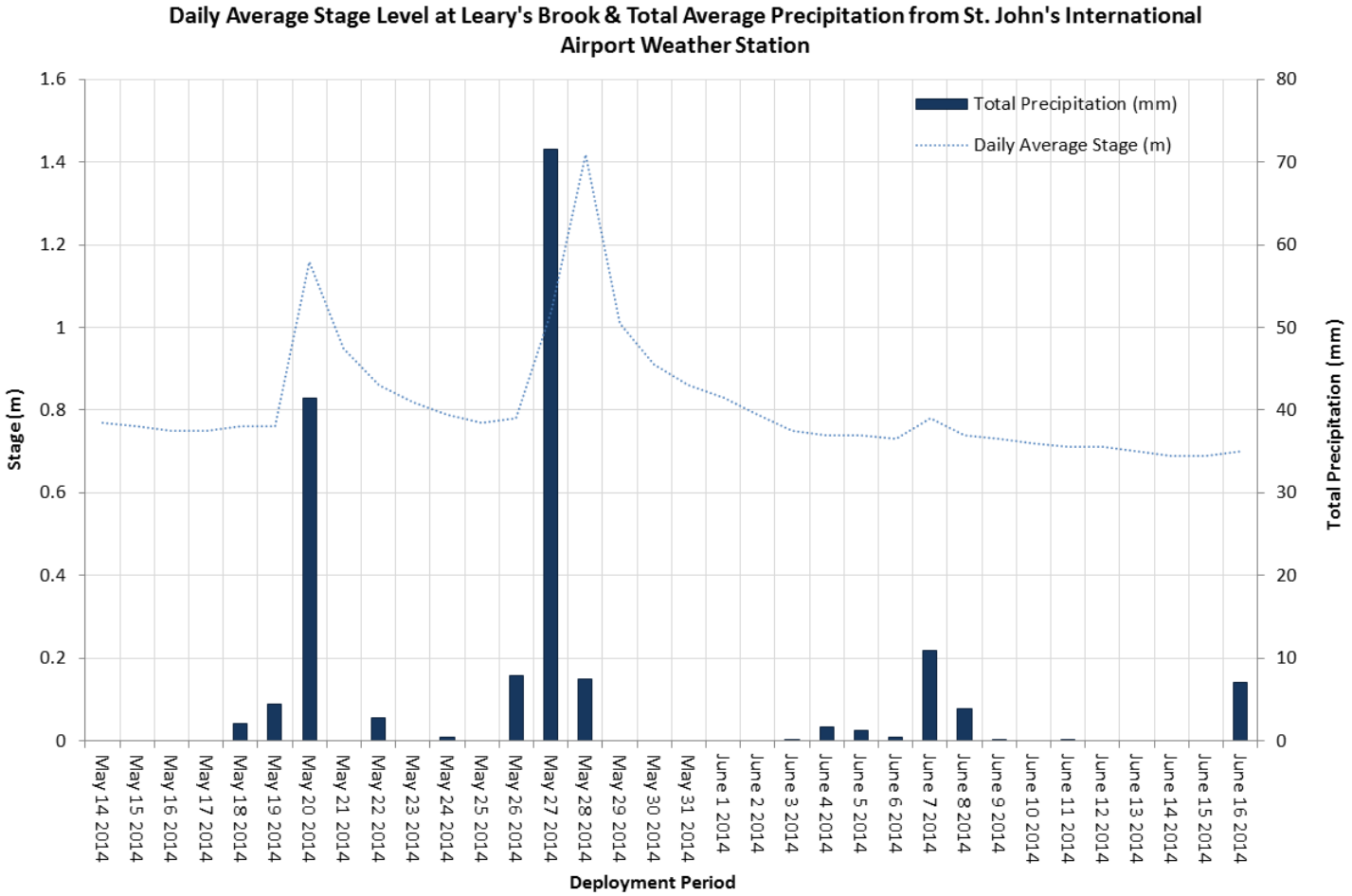

Figure 7: Stage values (m) from Leary's Brook Station and daily total precipitation values (mm) from St. John's International Airport.

Conclusions

Generally in natural environments, climate and weather conditions contribute in large part to the variation in water quality 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 turbidity, pH, specific conductance, and TDS as noted on May 19th and May 20th as well as a larger event on May 27th to May 29th, 2014. As ambient air temperatures increased, there were correspondingly warmer water temperatures, which in turn slightly decreased the amount of dissolved oxygen in the water.

During this deployment period the median water temperature at the Leary's Brook station was 9.63°C. Water temperature will continue to fluctuate and be influenced by the surrounding spring air temperatures.

As the spring thaw runoff settled as the month of June approached, the conductivity levels dropped and there were fewer spikes. The Specific Conductivity median at Leary's Brook was 194.3µS/cm, which was lower than the previous deployment.

The median pH value for Leary's Brook Station was 6.86 (pH units). The pH level for the most part is steady at this station.

Dissolved Oxygen at Leary's Brook had a median of 96.9%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.

The majority of turbidity events were correlated with increases in precipitation and coinciding stage increases. The turbidity median value at Leary's Brook during deployment was 0.0 NTU. Increases in stage level can explain the peaks in the turbidity values during the deployment period. As organic matter and natural minerals are washed into the brook, the suspended matter in the water column will increase and the turbidity sensor and the specific conductivity sensor will pick up these additional changes in the water body. A buildup of sediment around the turbidity probe caused the data from the last 9 days of deployment to be inaccurate and it was removed from the dataset.