Real-Time Water Quality Deployment Report

Paddy's Pond

October 2, 2018 to November 2, 2018

Government of Newfoundland & Labrador
Department of Municipal Affairs and Environment
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

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2018-10-02 to 2018-11-02

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- All water quality values appear to be within expected ranges for this time of year.

Maintenance and Calibration of Instrument

- As part of the Quality Assurance and Quality Control protocol (QAQC), 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.
    - Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.
    - At the end of a deployment period, a freshly cleaned and calibrated QAQC Sonde is placed *in situ*, adjacent to the Field Sonde. Values are compared between all parameters and differences are ranked for placement in Table 1.

Table 1: Qualitative QAQC Ranking

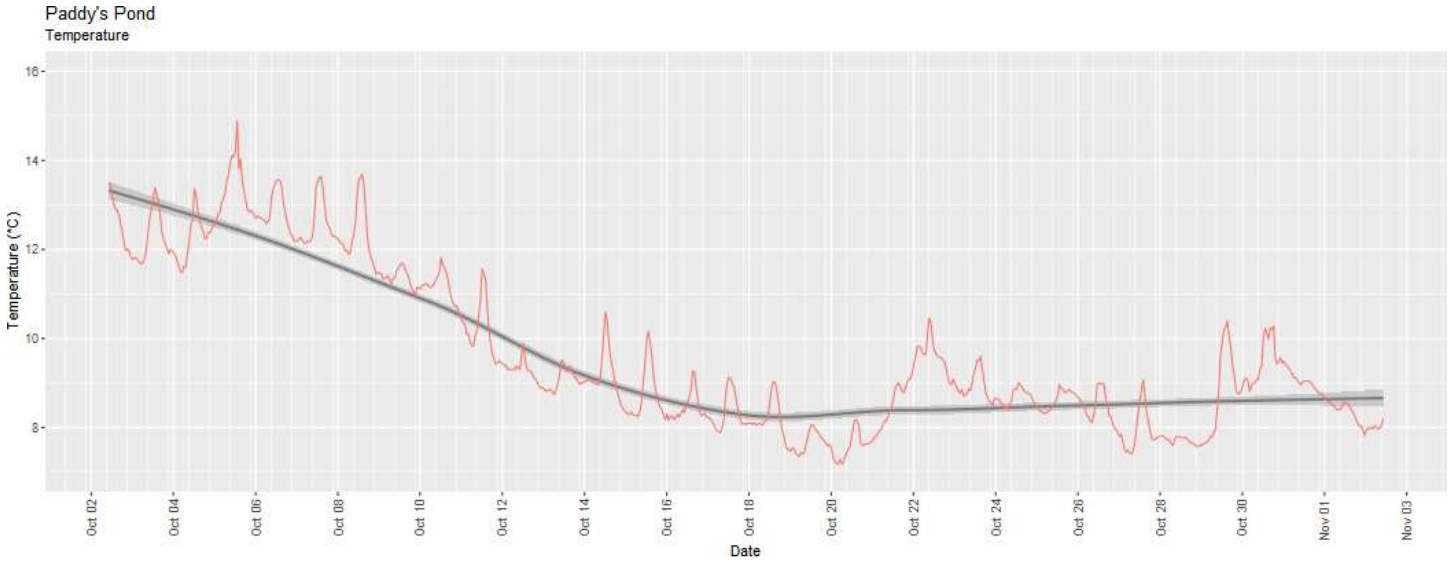
Date	Action	Comparison Ranking				
		Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
2018-10-02	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
2018-11-02	Removal	Poor	Fair	Excellent	Good	Excellent

- A "Poor" ranking was returned for Temperature during removal. This could point towards an issue with the QAQC sonde temperature sensor.

Data Interpretation

Temperature

Water Temperature is a major factor used to describe water quality. Temperature has major implications on both the ecology and chemistry of a water body, governing processes such as the metabolic rate of aquatic plants and animals and the degree of dissolved oxygen saturation.

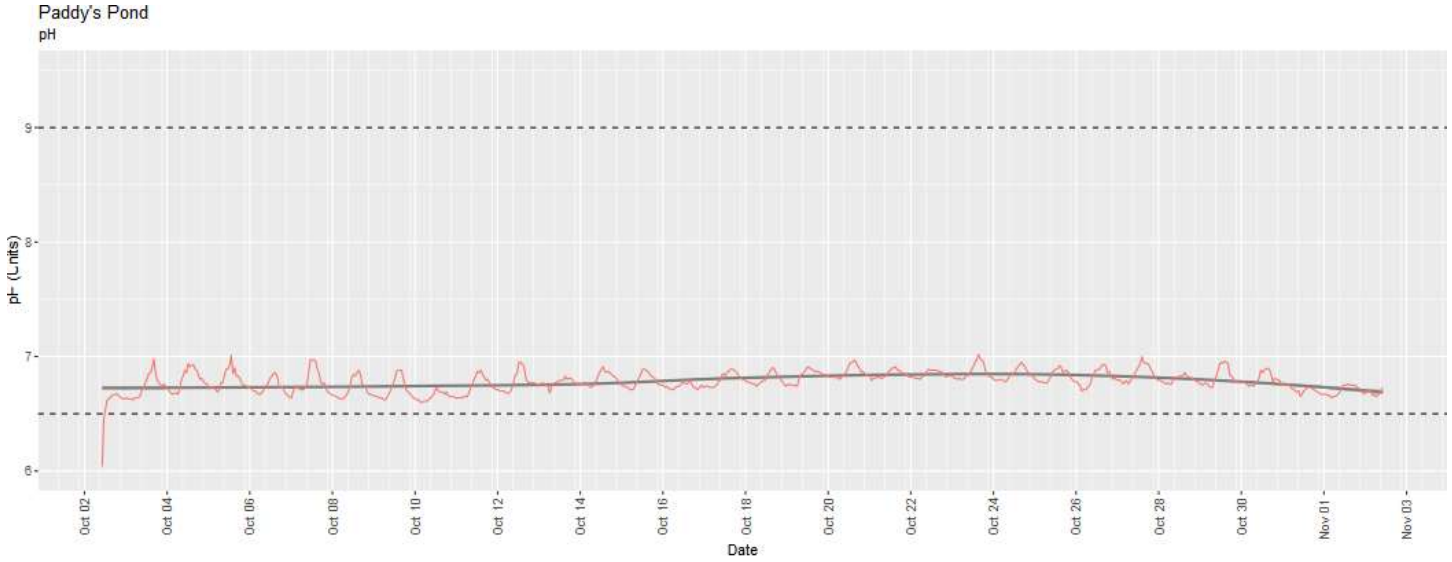


Mean	Median	Min	Max
9.67	9.00	7.18	14.89

- Water temperatures declined over this deployment period as it reached a near-plateau phase from October 22nd, onward.
- During this time, erratic air temperatures and precipitation (as shown in the Appendix) resulted in a departure from the typical, smooth diurnal shifts from daily high and low water temperatures. Instead, water temperatures are seen to rise and sharply fall on a near daily basis.

pH

pH is used to give an indication of the acidity or basicity of a solution. A pH of 7 denotes a neutral solution while lower values are acidic and higher values are basic. Technically, the pH of a solution indicates the availability of protons to react with molecules dissolved in water. Such reactions can affect how molecules function chemically and metabolically.

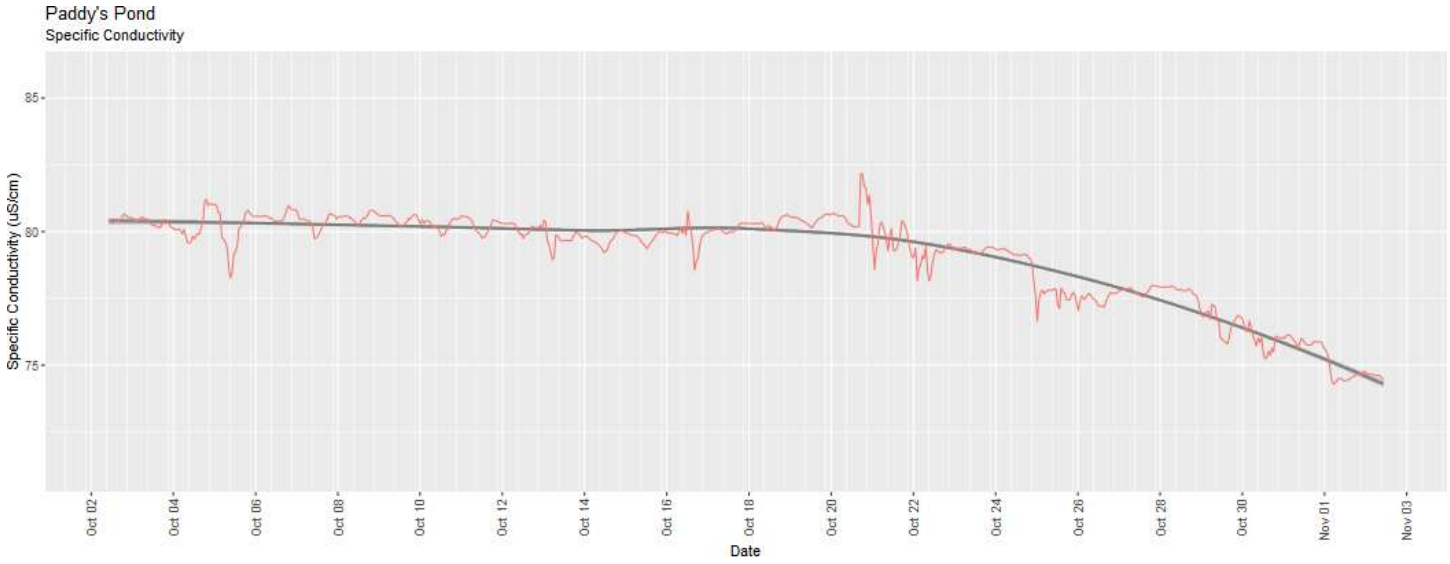


Mean	Median	Min	Max
6.78	6.78	6.04	7.02

- pH levels were mostly stable from October to November and were generally within the CCME guidelines for the protection of aquatic life.
- A diurnal cycle in pH levels is readily apparent early in the deployment but becomes less substantial as time goes on. This downward trend in variability indicates a slow reduction in aquatic productivity which is a primary driver of change in pH.

Specific Conductivity

Conductivity relates to the ease of passing an electric charge – or resistance – through a solution. Conductivity is highly influenced by the concentration of dissolved ions in solution: distilled water has zero conductivity (infinite resistance) while salty solutions have high conductivity (low resistance). Specific Conductivity is corrected to 25^{o}C to allow comparison across variable temperatures.

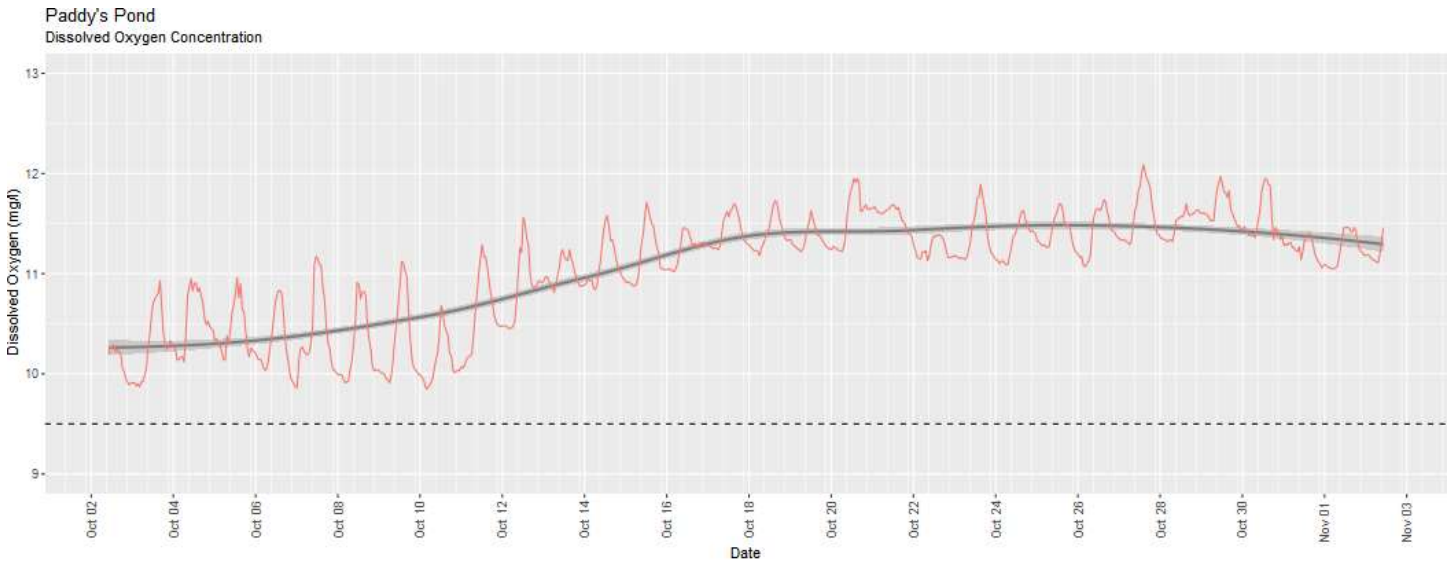


Mean	Median	Min	Max
79.11	79.87	74.28	82.18

- Following October 20th, during a warm air temperature period, a decline in pH is observed. This decline may have been driven by precipitation wherein low dissolved solids water had a diluting effect on the relatively high dissolved solid pond water.
- As the fall proceeds into the ice control season where road salt is spread along the nearby Trans-Canada Highway, specific conductivity levels can be expected to increase.

Dissolved Oxygen

Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The concentration of oxygen in water depends on many factors, especially temperature – the saturation of oxygen in water is inversely proportional to water temperature. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.

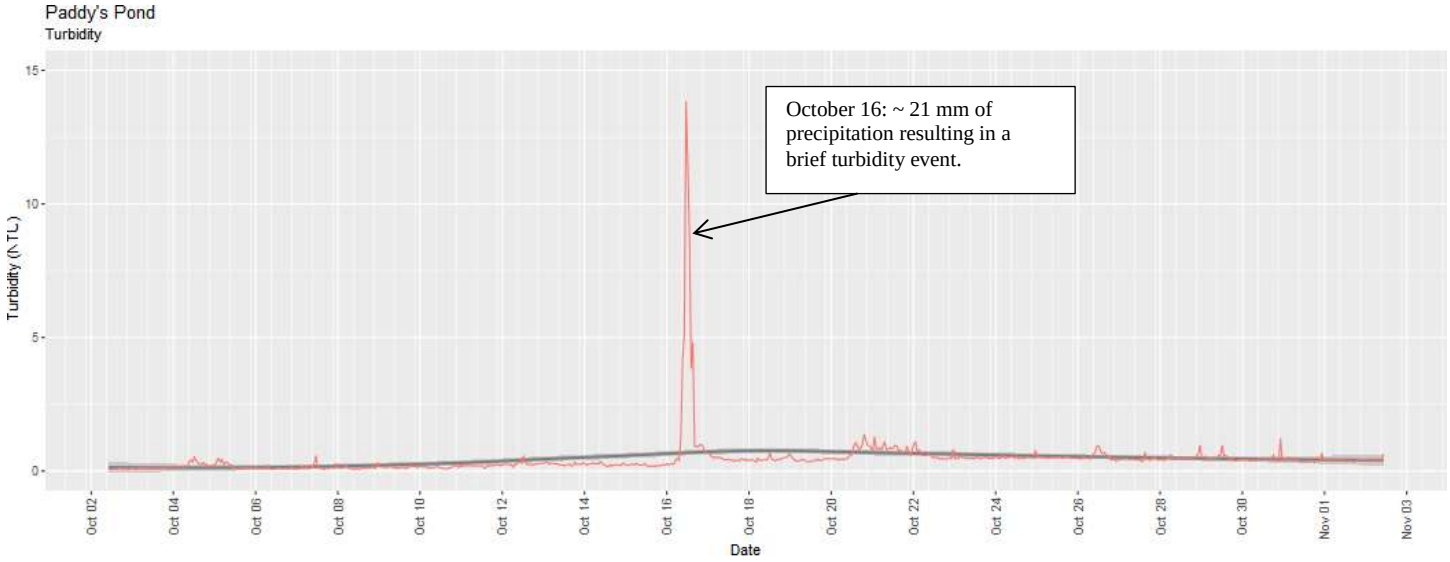


Mean	Median	Min	Max
11.04	11.21	9.85	12.09

- With declining water temperatures in the fall, dissolved oxygen content can be expected to rise; as is seen in the latter half of this deployment period. Also observed is the gradual decline in diurnal variation in oxygen concentration as the difference between daytime and nighttime water (and air) temperatures is reduced.
- All values were found to be greater than the CCME guideline for the protection of aquatic life.

Turbidity

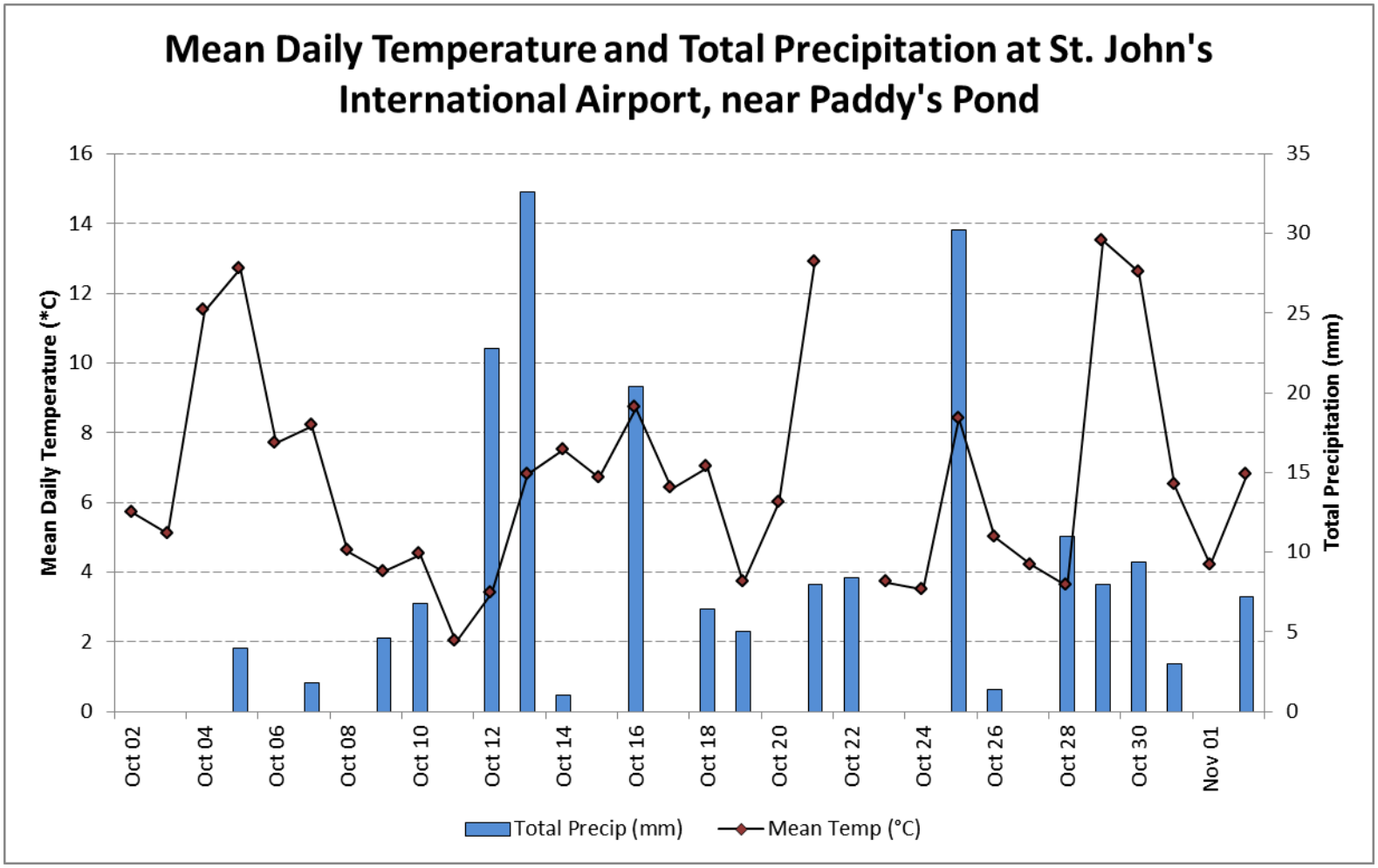
Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover spawning areas.



Mean	Median	Min	Max
0.44	0.39	0.04	13.83

- A low level of turbidity was present during most of this deployment period. A single prominent turbidity event occurred on October 16 during approximately 21 mm of precipitation.

Appendix


Mean Daily Temperature and Total Precipitation at St. John's International Airport, near Paddy's Pond
Mean Daily Temperature (*C)
Total Precipitation (mm)
16
14
12
10
8
6
4
2
0
35
30
25
20
15
10
5
0
Oct 02
Oct 04
Oct 06
Oct 08
Oct 10
Oct 12
Oct 14
Oct 16
Oct 18
Oct 20
Oct 22
Oct 24
Oct 26
Oct 28
Oct 30
Nov 01
Total Precip (mm)
Mean Temp (°C)