Real-Time Water Quality Deployment Report

Rattling Brook Network

September 19, 2019 to November 14, 2019

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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2019-09-19 to 2019-11-14

General

- Department of Municipal Affairs and Environment staff monitor the real-time web pages consistently.
- Hydrometric data included in this report is provisional and used only for illustrative purposes. Corrected and finalized data may be retrieved from the Water Survey of Canada website (http://www.ec.gc.ca/rhc-wsc/)*.

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

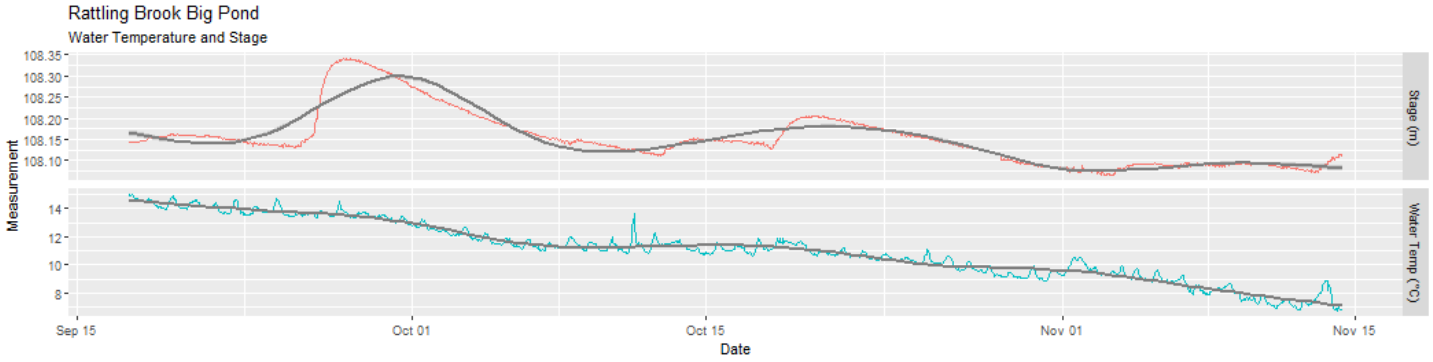
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	September 19	Deployment	Excellent	Fair	Excellent	Excellent	Poor
	November 14	Removal	Good	Poor	Excellent	Excellent	Excellent
Rattling Brook below Bridge	September 19	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	November 14	Removal	Excellent	Excellent	Excellent	Excellent	Excellent
Rattling Brook below Plant Discharge	September 19	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	November 14	Removal	Good	Marginal	Excellent	Good	Good

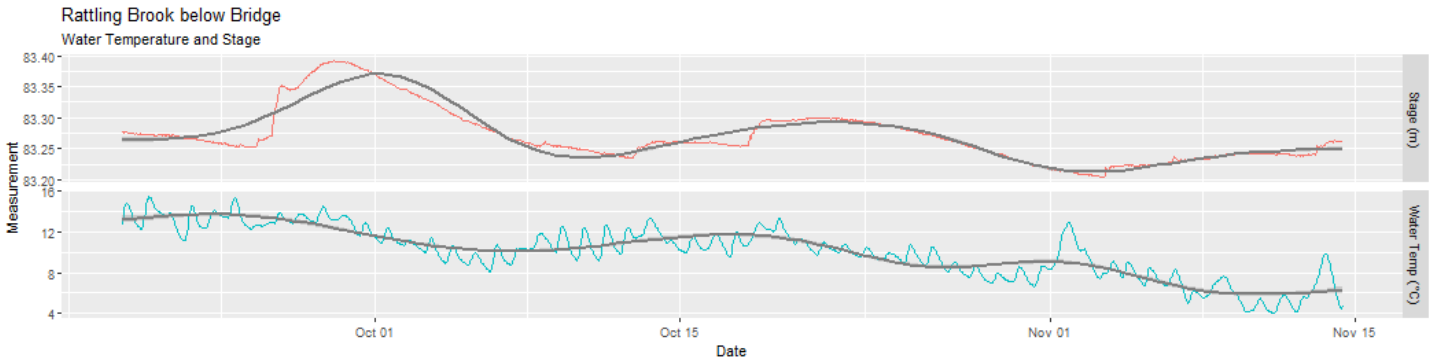
- All comparisons ranked ‘Fair’ to ‘Excellent’ with the following exceptions:
    - Big Pond Deployment: Turbidity ranked ‘Poor’. The field sonde read 11.2, QA/QC read 0.3 while the grab sample read 5.5 NTU. The placement of the QAQC sonde during deployment may not have been as comparable to the Field sonde as assumed.
    - Big Pond Removal: pH ranked ‘Poor’. The field sonde read 6.16, QA.QC sonde read 4.95 (pH units). Possibly a result of not allowing enough time to pass for the sensor to regulate in the water body.

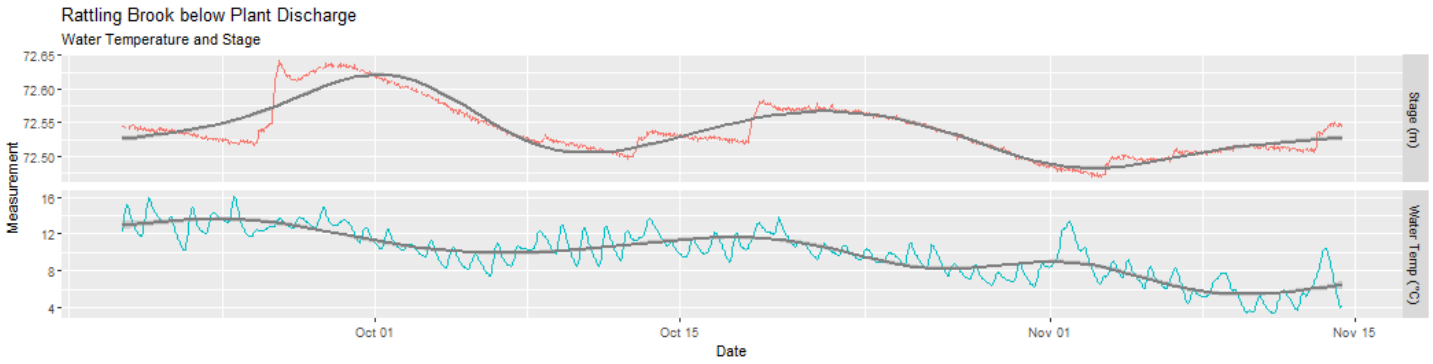
Data Interpretation

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.







Station	Mean	Median	Min	Max
Big Pond	11.07	11.08	6.7	15.01
Below Bridge	10.16	10.33	4.03	15.45
Below Plant Discharge	9.91	10.17	3.4	16.07

- The declining temperature trend from the previous deployment period continued into October - November, as expected. Similar trends were observed in temperature at each station during this deployment period.

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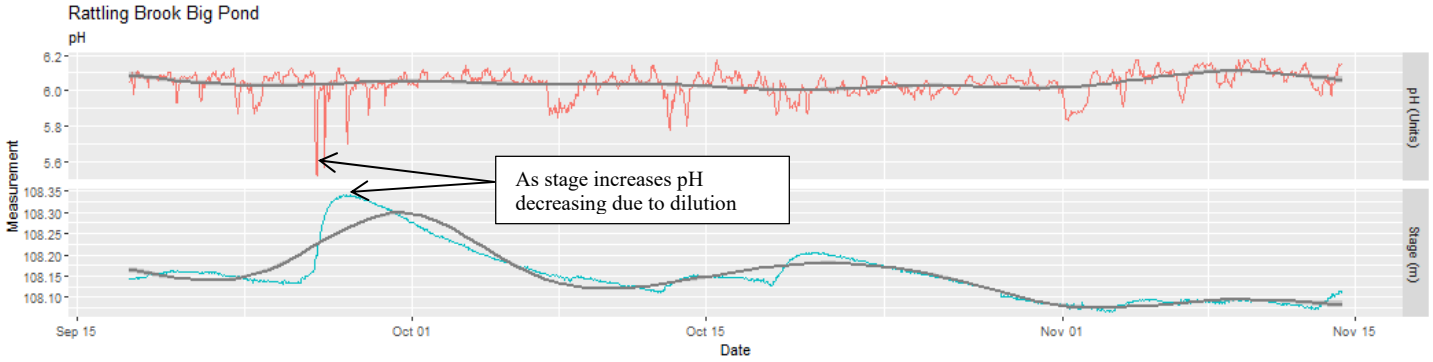
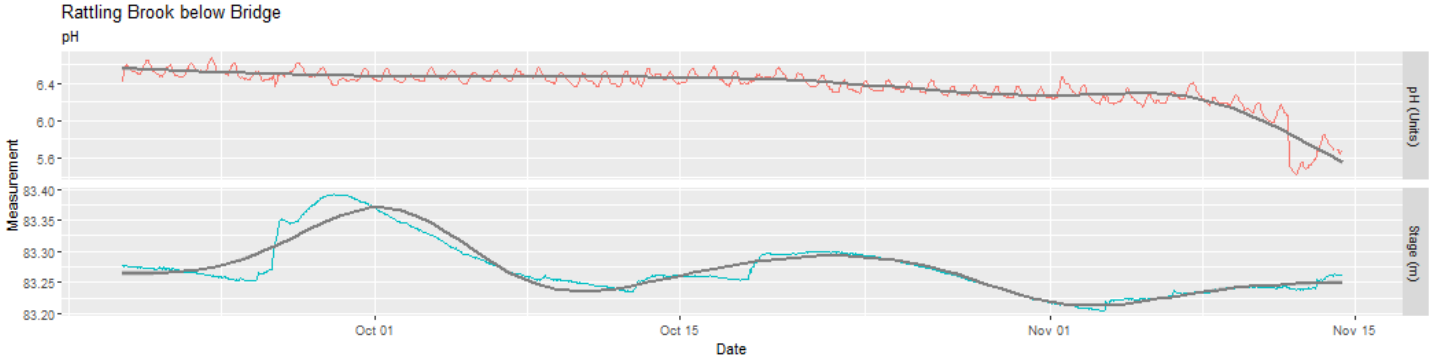
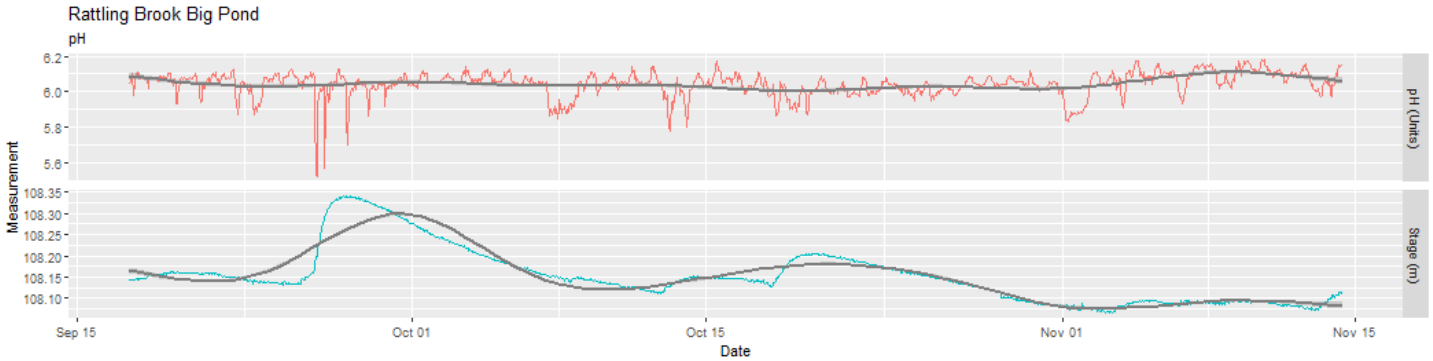
pH

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.







Station	Mean	Median	Min	Max
Big Pond	6.04	6.05	5.52	6.18
Below Bridge	6.37	6.42	5.42	6.67
Below Plant Discharge	6.26	6.44	5.19	6.73

- pH values showed variability during the fall season. pH values were mostly within site-specific guidelines (5.67-6.56 pH Units) at all stations decreasing late in deployment.

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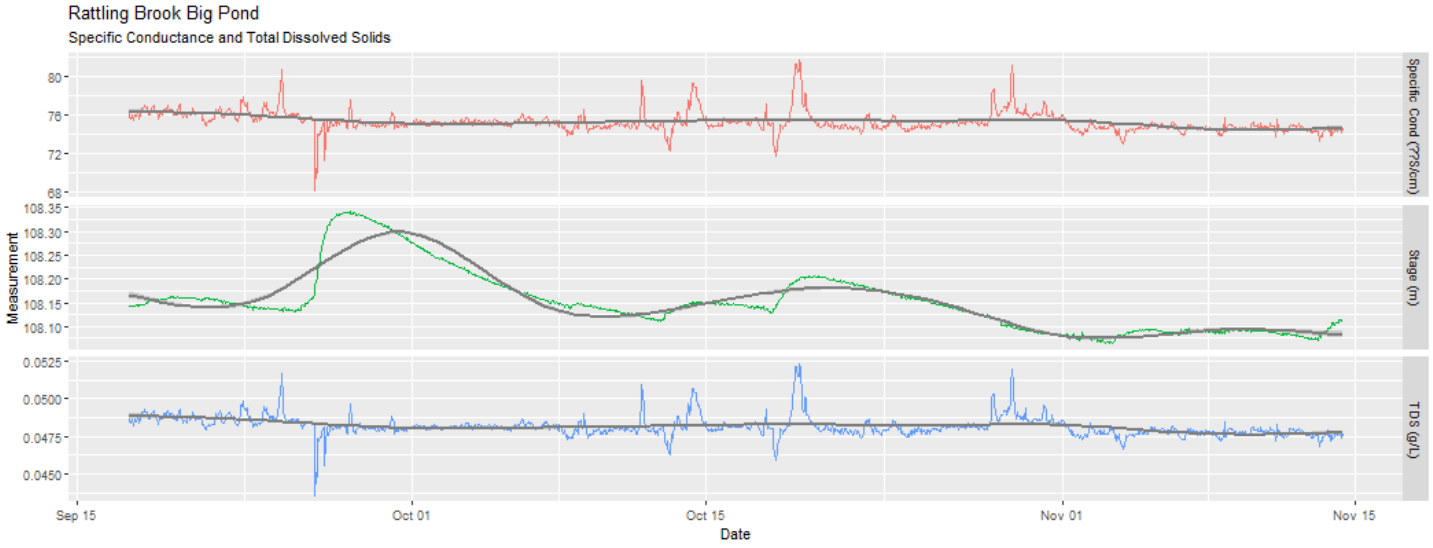
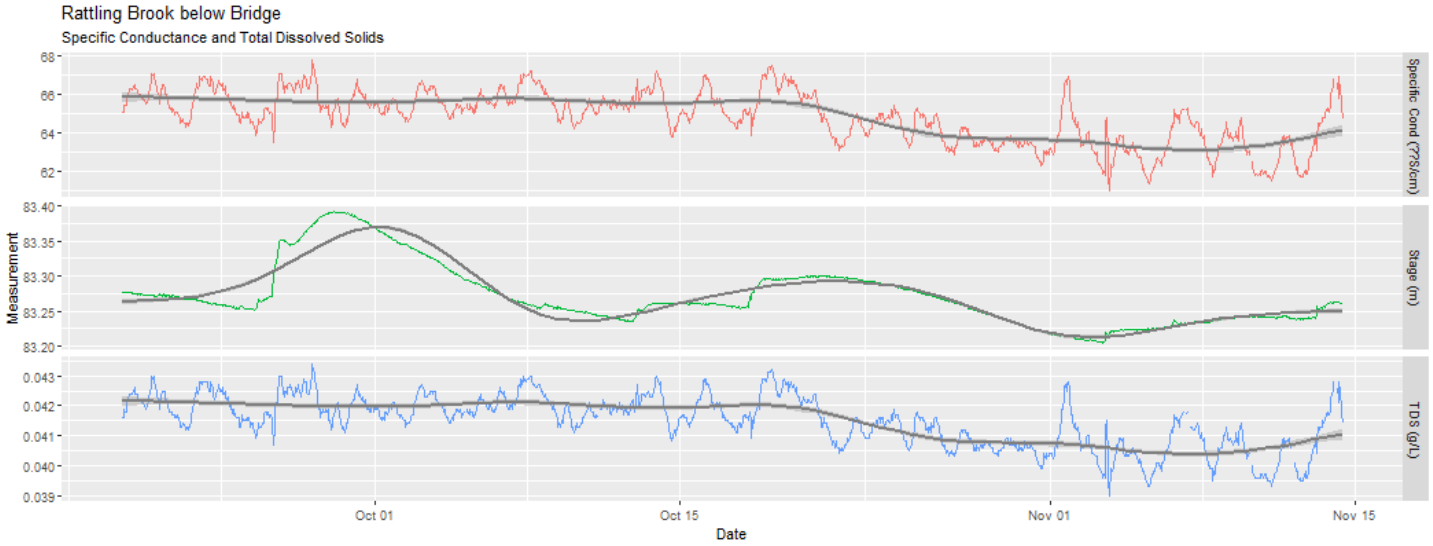
Specific Conductivity

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 25ºC to allow comparison across variable temperatures.





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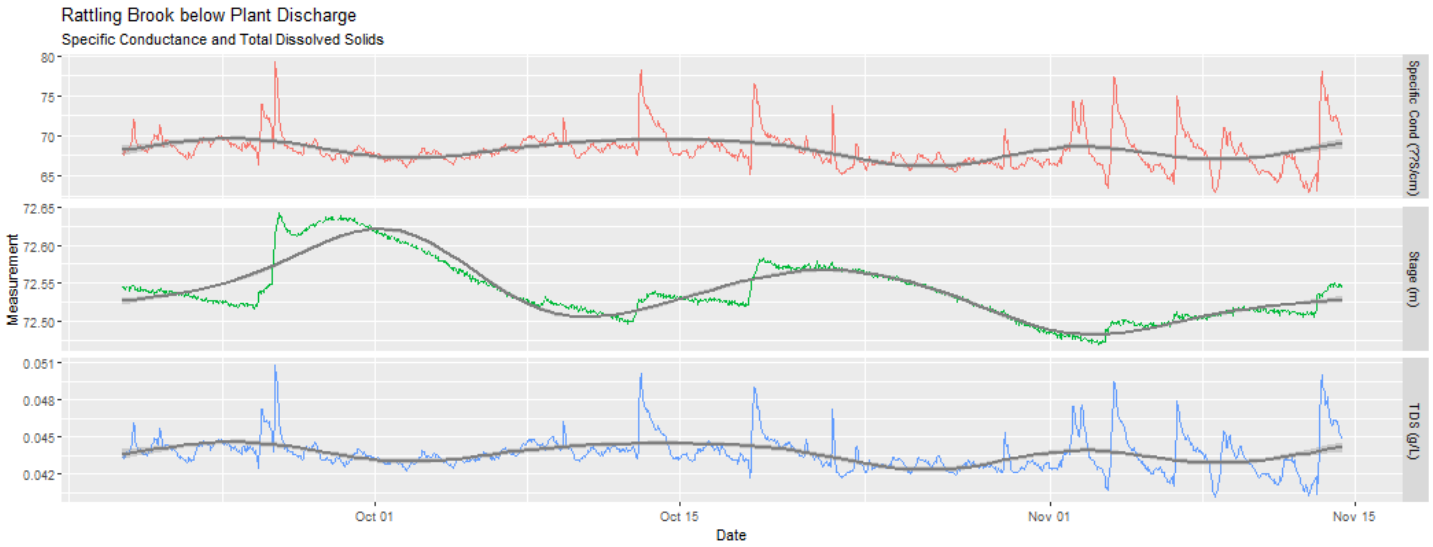

Station	Mean	Median	Min	Max
Big Pond	75.3	75.1	68.1	81.7
Below Bridge	64.8	65.0	61.0	67.8
Below Plant Discharge	68.2	67.9	62.9	79.3

- Although numerous peaks can be identified in the figures above, specific conductivity was relatively stable at all stations during this deployment period. Sharp increases correlate to changes in stage and are likely to result of precipitation events washing particles into the river as runoff.

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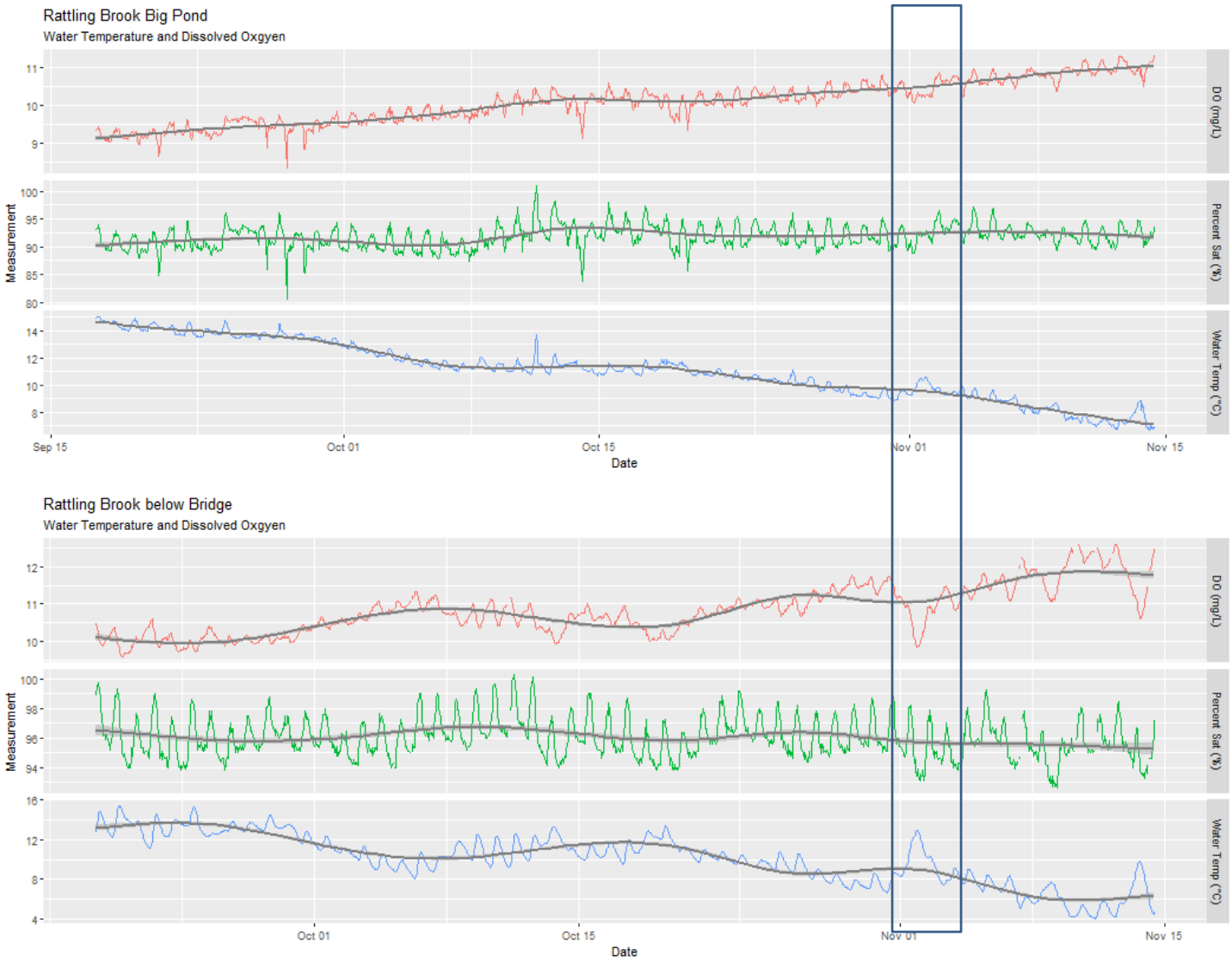
Dissolved Oxygen

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 oxidation reactions.



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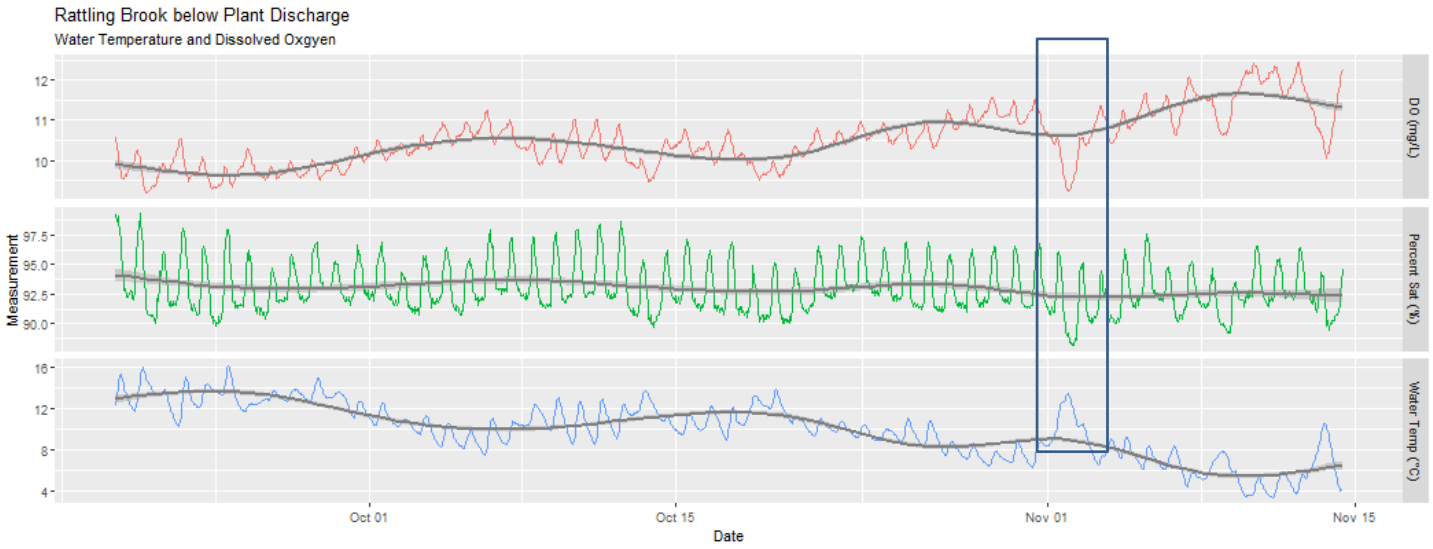

Station	Mean	Median	Min	Max
Big Pond	10.07	10.11	8.32	11.33
Below Bridge	10.79	10.75	9.57	12.61
Below Plant Discharge	10.51	10.45	9.19	12.46

- As expected, cooler water temperatures saw dissolved oxygen concentrations increase overall at each monitoring station during this deployment period.
- The data shows plunges in dissolved oxygen concentrations during this deployment period linked to abnormal elevated water temperatures.

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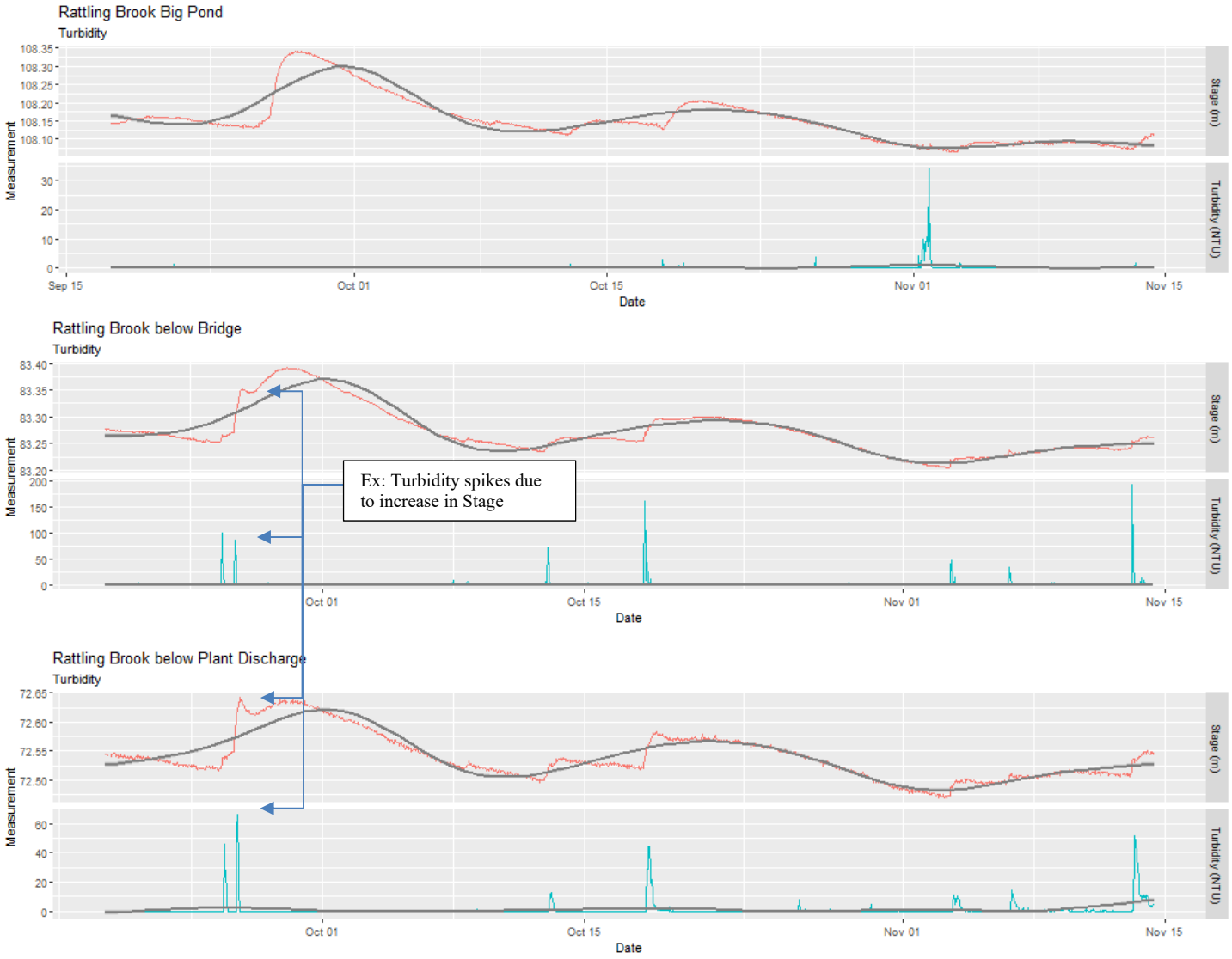
Turbidity

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.



Station	Mean	Median	Min	Max
Big Pond	0.1	0.0	0.0	34.1
Below Bridge	0.8	0.0	0.0	160.3
Below Plant Discharge	1.0	0.0	0.0	66.0

- Turbidity levels were low for this deployment period. Most turbidity peaks are associated with precipitation events and stage level increases; all of which resolved within a few hours

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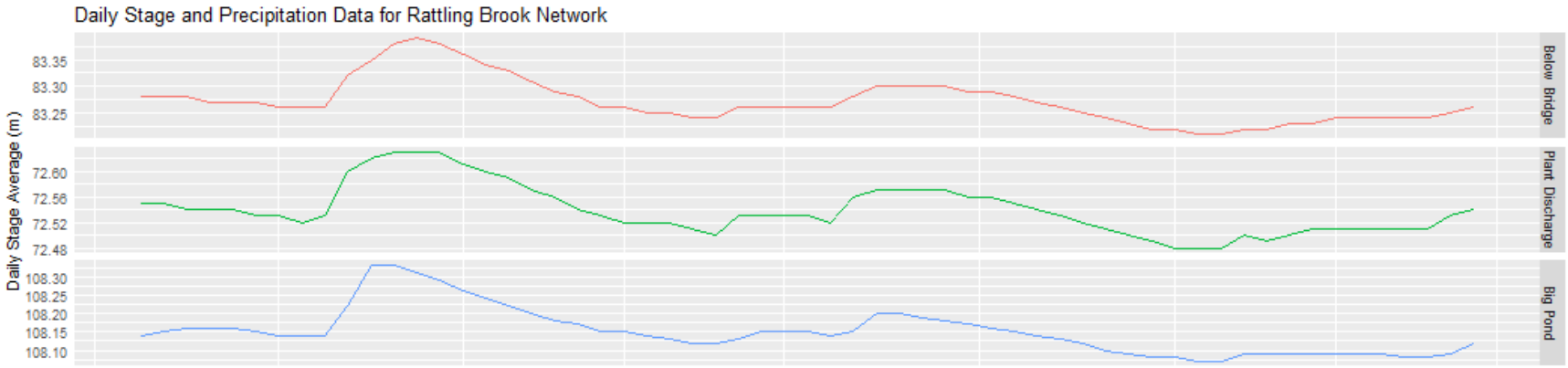
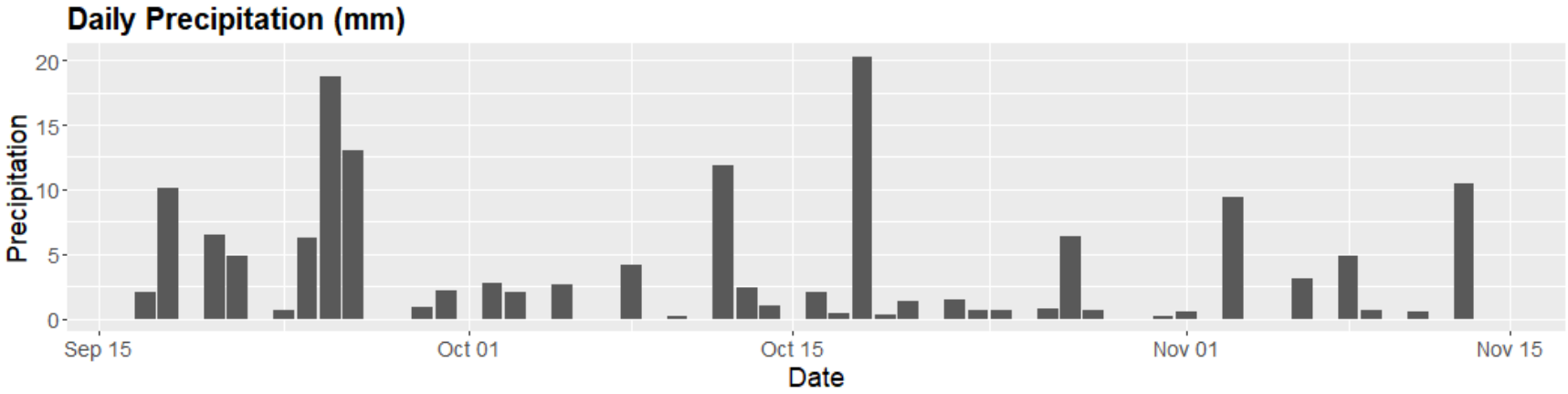
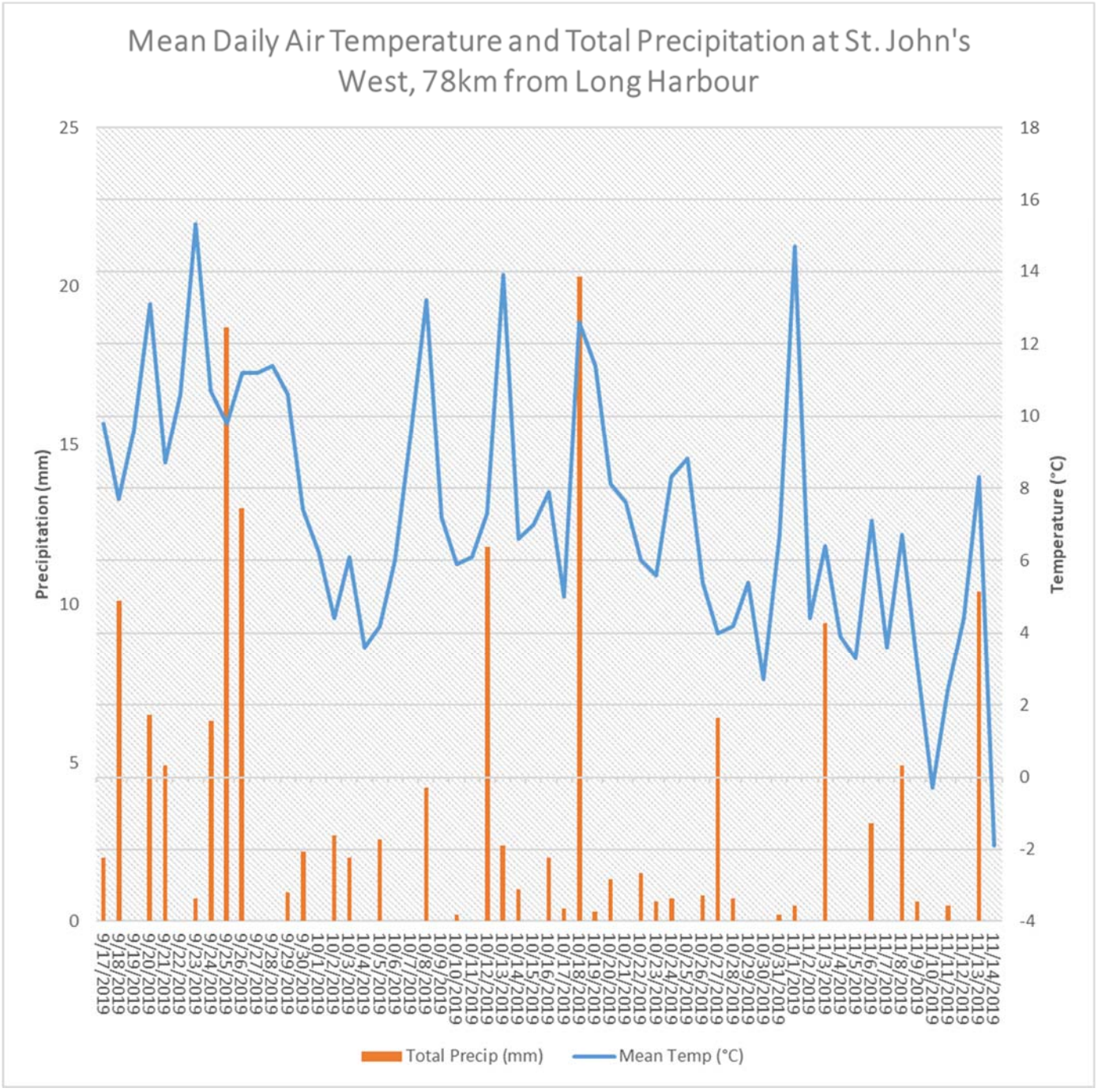
Appendix


Daily Stage and Precipitation Data for Rattling Brook Network
Daily Stage Average (m)
83.35
83.30
83.25
72.60
72.56
72.52
72.48
108.30
108.25
108.20
108.15
108.10
Below Bridge
Plant Discharge
Big Pond


Daily Precipitation (mm)
Precipitation
20
15
10
5
0
Sep 15
Oct 01
Oct 15
Nov 01
Nov 15
Date


Mean Daily Air Temperature and Total Precipitation at St. John's West, 78km from Long Harbour
Precipitation (mm)
Temperature (°C)
Total Precip (mm)
Mean Temp (°C)