Real-Time Water Quality Deployment Report

Rattling Brook Network

December 6, 2018 to January 17, 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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2018-12-06 to 2019-01-17

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Rattling Brook Big Pond was not removed with the other stations on January 17, 2019 due to ice conditions. Winter 2018 was the first time equipment was left under the ice to gather data during an extended deployment. With a higher water level in Big Pond and a subsequently reduced risk of ice damage, it was decided to repeat the extended deployment in 2019 instead of removing equipment.
- 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

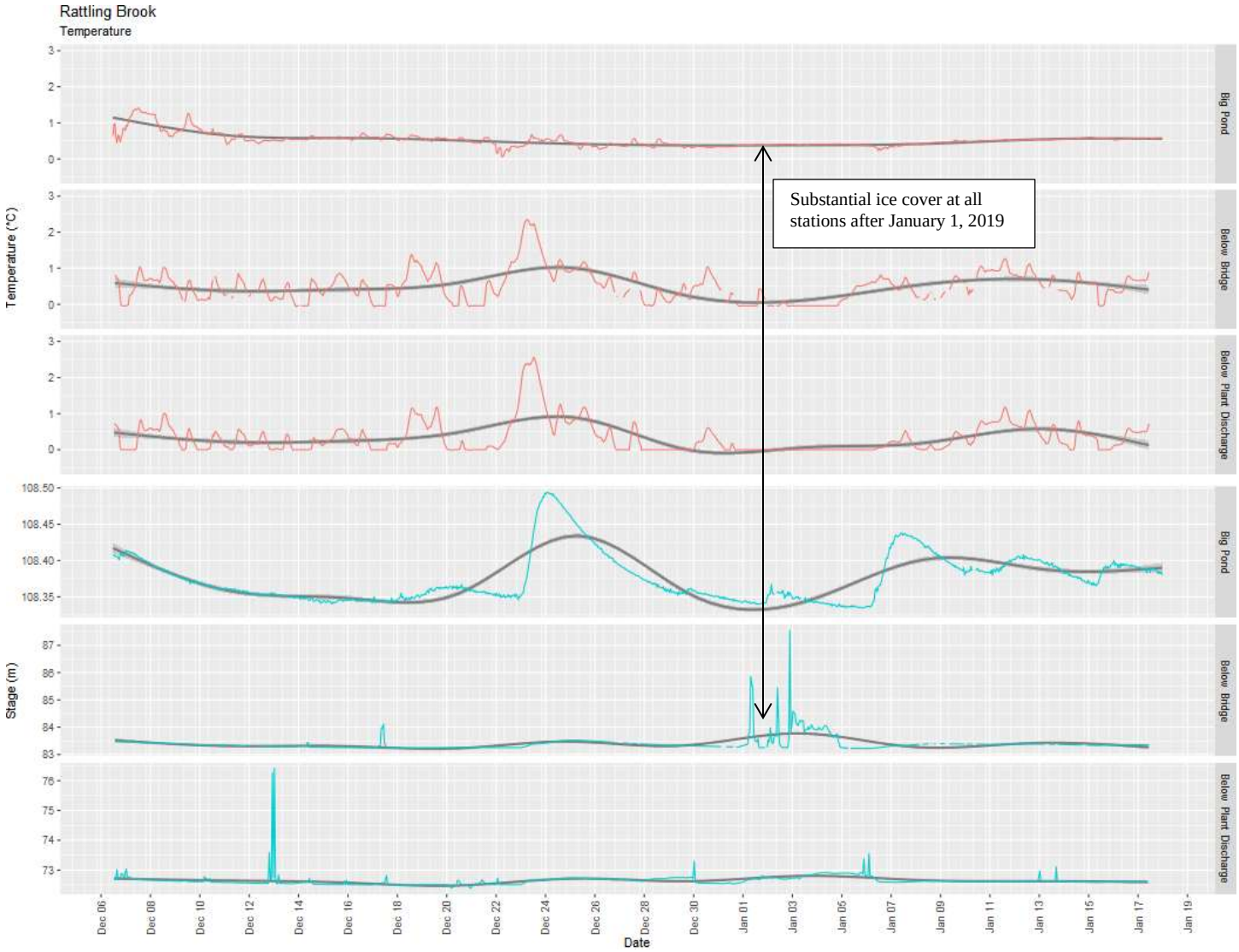
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	December 6, 2018	Deployment	Excellent	Excellent	Excellent	NA	Excellent
	January 17, 2019	Ongoing	NA	NA	NA	NA	NA
Rattling Brook below Bridge	December 6, 2018	Deployment	Excellent	Good	Excellent	NA	Good
	January 17, 2019	Removal	Good	Good	Excellent	Good	Excellent
Rattling Brook below Plant Discharge	December 6, 2018	Deployment	Excellent	Good	Excellent	NA	Good
	January 17, 2019	Removal	Excellent	Excellent	Excellent	Good	Excellent

- "Poor" rankings were initially calculated for Dissolved Oxygen, however, this called into question the validity of the QAQC DO sensor. It will be checked for data quality.

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	0.52	0.51	0.06	1.41
Below Bridge	0.50	0.48	-0.07	2.35
Below Plant Discharge	0.33	0.18	-0.02	2.56

- Cold air temperatures resulted in substantial ice formation by early January, 2019. Ice formation is suggested by erratic stage level (from ice damming/ release) and the nearly flat-line temperatures at 0°C as indicated in the figure above. During the six week deployment period this report considers, only six days had a mean temperature greater than 0°C.

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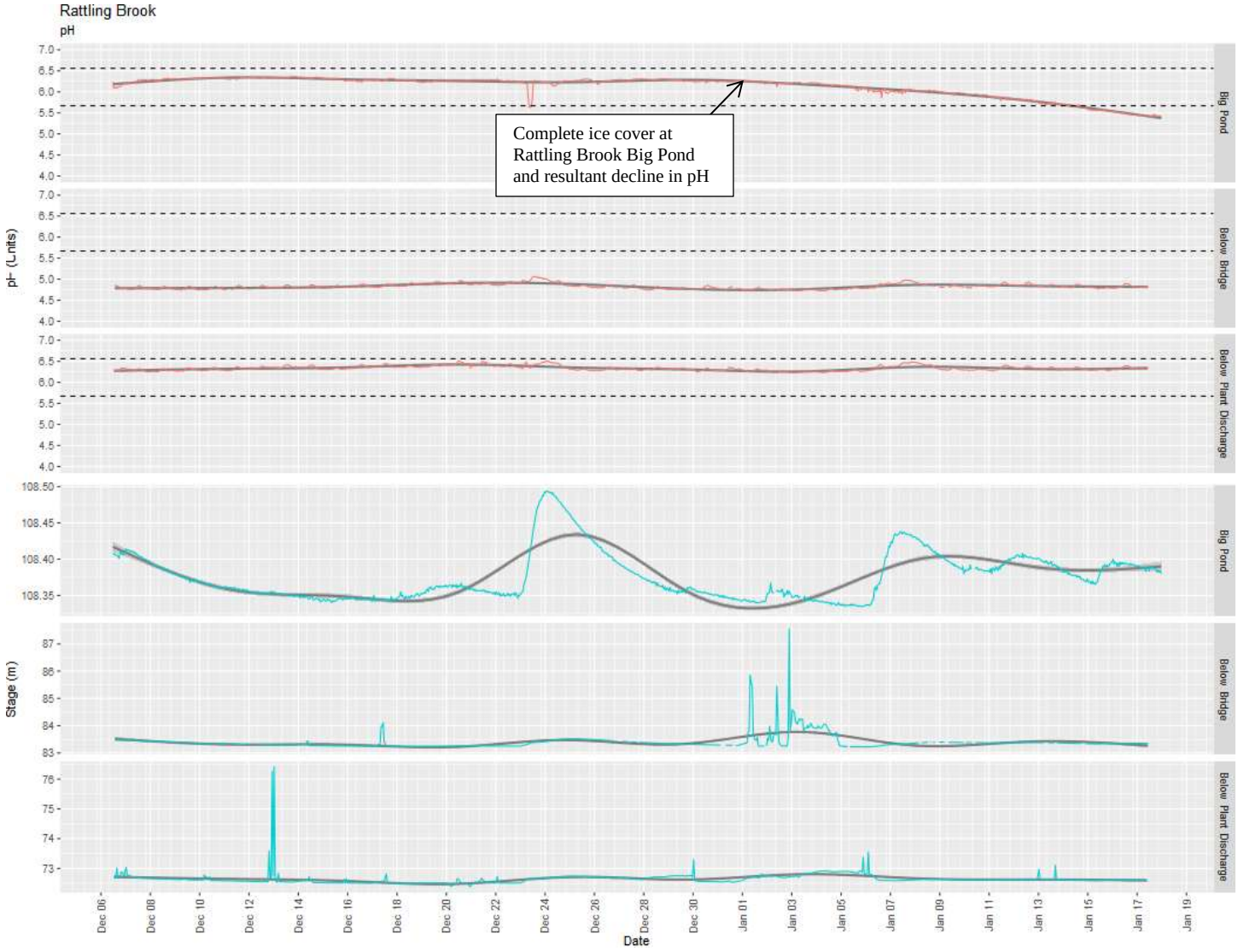
pH

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	6.13	6.25	5.38	6.36
Below Bridge	4.83	4.82	4.72	5.06
Below Plant Discharge	6.33	6.32	6.22	6.51

- pH levels at Bridge and Plant Discharge stations were mostly stable during this deployment. Big Pond station, however, indicated a steady drop in pH from approximately January 1st, onwards. This is likely the result of full ice cover and an elimination of gas exchange between the water and atmosphere. A buildup of carbon dioxide will result in a depression of pH. As ice cover recedes in the spring, pH will rise.

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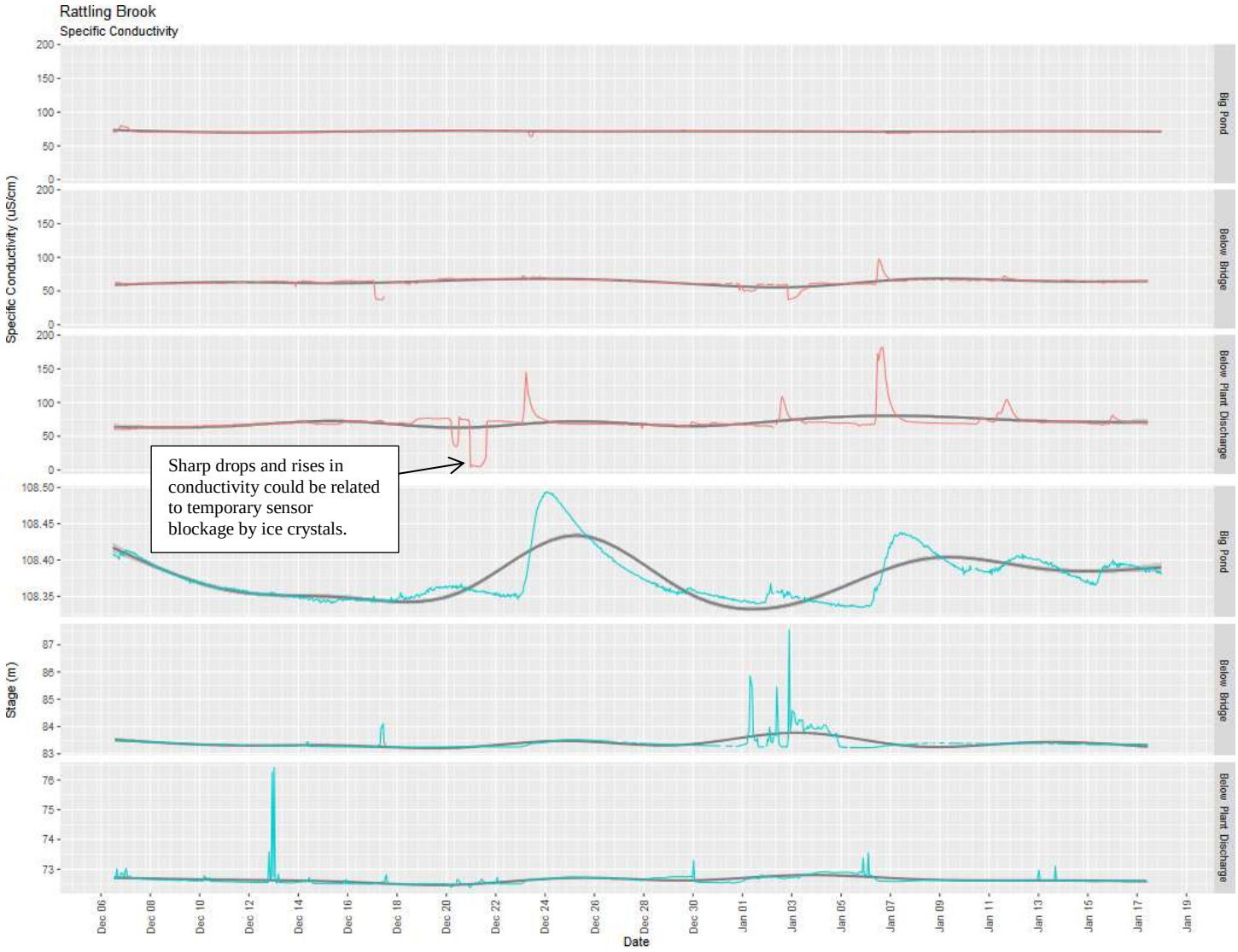
Specific Conductivity

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 25°C to allow comparison across variable temperatures.



Station	Mean	Median	Min	Max
Big Pond	71.3	71.5	63.2	80.2
Below Bridge	63.4	64.1	37.3	97.2
Below Plant Discharge	70.3	69.2	3.7	181.8

- Occasional perturbations to specific conductivity were seen at Bridge and Plant Discharge stations and are related to precipitation. Otherwise, conductivity is mostly stable at each station during this deployment period, as is typical during the winter season.

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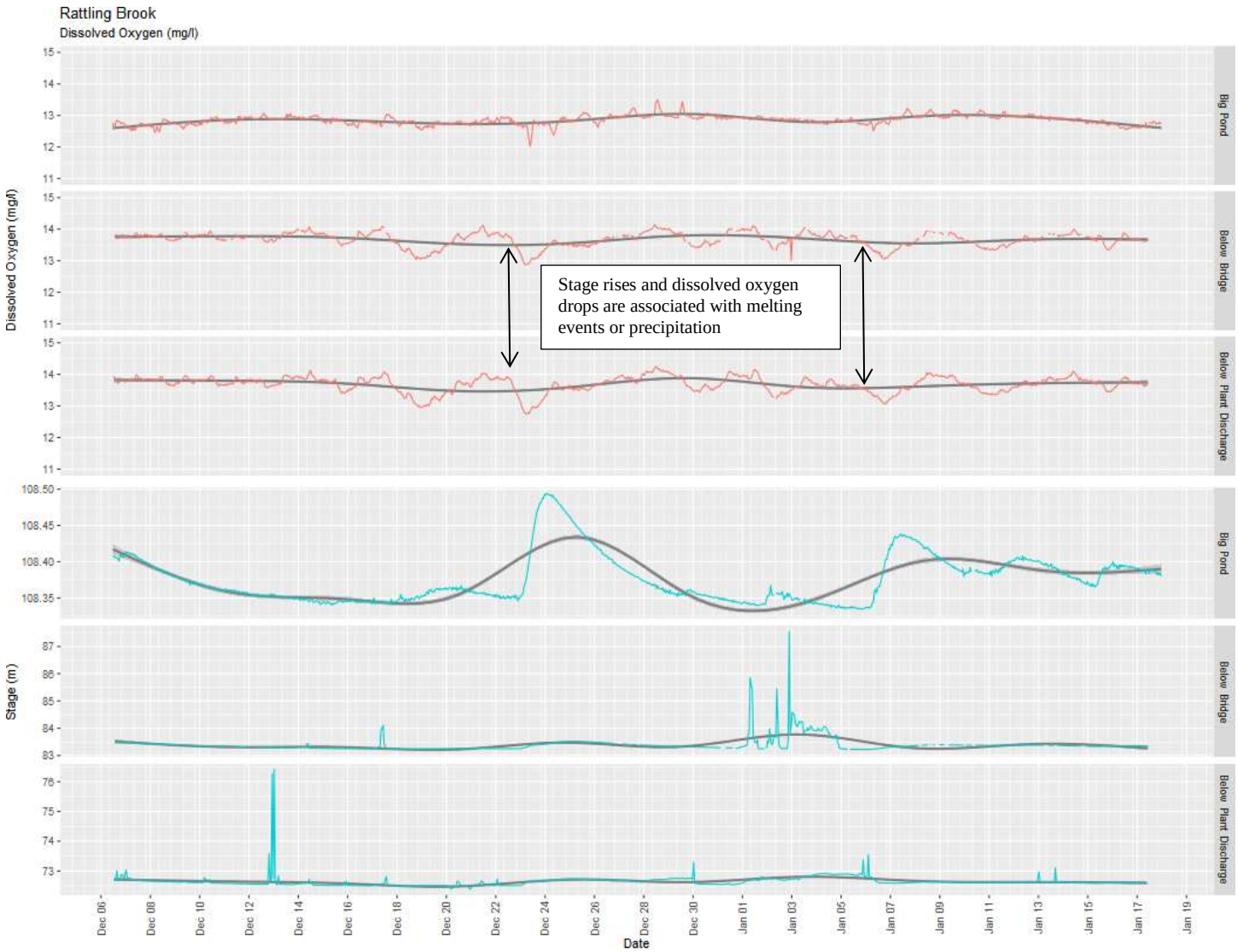
Dissolved Oxygen

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 the presence of oxidizing materials.



Station	Mean	Median	Min	Max
Big Pond	12.85	12.87	12.02	13.50
Below Bridge	13.67	13.71	12.87	14.14
Below Plant Discharge	13.69	13.73	12.75	14.25

- Periodic rises and falls in dissolved oxygen are observed throughout the deployment period and are likely motivated by precipitation and melting events. Incoming meltwater and precipitation is lower in dissolved oxygen compared to flowing water within Rattling Brook and thus dilutes the river.

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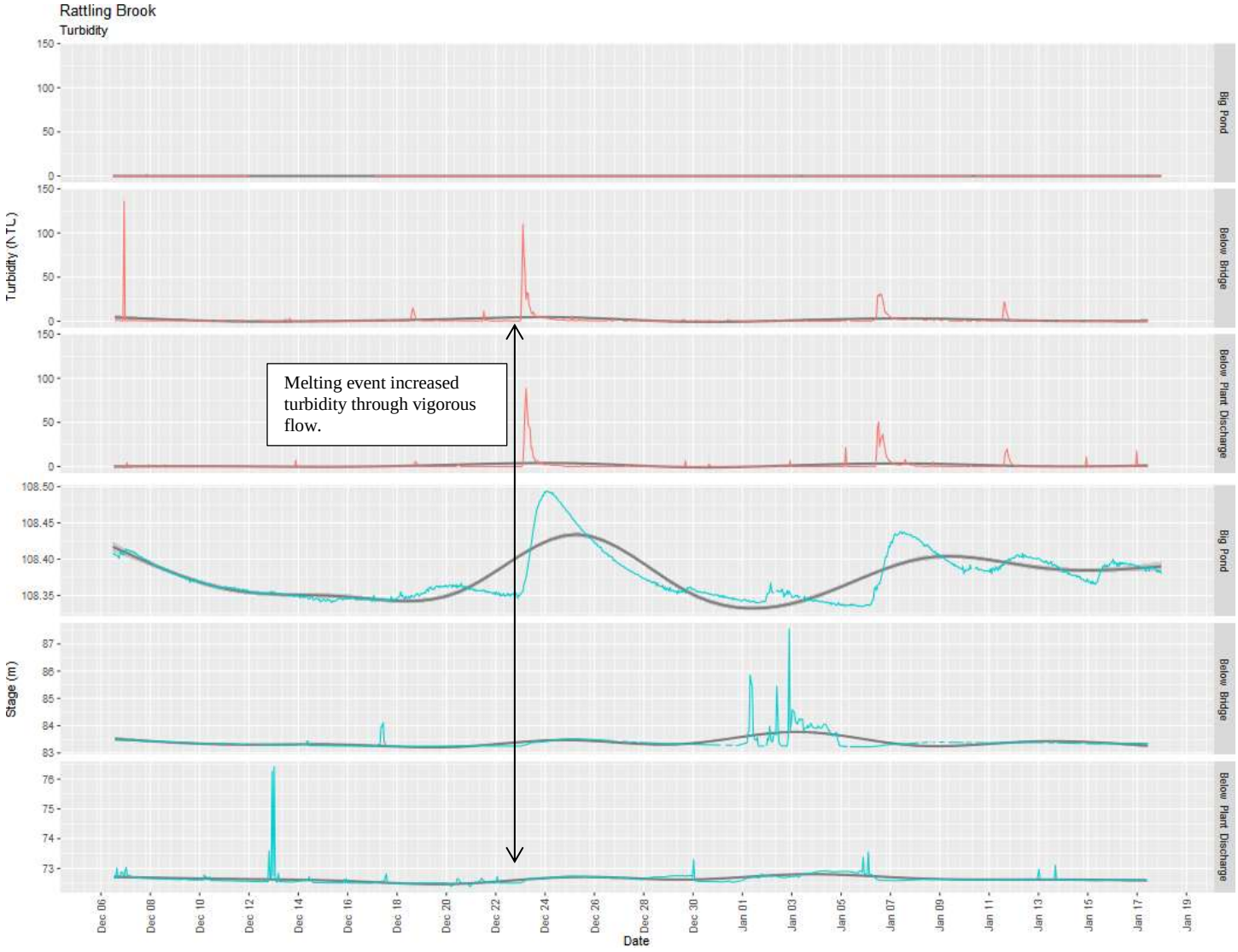
Turbidity

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	0.0	0.0	0.0	2.1
Below Bridge	1.6	0.4	0.0	136.0
Below Plant Discharge	1.1	0.0	0.0	88.4

- Turbidity was generally low during this deployment period with a few instances of short turbidity events instigated by melt water and precipitation. Otherwise, turbidity was low with median values of 0.0 NTU at both Big Pond and Plant Discharge stations and 0.4 NTU at Bridge station.

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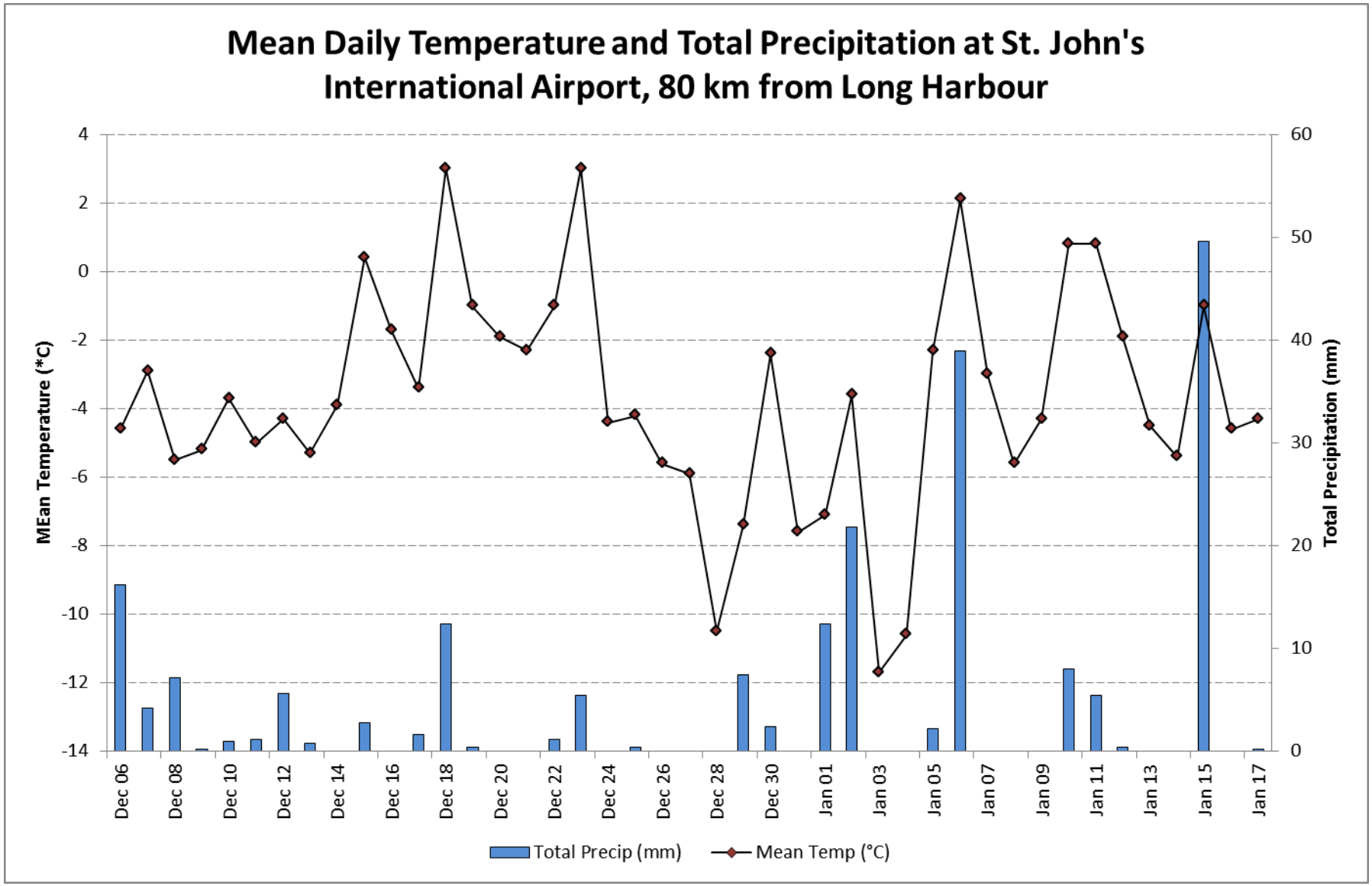
Appendix


Mean Daily Temperature and Total Precipitation at St. John's International Airport, 80 km from Long Harbour
MEan Temperature (*C)
Total Precipitation (mm)
4
2
0
-2
-4
-6
-8
-10
-12
-14
60
50
40
30
20
10
0
Dec 06
Dec 08
Dec 10
Dec 12
Dec 14
Dec 16
Dec 18
Dec 20
Dec 22
Dec 24
Dec 26
Dec 28
Dec 30
Jan 01
Jan 03
Jan 05
Jan 07
Jan 09
Jan 11
Jan 13
Jan 15
Jan 17
Total Precip (mm)
Mean Temp (°C)