Real-Time Water Quality Deployment Report

Rattling Brook Network

January 17, 2019 to March 7, 2019

Newfoundland Labrador

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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2019-01-18 to 2019-03-07

General

- Department of Municipal Affairs and Environment staff monitor the real-time web pages consistently.
- The deployment interval for Big Pond station used in this report is only to maintain consistency compared to Bridge and Plant Discharge stations downstream. Equipment at Big Pond station was actually deployed on December 6, 2018 and remained deployed under the ice for the duration of the winter. The deployment interval for Big Pond will end once ice cover at Big Pond allows for removal.
- A turbidity sensor failure at Rattling Brook below Bridge required a mid-deployment switch of equipment on January 30, 2019.
- 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.

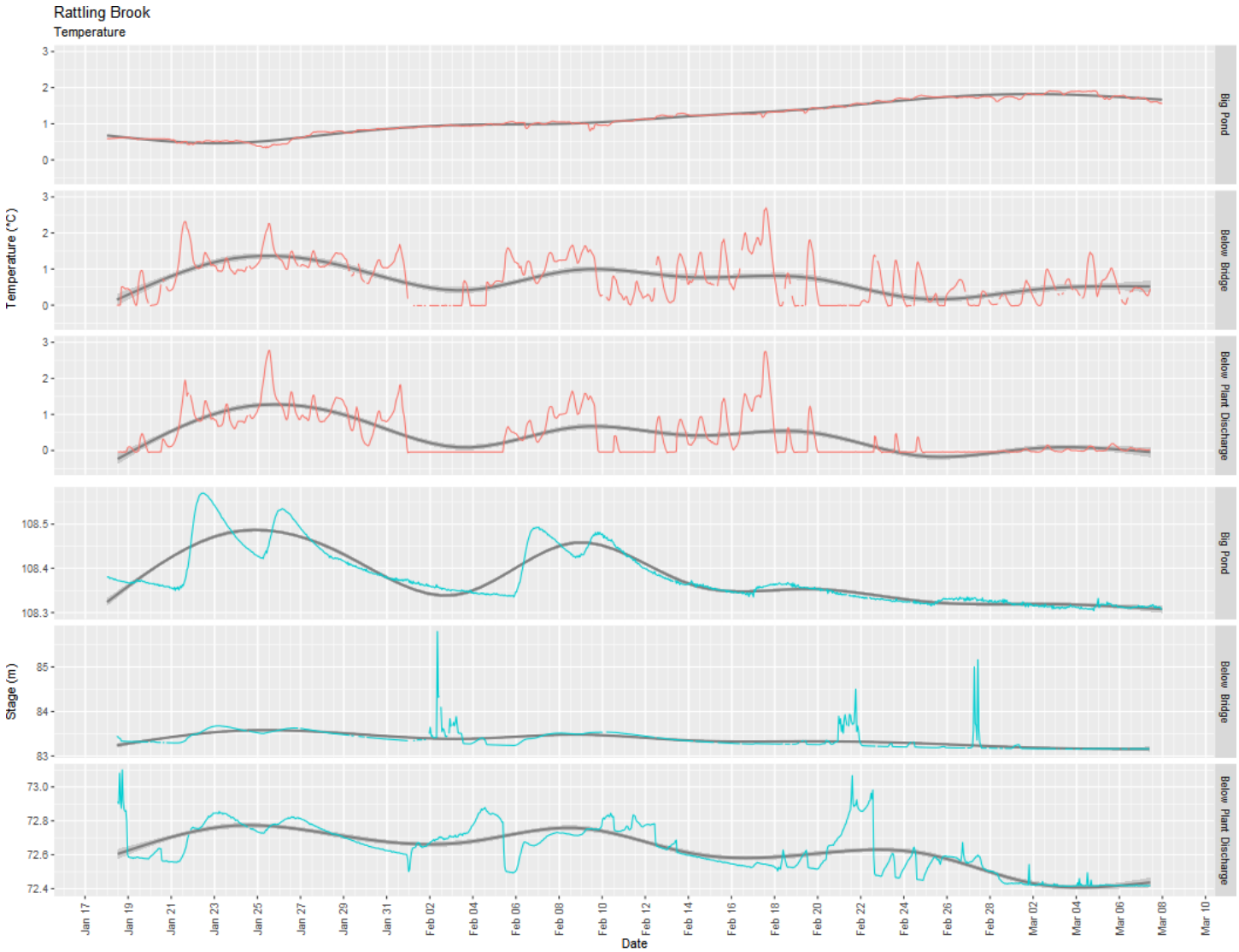
Table 1: Qualitative QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	December 6, 2018	Deployment	Excellent	Excellent	Excellent	NA	Excellent
	-	Ongoing	NA	NA	NA	NA	NA
Rattling Brook below Bridge	January 18, 2019	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	March 7, 2019	Removal	Excellent	Good	Good	Excellent	Marginal
Rattling Brook below Plant Discharge	January 18, 2019	Deployment	Excellent	Excellent	Excellent	Good	Marginal
	March 7, 2019	Removal	Excellent	Fair	Good	Fair	Good

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	1.16	1.08	0.33	1.91
Below Bridge	0.71	0.65	-0.04	2.70
Below Plant Discharge	0.41	0.06	-0.07	2.78

- Water temperatures at Big Pond station differed substantially from those observed downstream at Bridge and Plant Discharge stations. Trend lines show a general increase in water temperature at Big Pond station from mid-January to March whereas trend lines show a decrease at downstream stations. This difference is likely due to the degree of ice cover providing insulation from cold air temperatures at Big Pond station.

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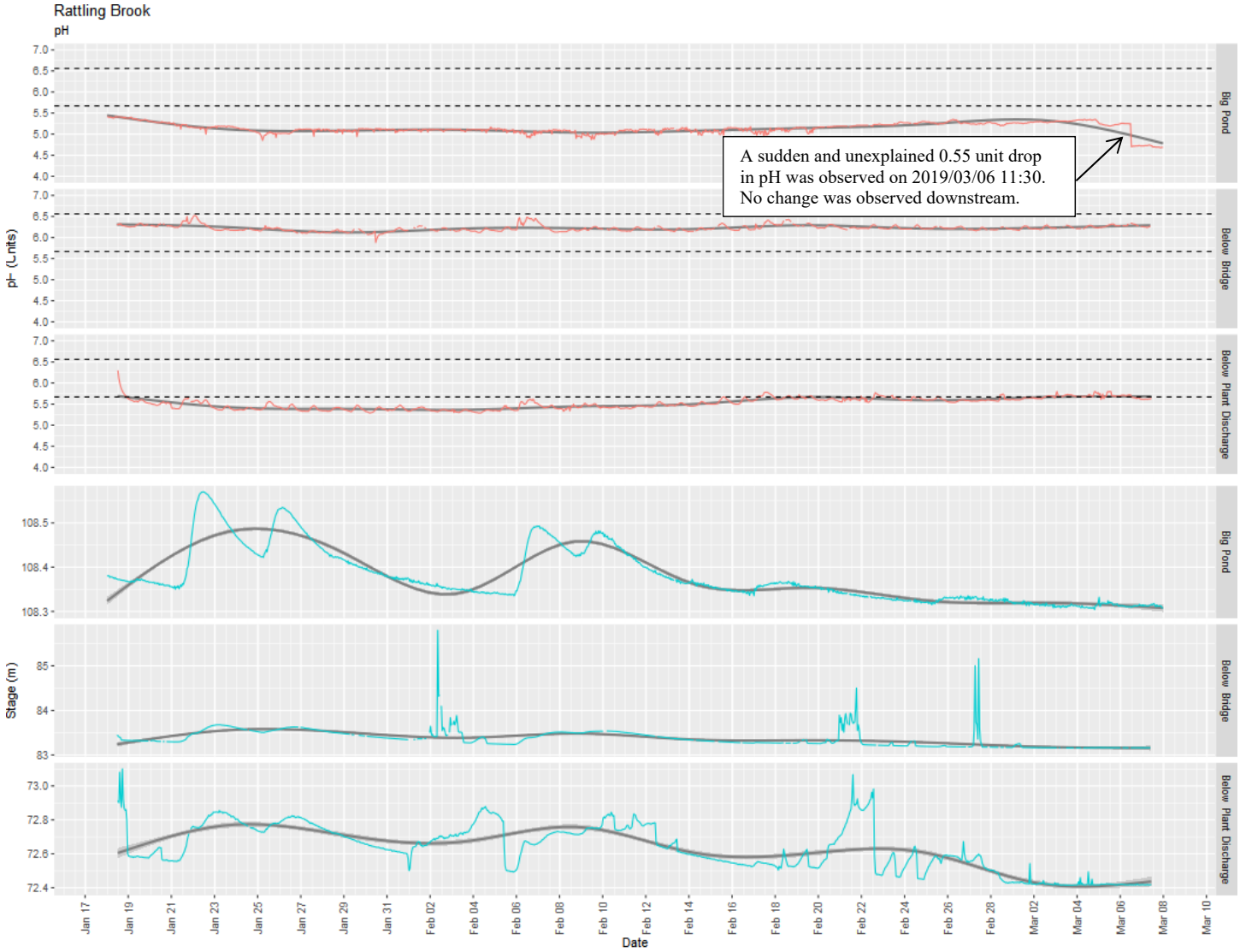
pH

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	5.14	5.12	4.68	5.42
Below Bridge	6.22	6.21	5.88	6.52
Below Plant Discharge	5.52	5.52	5.29	6.30

- pH values tend to show stability during the winter season that is not observed during spring, summer, and fall. Key differences are the decrease in biological activity during winter and the reduced volume of freshwater entering the river system as runoff.
- Most pH values fell below site-specific guidelines at Big Pond and Plant Discharge stations whereas most were within site-specific guidelines at Bridge station.

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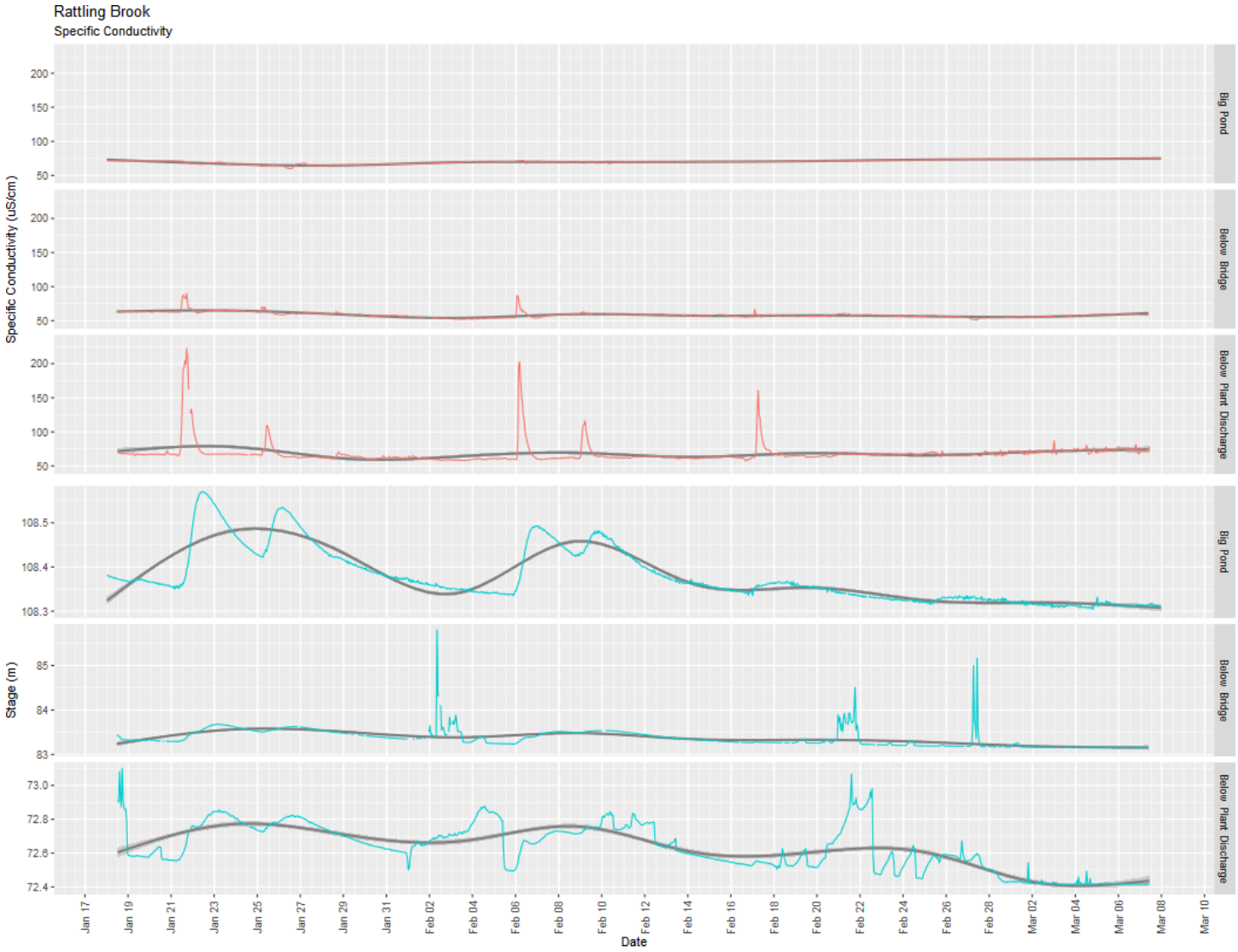
Specific Conductivity

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.



Station	Mean	Median	Min	Max
Big Pond	70.3	70.4	60.1	75.3
Below Bridge	58.6	58.0	51.0	90.0
Below Plant Discharge	68.3	65.5	57.5	222.0

- Specific conductivity at Big Pond station was very stable from January to March. Bridge station was found to be slightly lower in conductivity with a presence of conductivity events that were absent at Big Pond station (an effect of ice cover). The largest conductivity events were seen at Plant Discharge station due to the cumulative effect of dissolved solids entering Rattling Brook along the length of the river.

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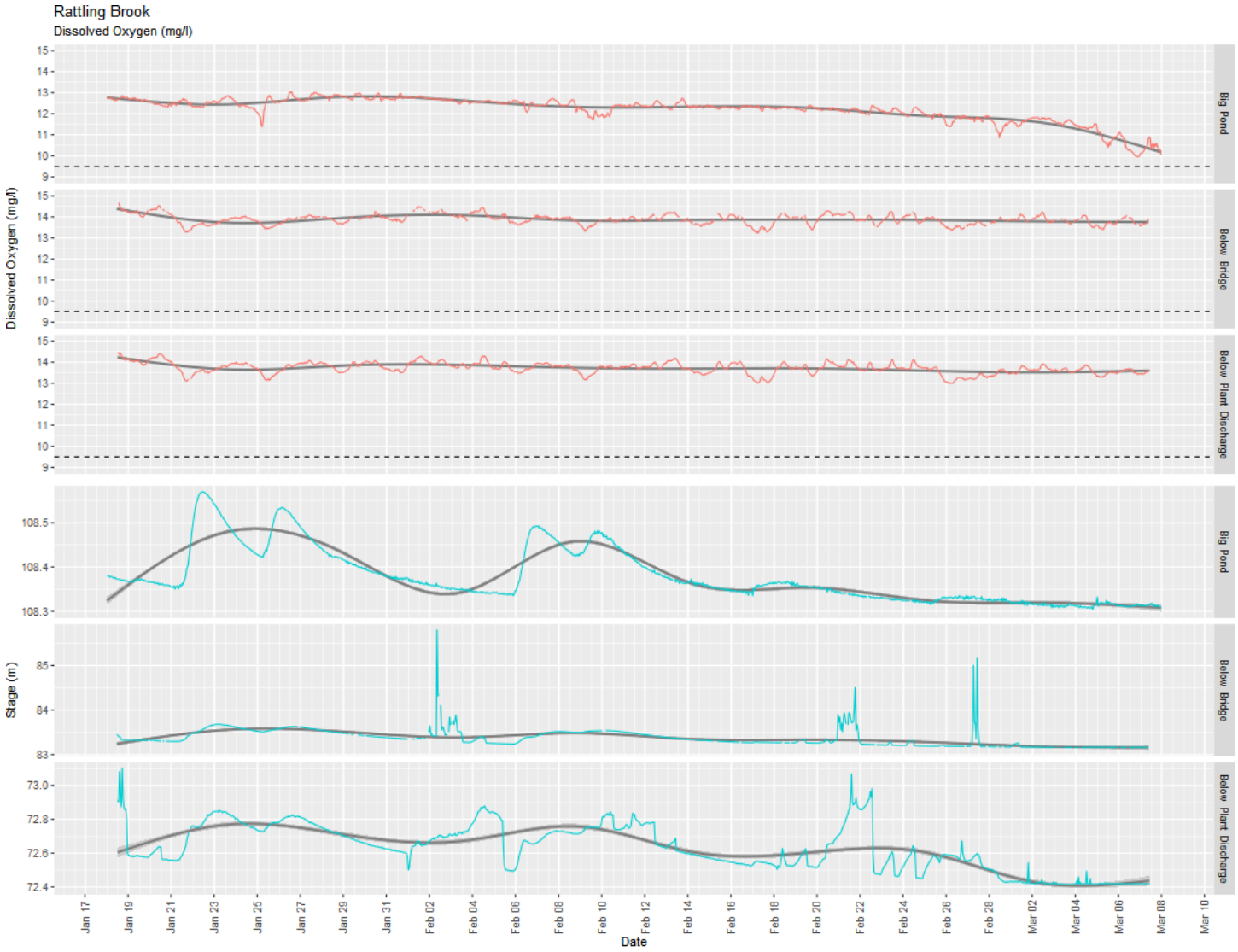
Dissolved Oxygen

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.



Station	Mean	Median	Min	Max
Big Pond	12.20	12.34	9.95	13.05
Below Bridge	13.88	13.90	13.23	14.73
Below Plant Discharge	13.72	13.72	12.99	14.44

- Ice cover prevents the exchange of dissolved gasses with the atmosphere. As a result, dissolved oxygen is slowly consumed at Big Pond station through biological processes and inorganic oxidation reactions. At Bridge and Plant Discharge stations, dissolved oxygen is not depleted – gas is exchanged as water passes over falls and riffles.

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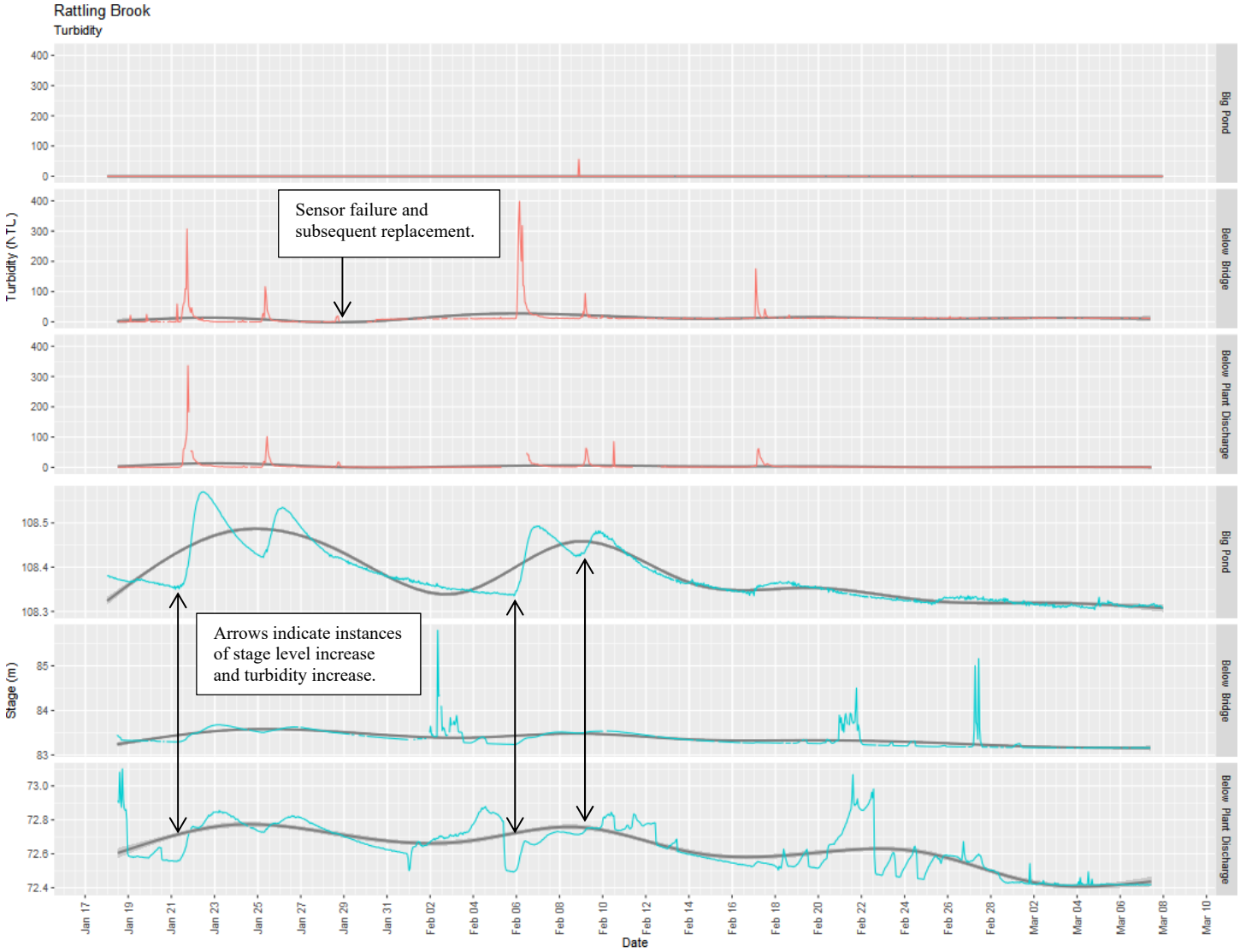
Turbidity

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	56.2
Below Bridge	13.1	11.2	0.0	398.0
Below Plant Discharge	3.6	1.0	0.3	335.8

- Turbidity at Big Pond station was low and showed very little variation during this deployment period due to complete ice cover. The lack of complete ice cover downstream at Bridge and Plant Discharge stations allowed for influence from precipitation and silt deposition into the river. As a result, variability was notable, especially during stage level changes.

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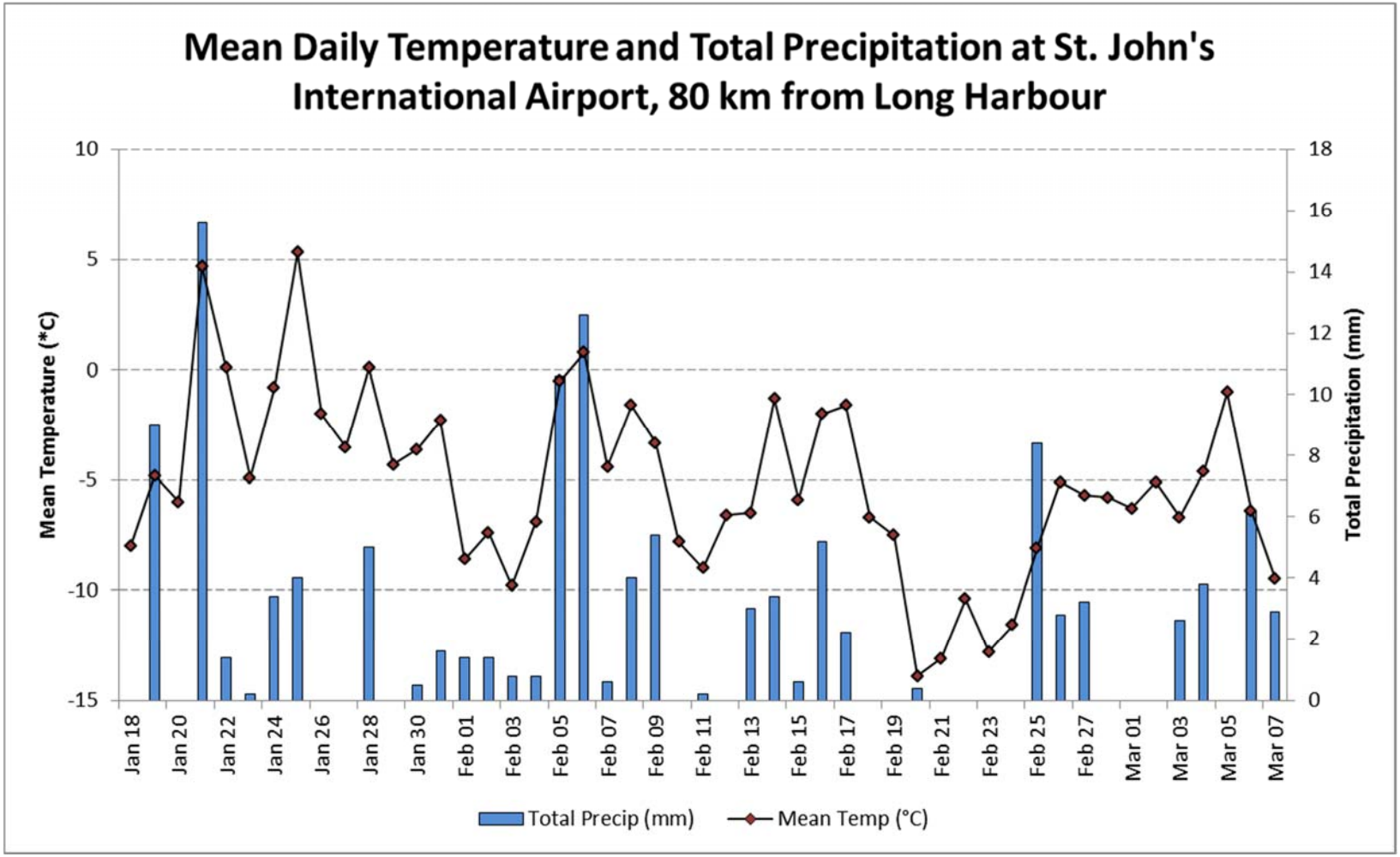
Appendix


Mean Daily Temperature and Total Precipitation at St. John's International Airport, 80 km from Long Harbour
Mean Temperature (*C)
Total Precipitation (mm)
10
5
0
-5
-10
-15
18
16
14
12
10
8
6
4
2
0
Jan 18
Jan 20
Jan 22
Jan 24
Jan 26
Jan 28
Jan 30
Feb 01
Feb 03
Feb 05
Feb 07
Feb 09
Feb 11
Feb 13
Feb 15
Feb 17
Feb 19
Feb 21
Feb 23
Feb 25
Feb 27
Mar 01
Mar 03
Mar 05
Mar 07
Total Precip (mm)
Mean Temp (°C)