Real-Time Water Quality Deployment Report

Rattling Brook Network

January 26, 2018 to March 15, 2018

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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2018-01-26 to 2018-03-15

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Due to potential damage resulting from the breakup of ice coverage instrumentation has typically been removed from Big Pond station in January. However, a substantial increase in water level due to the construction of a flow control structure at the outlet of Big Pond has had a calming effect on wave action where equipment typically sits. Going forward, equipment will remain in Big Pond over the winter, despite ice. Consequently, the deployment period being presented for Big Pond is a continuation of the previous deployment starting on December 15, 2017.
- 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

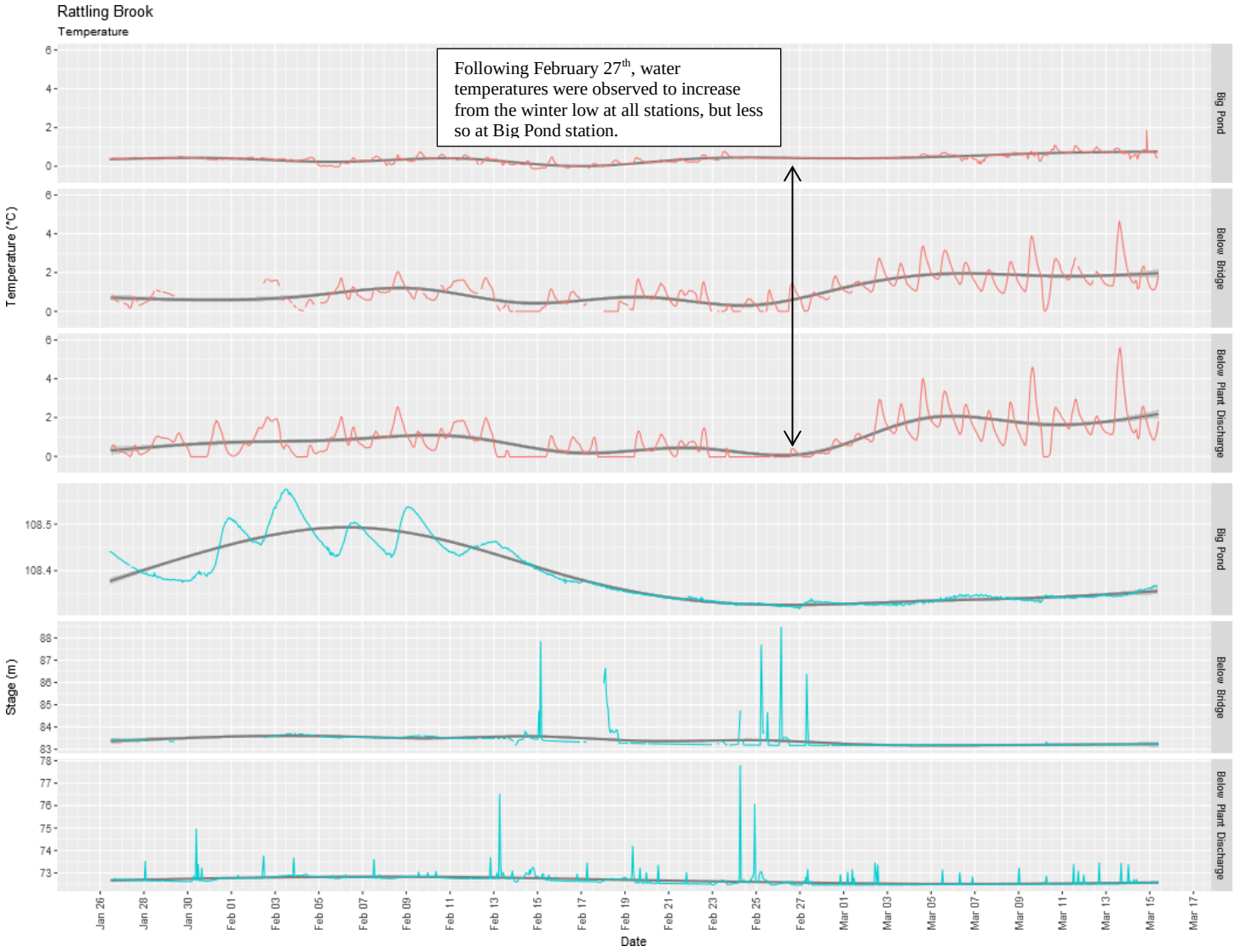
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	*December 15, 2017*	Continuation	NA	NA	NA	NA	NA
	March 15, 2018	Removal	Good	Good	Marginal	Marginal	Excellent
Rattling Brook below Bridge	January 26, 2018	Deployment	Excellent	Excellent	Good	Excellent	Excellent
	March 15, 2018	Removal	Excellent	Good	Excellent	Good	Poor
Rattling Brook below Plant Discharge	January 26, 2018	Deployment	Excellent	Fair	Good	Good	Excellent
	March 15, 2018	Removal	Excellent	Marginal	Excellent	Good	Poor

- "Poor" rankings were recorded at Bridge and Plant Discharge stations during removal on March 15, 2018. Both field sondes recorded values somewhat lower than the QAQC sonde. This may be due to calibration drift over the course of the deployment period.

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	0.40	0.41	-0.13	1.84
Below Bridge	1.09	1.02	-0.02	4.65
Below Plant Discharge	0.91	0.77	-0.04	5.61

- Prior to February 27th, mean air temperatures were less than -5°C. On February 27th, mean air temperatures were close to the freezing point with almost 20 mm of total precipitation. This particular day appears to be the best visual indicator of the end of the coldest winter water temperatures. A general warming trend and diurnal variation are notable at Bridge and Plant Discharge stations after this date.

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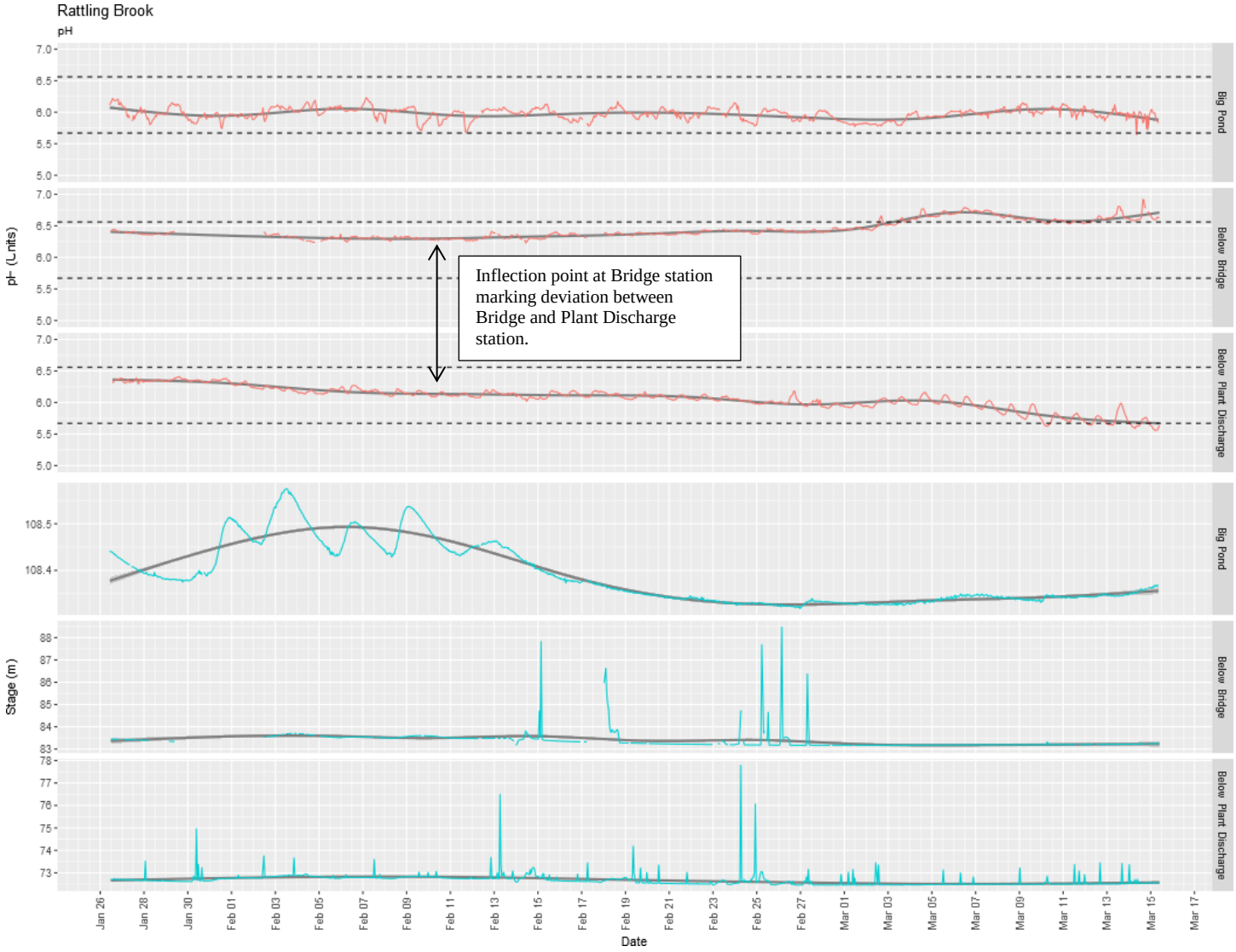
pH

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	5.97	5.98	5.64	6.23
Below Bridge	6.44	6.40	6.23	6.92
Below Plant Discharge	6.07	6.09	5.56	6.41

- Throughout this deployment period, most pH values were found to be within the CCME Guidelines (dashed lines in figure above). Big Pond station was largely stable during the deployment period. Plant Discharge station showed a declining trend over the entire deployment period while Bridge station showed an increasing trend after approximately February 11th when a mean air temperature was >0^{o}C with >10 mm precipitation. This deviation is not uncommon and indicates that some feature between both stations imposes a difference in water quality parameters.

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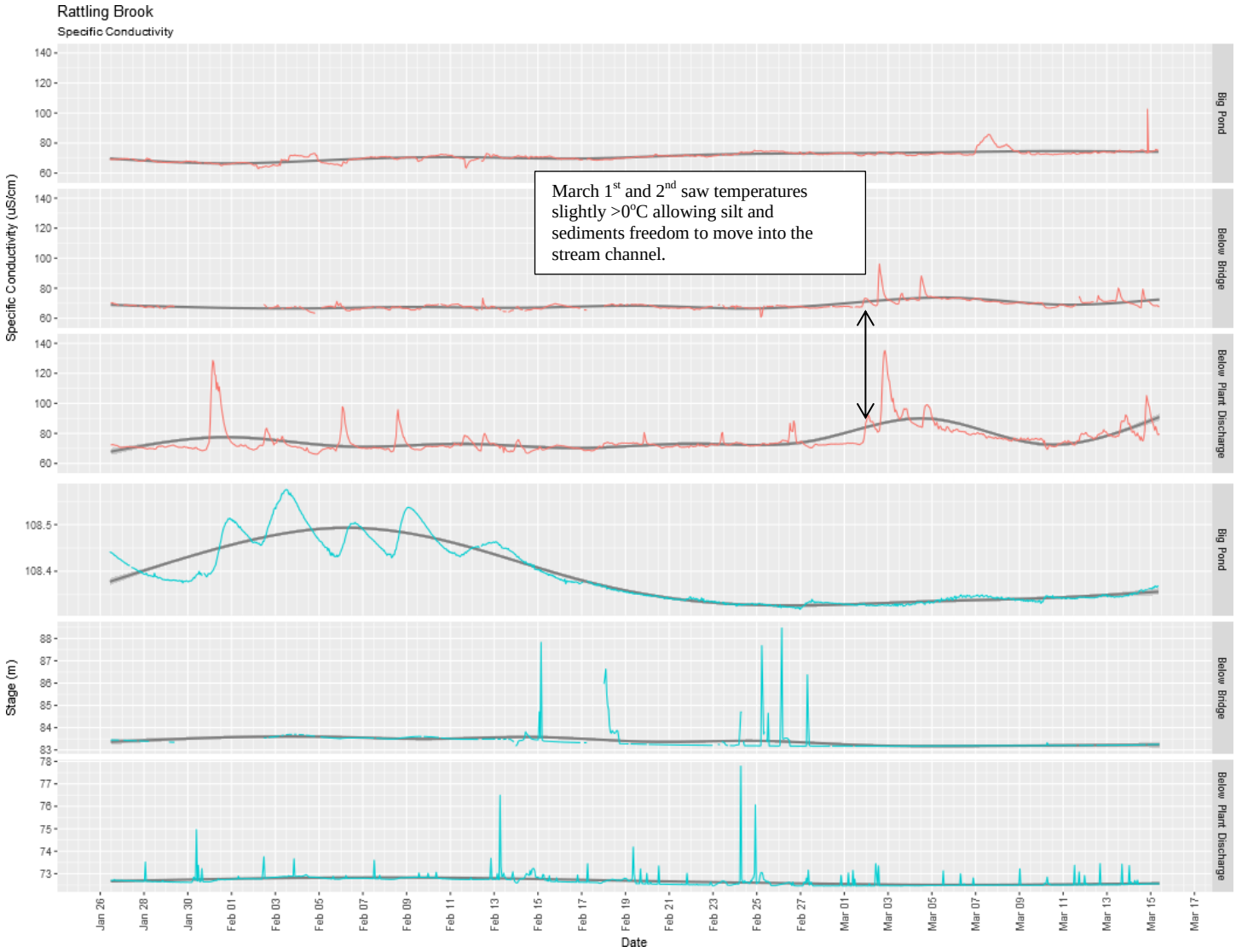
Specific Conductivity

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	62.9	102.6
Below Bridge	68.8	68.0	60.7	96.2
Below Plant Discharge	75.7	72.8	66.2	135.2

- Specific conductivity tends to increase with distance along the river channel due to additive amounts of dissolved solids along the river course. This characteristic bears true where little variability in conductivity is seen at Big Pond but notable variability is observed at Plant Discharge station. The exaggerated difference in conductivity levels between Bridge and Plant Discharge station is likely related to effluent from storm water settling ponds.

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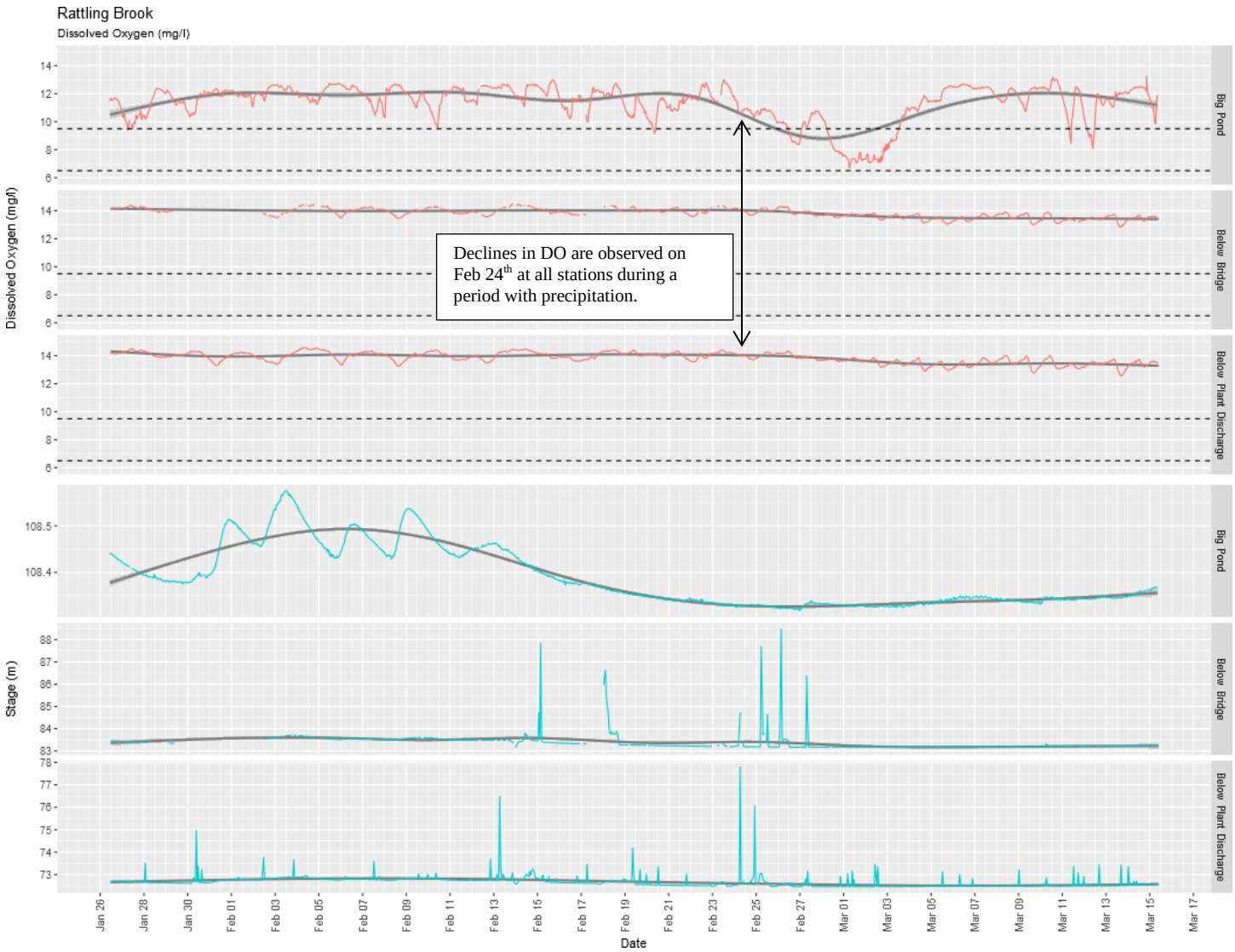
Dissolved Oxygen

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	11.33	11.70	6.70	13.25
Below Bridge	13.82	13.83	12.83	14.47
Below Plant Discharge	13.85	13.88	12.53	14.59

- Dissolved oxygen values were above CCME guidelines for the protection of cold water biota at Bridge and Plant Discharge stations. Big Pond station, however, showed a notable decline almost as low as the lower-level guidelines of 6.5 mg/l. This is likely due to the limited exposure to the atmosphere because of total ice coverage at that time. Dissolved oxygen concentrations recovered after approximately four days.

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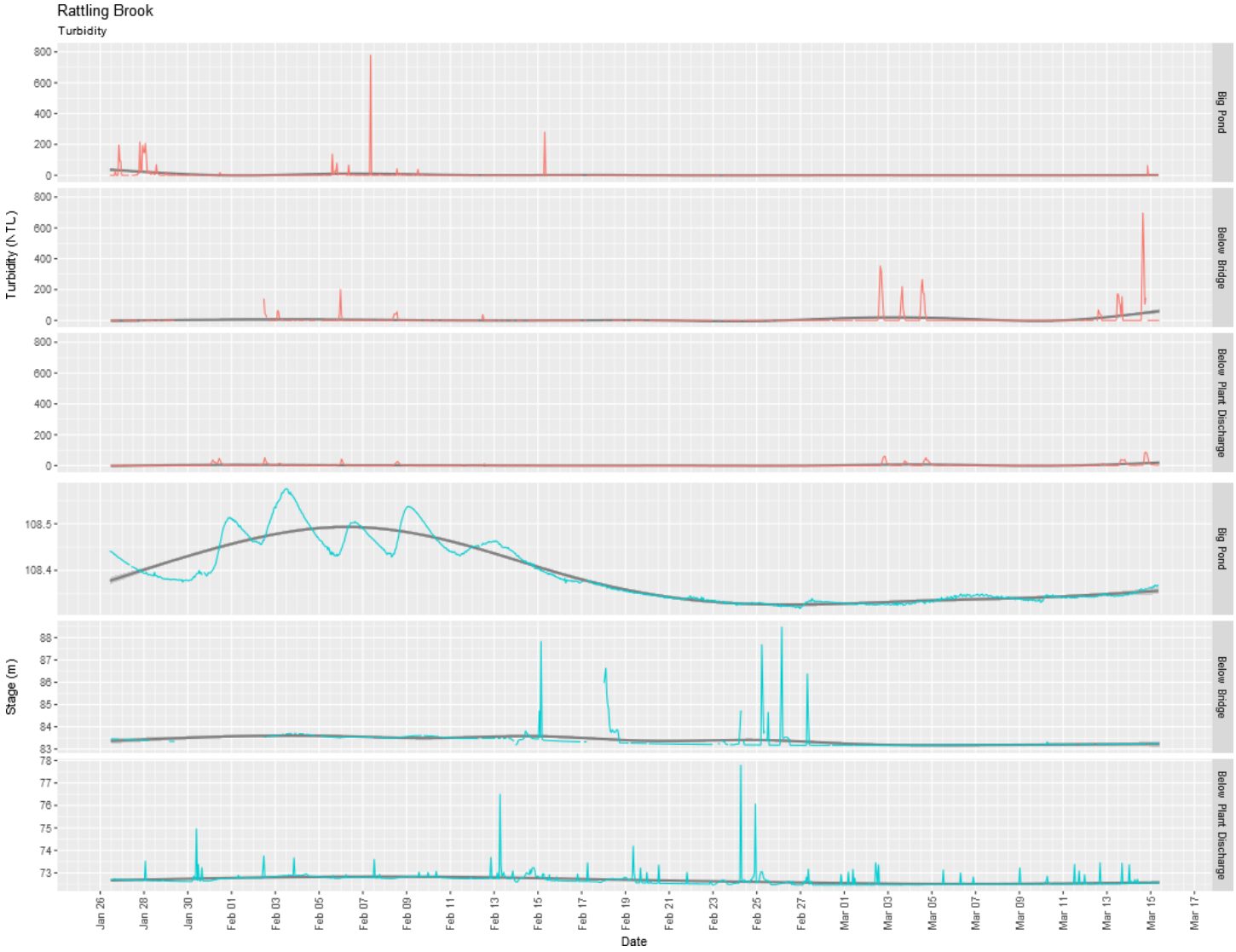
Turbidity

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	3.1	0.0	0.0	779.0
Below Bridge	6.6	0.0	0.0	696.0
Below Plant Discharge	2.6	0.3	0.0	86.9

- Turbidity levels were low for each of the Rattling Brook stations during this deployment period with occasional short term peaks (< 12 hours) – usually in response to unsettled weather and flow changes. Median turbidity levels were less than 1 NTU at Big Pond and Bridge stations with slightly higher levels at Plant Discharge station.

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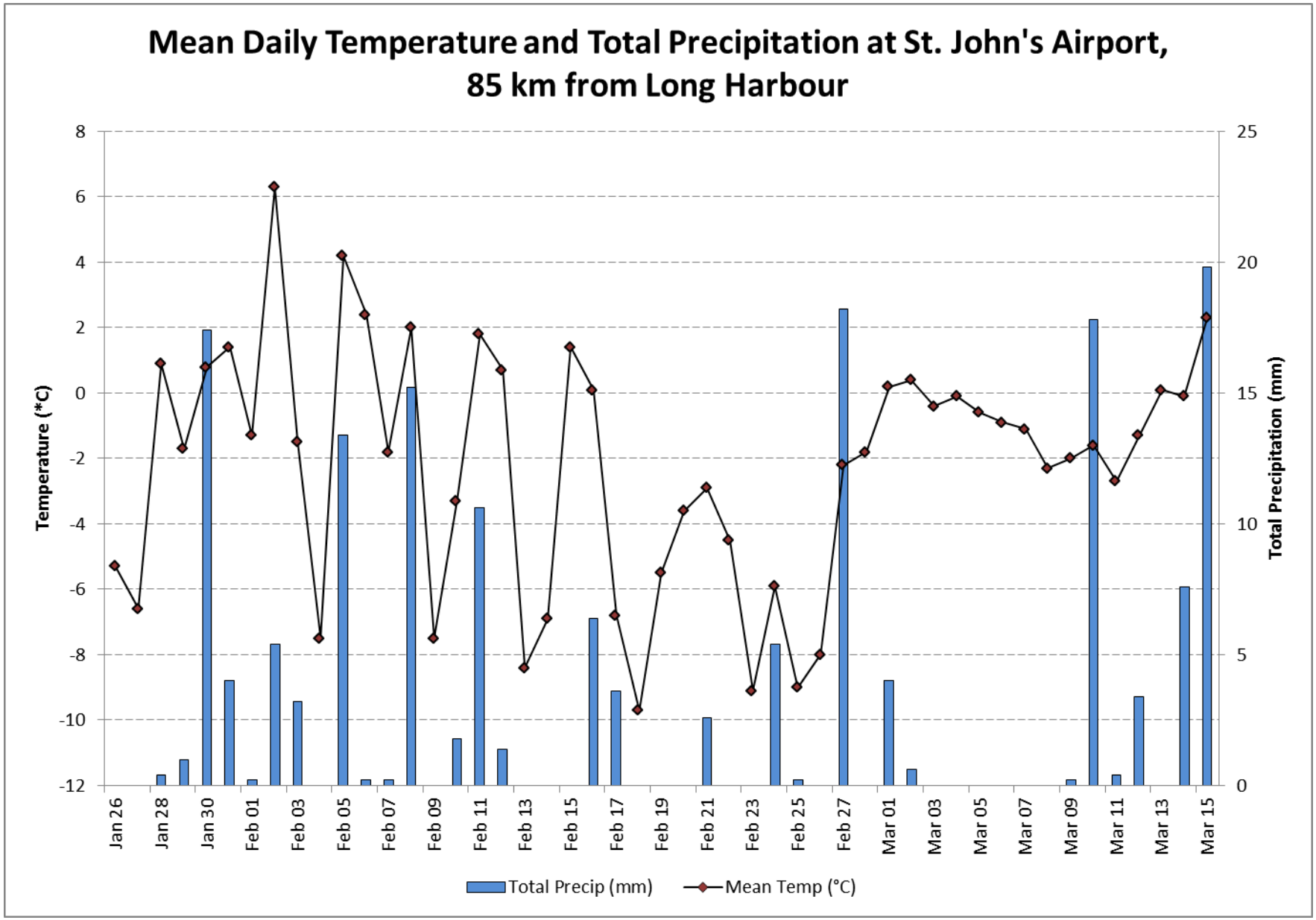
Appendix


Mean Daily Temperature and Total Precipitation at St. John's Airport, 85 km from Long Harbour
Temperature (*C)
Total Precipitation (mm)
8
6
4
2
0
-2
-4
-6
-8
-10
-12
25
20
15
10
5
0
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
Mar 09
Mar 11
Mar 13
Mar 15
Total Precip (mm)
Mean Temp (°C)