Real-Time Water Quality Deployment Report

Rattling Brook Network

January 12, 2021 to March 9, 2021

Newfoundland Labrador

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

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2021-01-12 to 2021-03-09

General

- Department of Environment, Climate Change and Municipalities 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 (https://wateroffice.ec.gc.ca/index_e.html)*.

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.
    - Note: Big Pond sonde was left deployed in March as ice conditions didn't allow for a switch out.
    - Note: Plant Discharge station went offline Feb 8th due to battery issues and was back online on Feb 12th. The data for this time period was populated from the sonde's internal log file.

Table 1: Qualitative QAQC Ranking

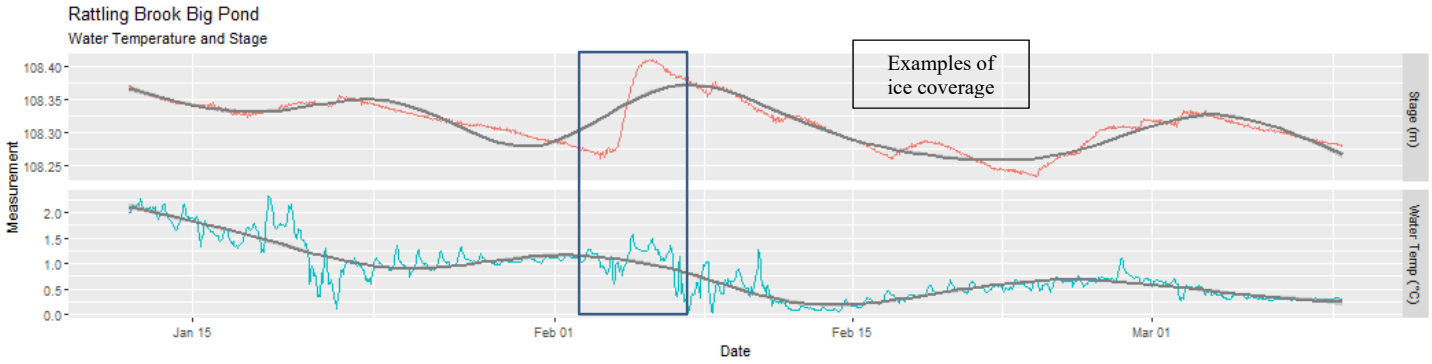
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	January 12	Deployment	Good	Fair	Poor	Excellent	Excellent
		Continuous	N/A	N/A	N/A	N/A	N/A
Rattling Brook below Bridge	January 12	Deployment	Good	Excellent	Good	Good	Excellent
	March 9	Removal	Good	Excellent	Good	Fair	Excellent
Rattling Brook below Plant Discharge	January 12	Deployment	Excellent	Excellent	Good	Good	Excellent
	March 9	Removal	Excellent	Good	Fair	Fair	Excellent

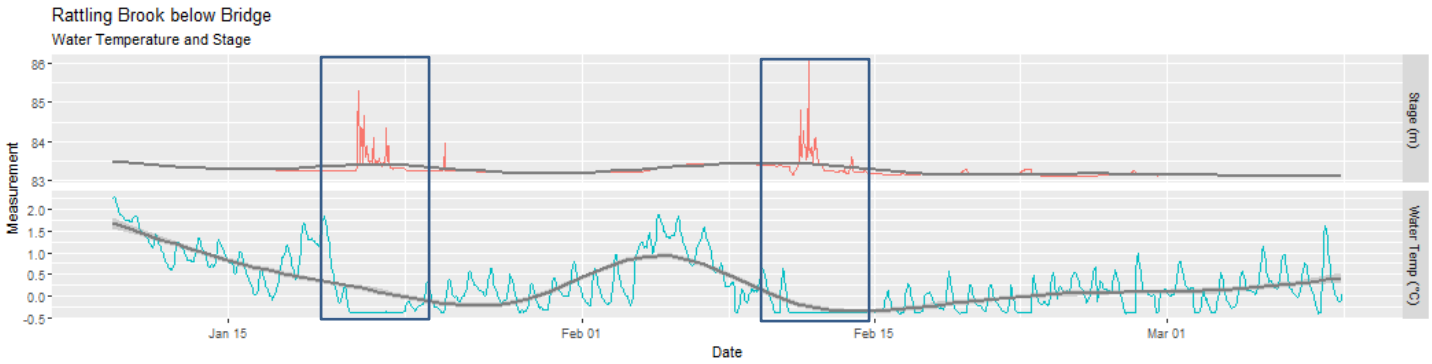
- The Big Pond Conductivity sensor ranked 'Poor' during deployment. The field sonde read 58.9 while the QA/QC sonde read 109.5 (µS/cm). This 'Poor' ranking is possibly a result of the location of the QA/QC sonde deployed in a disturbed area where sediment suspended into the water column.

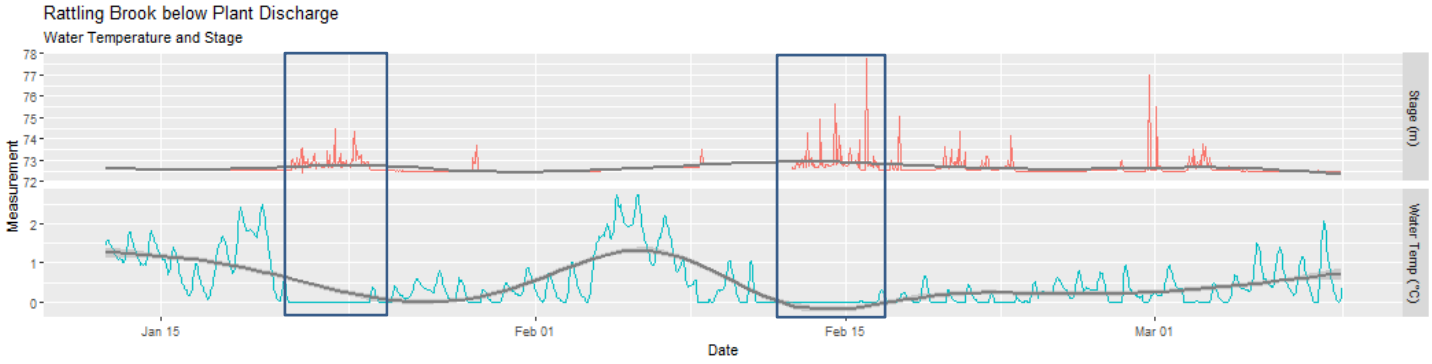
- Data Interpretation

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	Max	Min	Median	Mean
Big Pond	2.32	0.03	0.68	0.82
Below Bridge	2.28	-0.41	0.11	0.26
Below Plant Discharge	2.75	-0.03	0.23	0.47

- Trend lines show that water temperatures plateaued with the exception of a warm weather and rain event in early February.
- Stage fluctuations at Bridge and Plant Discharge stations are caused by ice dam conditions where water level rises before the subsequent release as ice collapses or melts.

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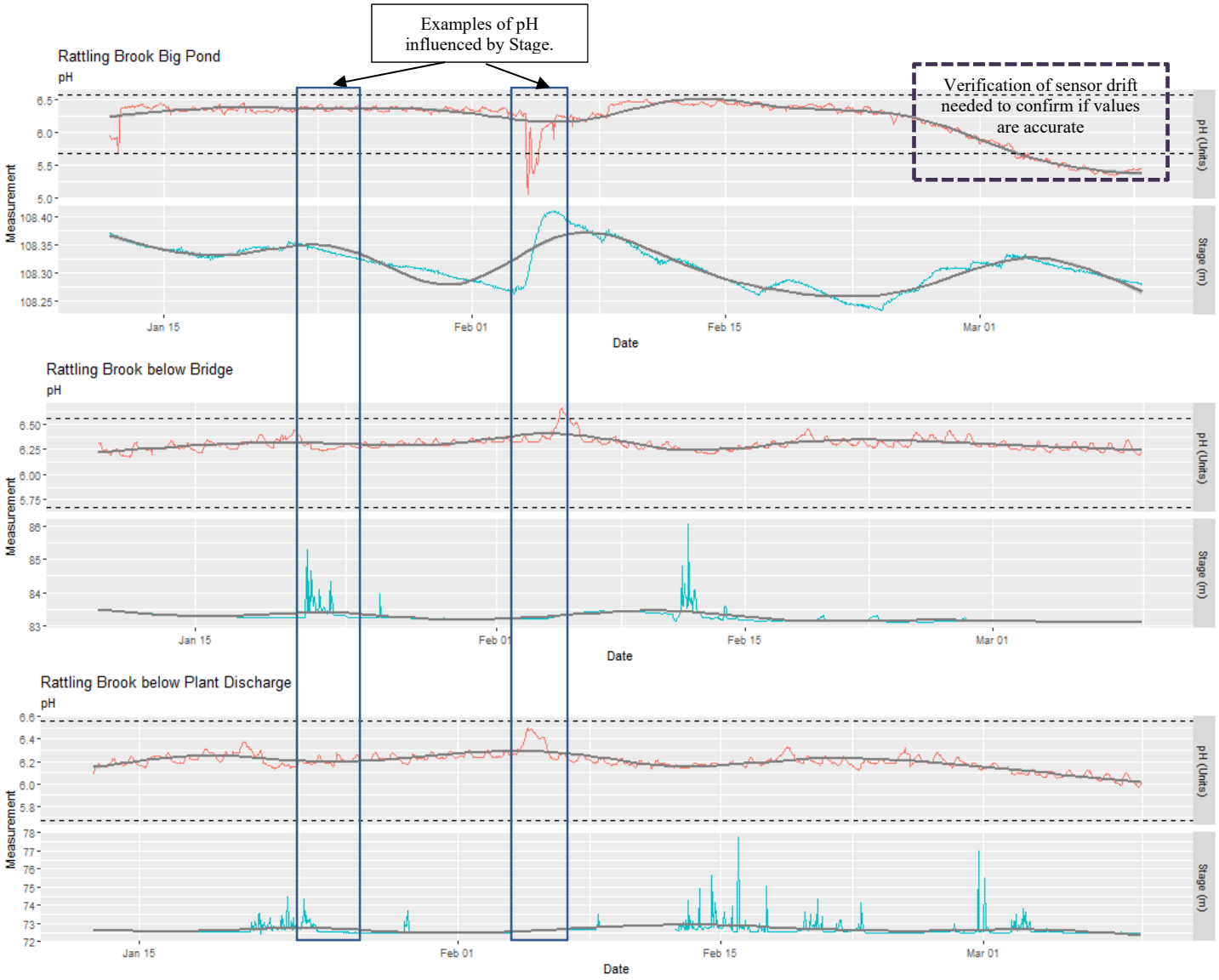
pH

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.



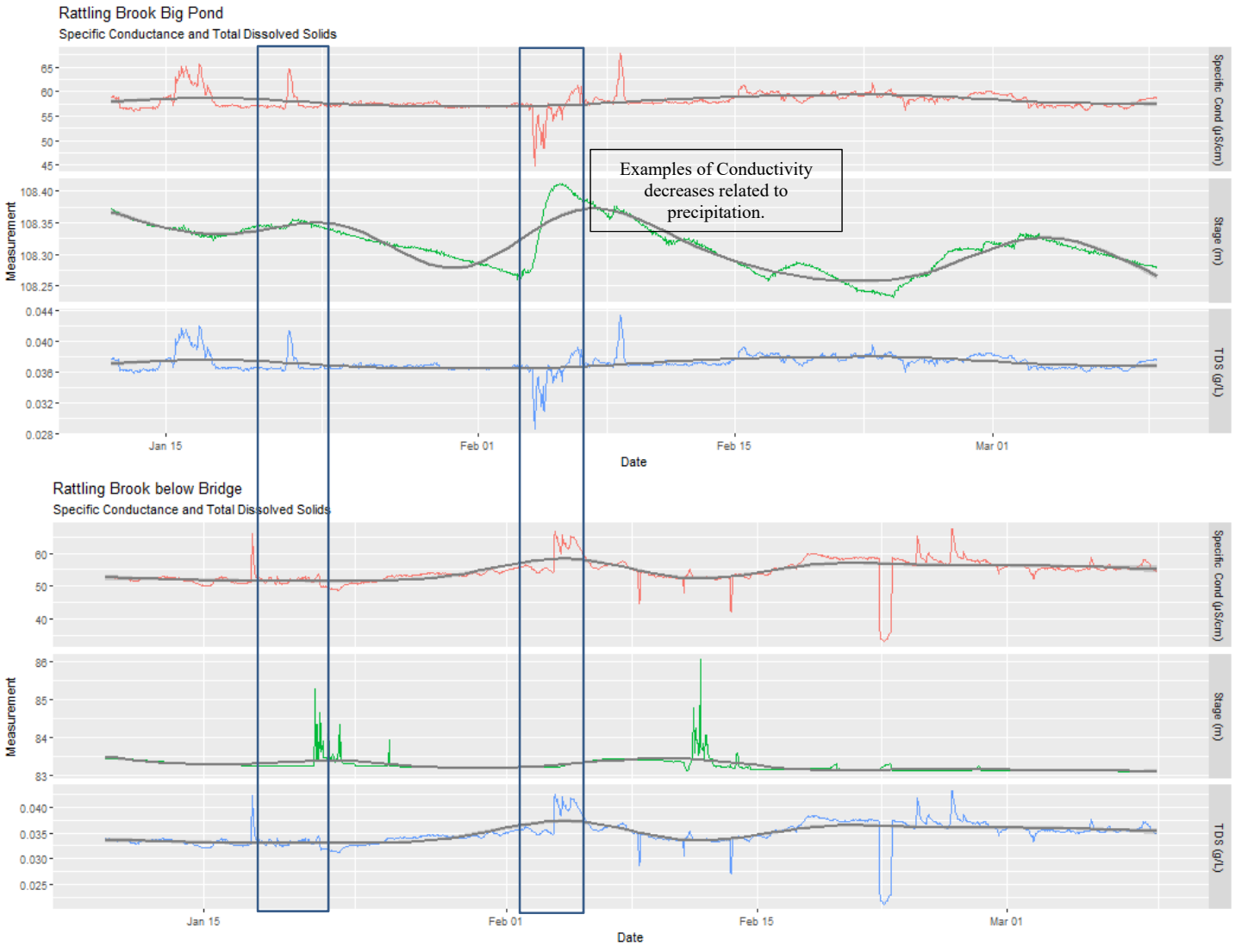
Station	Max	Min	Median	Mean
Big Pond	6.49	5.05	6.33	6.19
Below Bridge	6.66	6.17	6.30	6.30
Below Plant Discharge	6.50	5.97	6.20	6.20

- Bridge and Plant Discharge station pH values were consistent over the deployment period. The majority of values were within the site-specific guidelines (5.67-6.56 pH Units). Big Pond has a rapidly decreasing trend since Feb 25th. When ice conditions allow, a freshly calibrated instrument will be deployed to

determine if the observed trend is sensor drift due to the long deployment period. Data has been retained as an indication of change during the deployment.

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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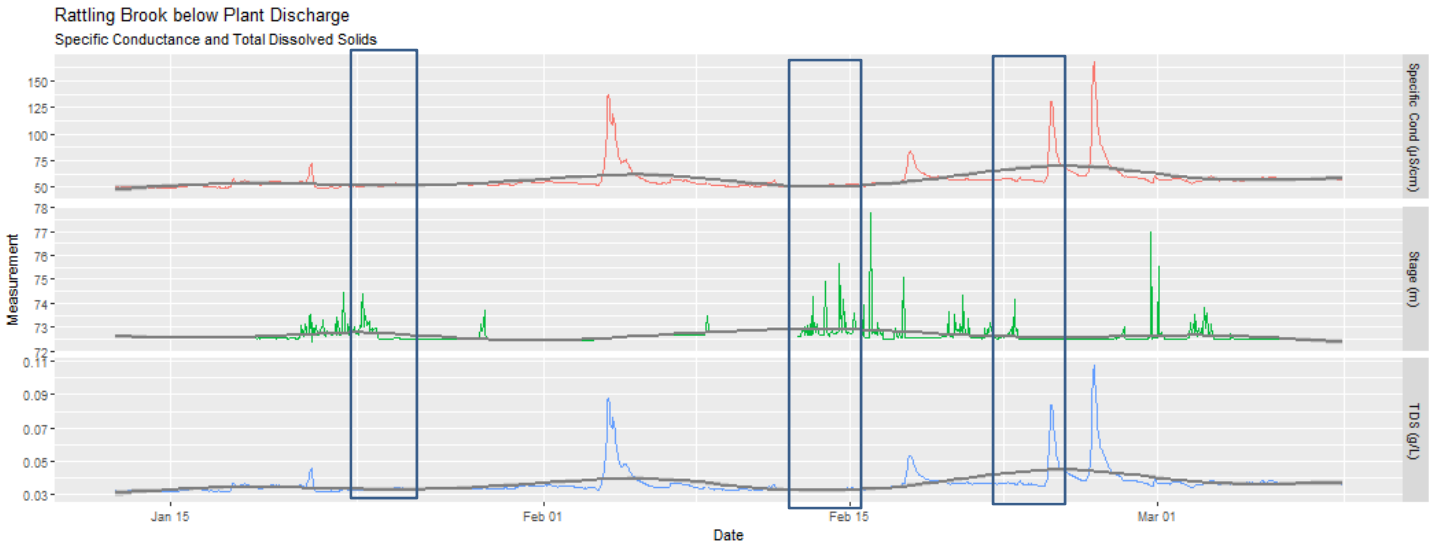

Station	Max	Min	Median	Mean
Big Pond	67.9	44.8	57.8	58.1
Below Bridge	67.5	33.1	54.1	54.5
Below Plant Discharge	168.3	49.0	54.4	57.0

- During the deployment period, specific conductivity ranged from 44.8µs/cm to 67.9µs/cm at Big Pond, 33.1µs/cm to 67.5µs/cm at Below Bridge and from 49.0µs/cm to 168.3µs/cm at Plant Discharge.
- Specific conductivity was relatively stable at all stations during this deployment period with few fluctuations due to variations in Stage caused by precipitation or snow melt.

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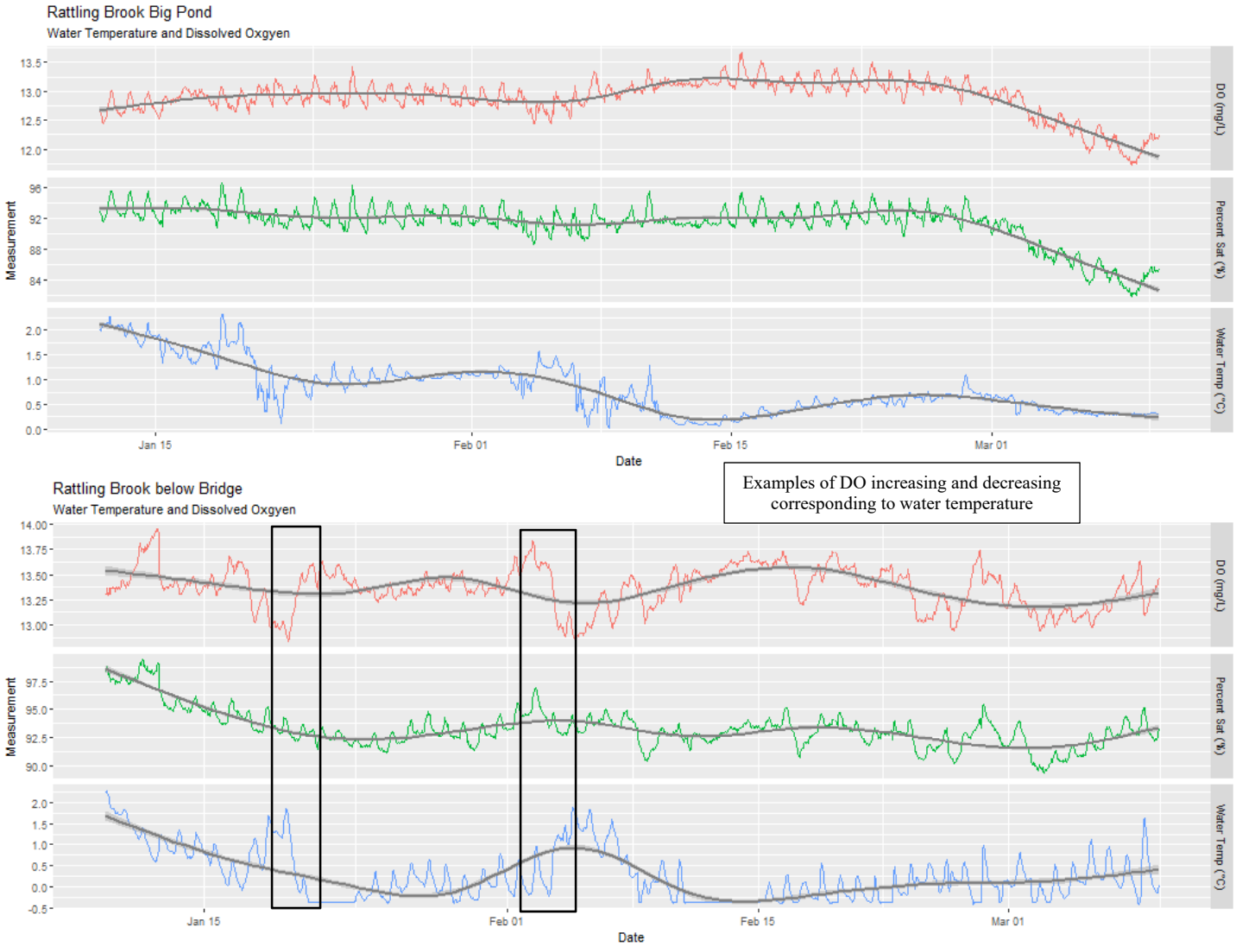
Dissolved Oxygen

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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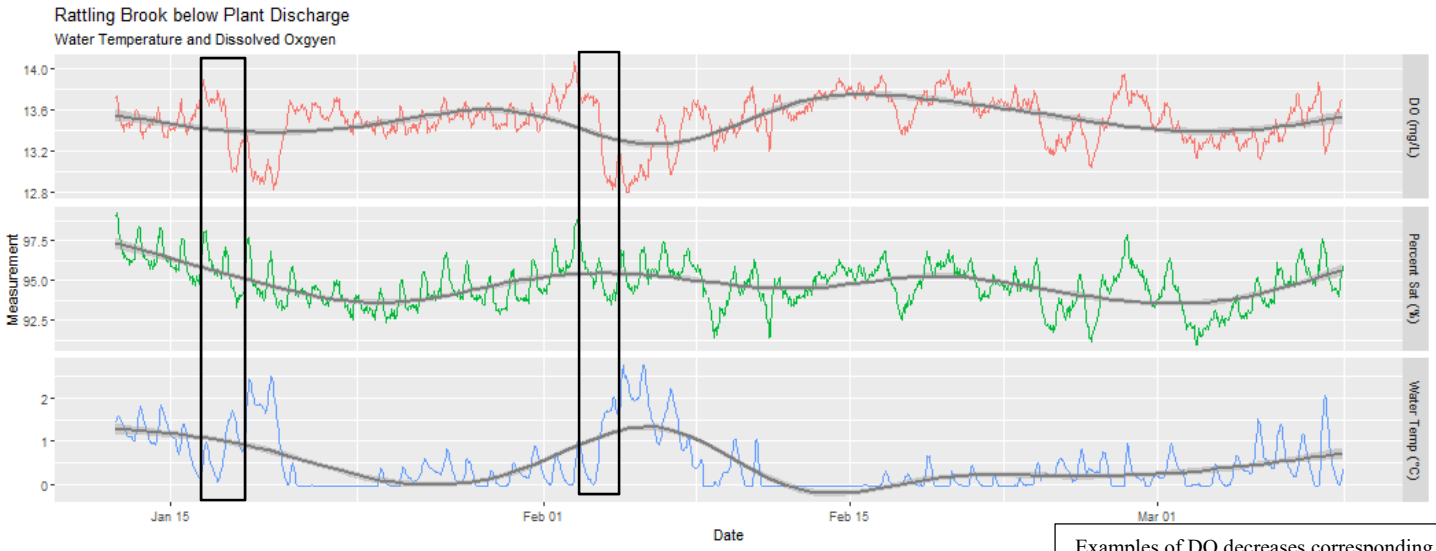

Examples of DO decreases corresponding to water temperature increases.

Station	Max	Min	Median	Mean
Big Pond	13.68	11.72	12.96	12.89
Below Bridge	13.96	12.83	13.39	13.37
Below Plant Discharge	14.07	12.79	13.52	13.50

- As expected, cooler water temperatures caused higher dissolved oxygen concentrations since last deployment. Big Pond station showed a notable decline since late February, this is likely due to the limited exposure to the atmosphere due to ice coverage.
- During this deployment period, all values remained above the minimum CCME Aquatic Guideline for other life stages (6.5 mg/l) and for cold water biota (9.5 mg/l).

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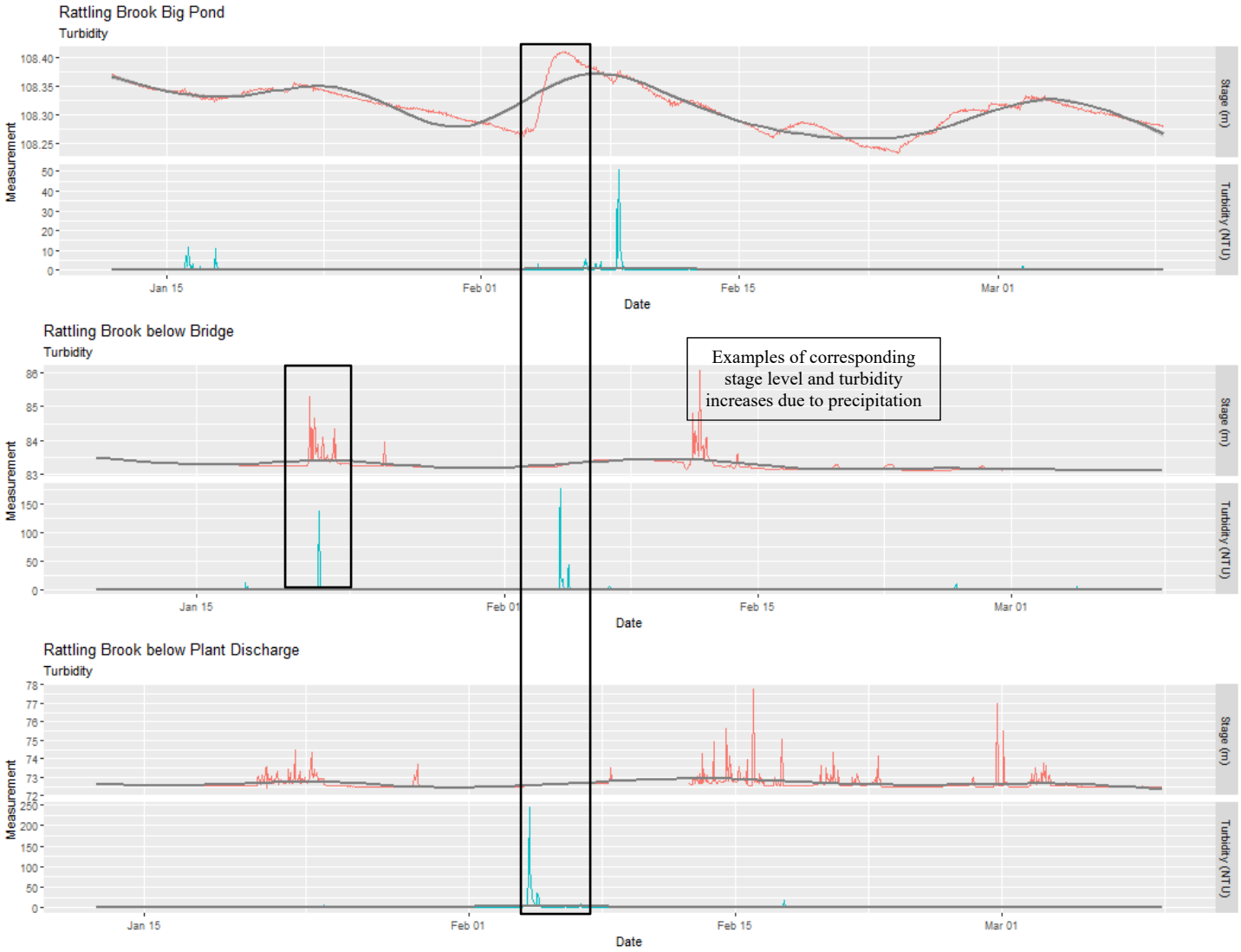
Turbidity

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	Max	Min	Median	Mean
Big Pond	50.8	0.0	0.0	0.2
Below Bridge	177.1	0.0	0.0	0.5
Below Plant Discharge	243.8	0.0	0.0	0.6

- During the deployment period, turbidity values ranged from 0.0 NTU to 50.8 NTU at Big Pond, 0.0 NTU to 177.1 NTU at Below Bridge and from 0.0 NTU to 243.8 NTU at Plant Discharge.
- Most turbidity peaks are associated with precipitation events and stage level increases.

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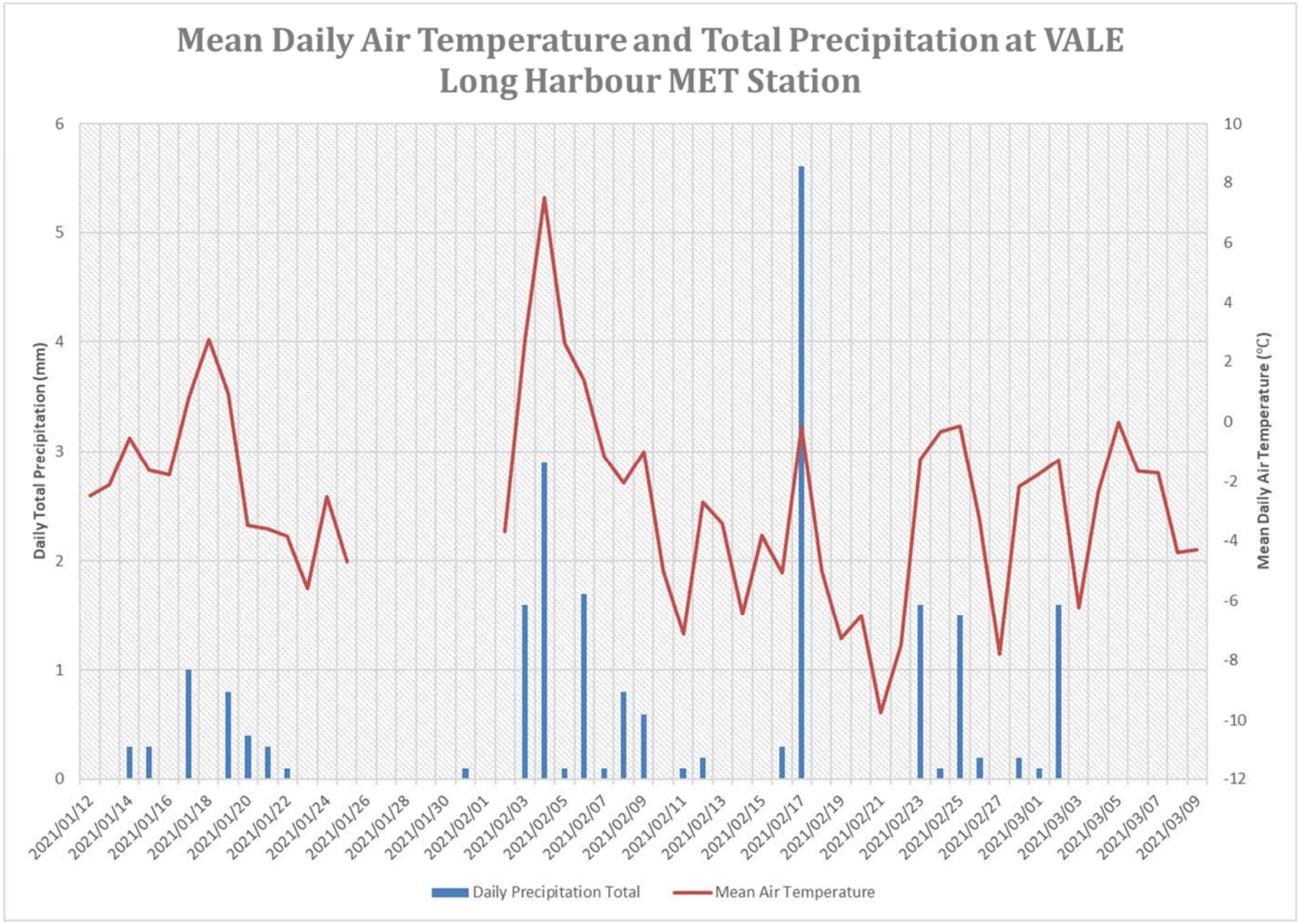
Appendix


Mean Daily Air Temperature and Total Precipitation at VALE Long Harbour MET Station
Daily Total Precipitation (mm)
Mean Daily Air Temperature (°C)
Daily Precipitation Total
Mean Air Temperature