Real-Time Water Quality Deployment Report

Rattling Brook Network

December 10, 2015 to January 22, 2016

Newfoundland Labrador

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

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General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Due to ice conditions, monitoring activities at Big Pond have been temporarily suspended. Monitoring is expected to resume in the spring (as early as late April).
- 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

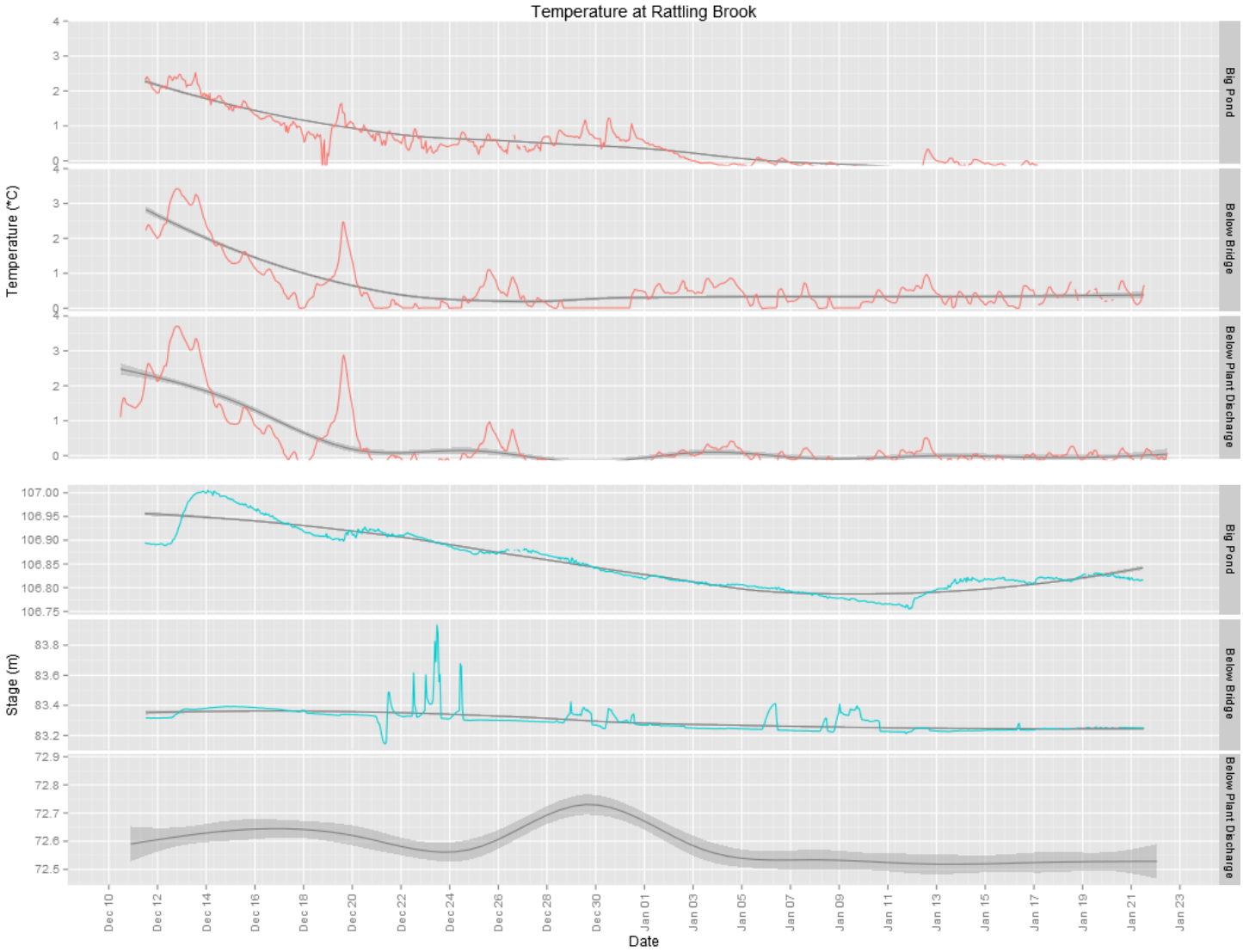
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	December 11, 2015	Deployment	Poor	Fair	Poor	Excellent	Excellent
	January 21, 2016	Removal	Excellent	Excellent	Excellent	Good	Good
Rattling Brook below Bridge	December 11, 2015	Deployment	Good	Good	Poor	Good	Excellent
	January 21, 2016	Removal	Good	Excellent	Excellent	Fair	Excellent
Rattling Brook below Plant Discharge	December 10, 2015	Deployment	Good	Excellent	Poor	Poor	Excellent
	January 22, 2016	Removal	Excellent	Excellent	Excellent	Poor	Excellent

- QAQC rankings achieved during Deployment indicated potential problems. However, a significant improvement in rankings at Removal gives a hint that disagreement between the Hydrolab DS5X (Field Sonde) and YSI Exo2 (QAQC Sonde) at Deployment is responsible for unfavorable rankings. While the two models usually agree to a large degree, the differences appear to be substantial enough that they skew QAQC rankings. In the future, QAQC rankings will be performed with like models.

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	0.44	0.31	-0.44	2.53
Below Bridge	0.57	0.37	-0.02	3.42
Below Plant Discharge	0.31	0.00	-0.22	3.71

- By mid-deployment (~December 28th) water temperature was near or occasionally below 0°C (supercooled) at Bridge and Plant Stations. Big Pond station was marginally later to reach its low point, suggesting that ice formation occurred somewhat later.
- Approximately 8" of ice was found at Big Pond station during removal.

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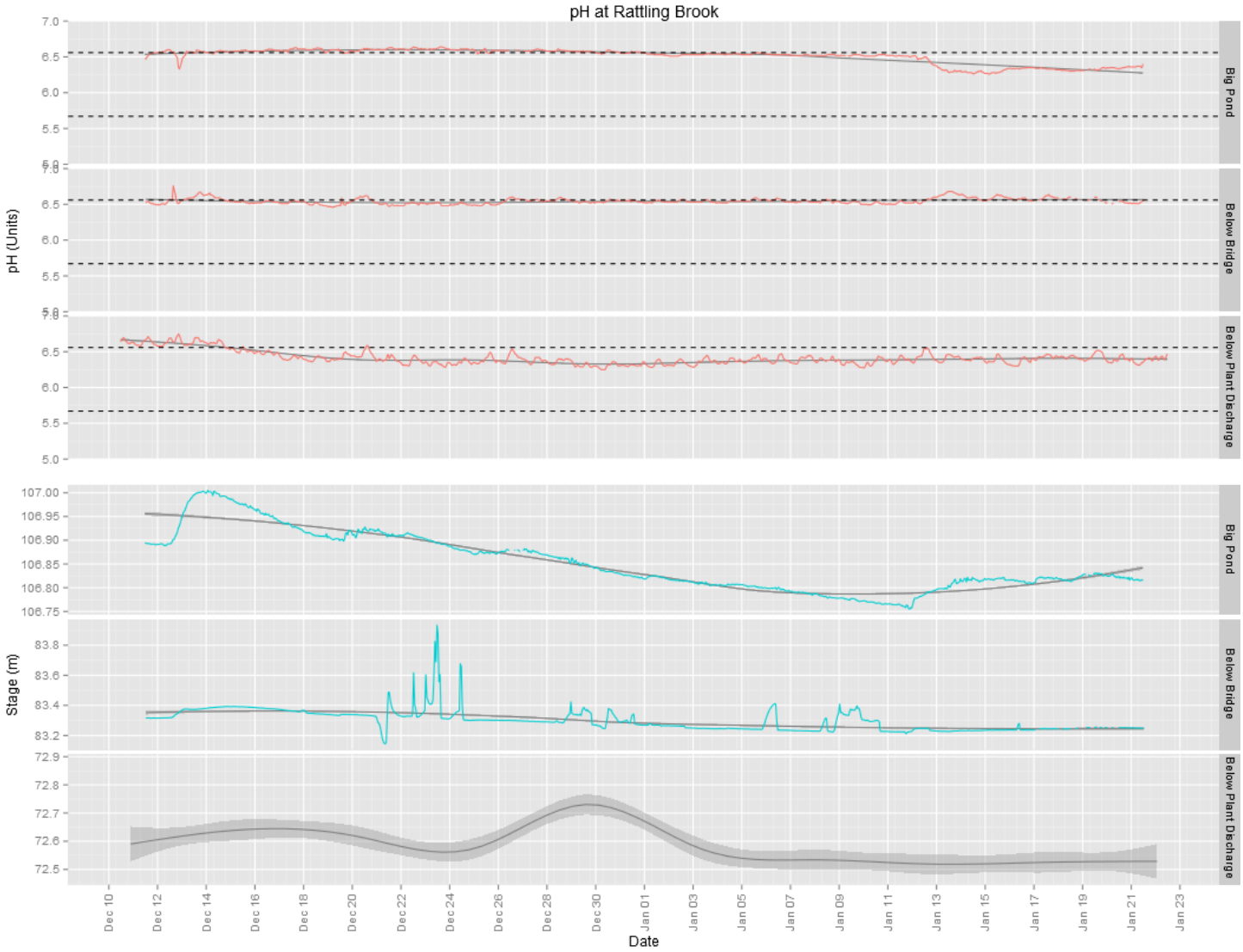
pH

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	6.51	6.54	6.26	6.64
Below Bridge	6.54	6.54	6.46	6.76
Below Plant Discharge	6.41	6.39	6.25	6.75

- pH levels hovered near the top of the Site Specific Guidelines for the majority of the deployment period (upper dashed line). Values were relatively stable throughout the timeframe owing to the season – pH does not exhibit the drastic diurnal variation in the winter as it does in the spring, summer, and early fall.

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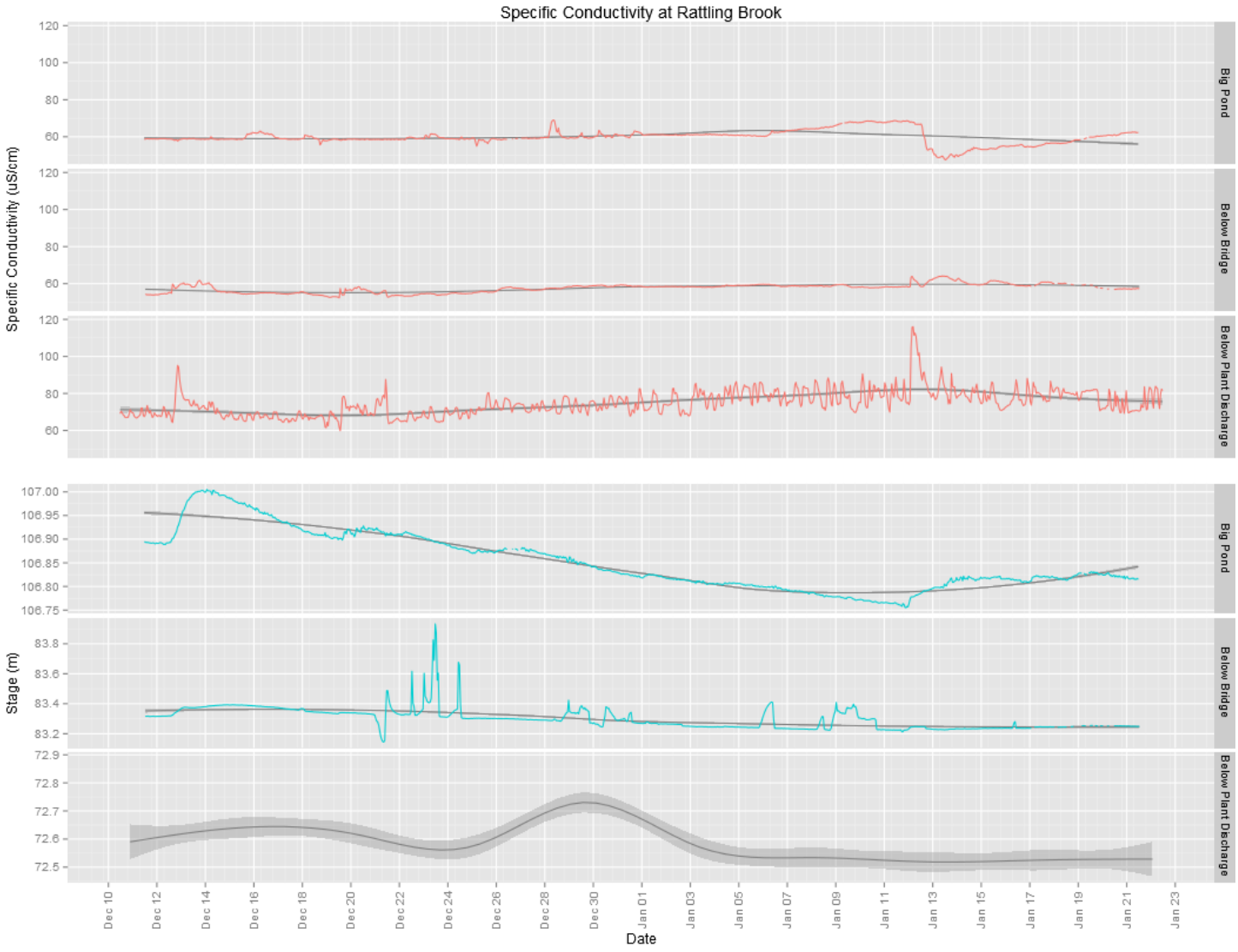
Specific Conductivity

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	59.9	59.4	47.5	69.1
Below Bridge	57.6	58.2	52.3	64.2
Below Plant Discharge	74.7	73.8	59.9	116.0

- Some indication of an rising trend is seen at Big Pond station, however, a sharp decline on January 12 is likely related to snowmelt. An increasing trend is clearer at Bridge and Plant Discharge stations, possibly due to the increased use of ice control measures in and around the Vale plant site.

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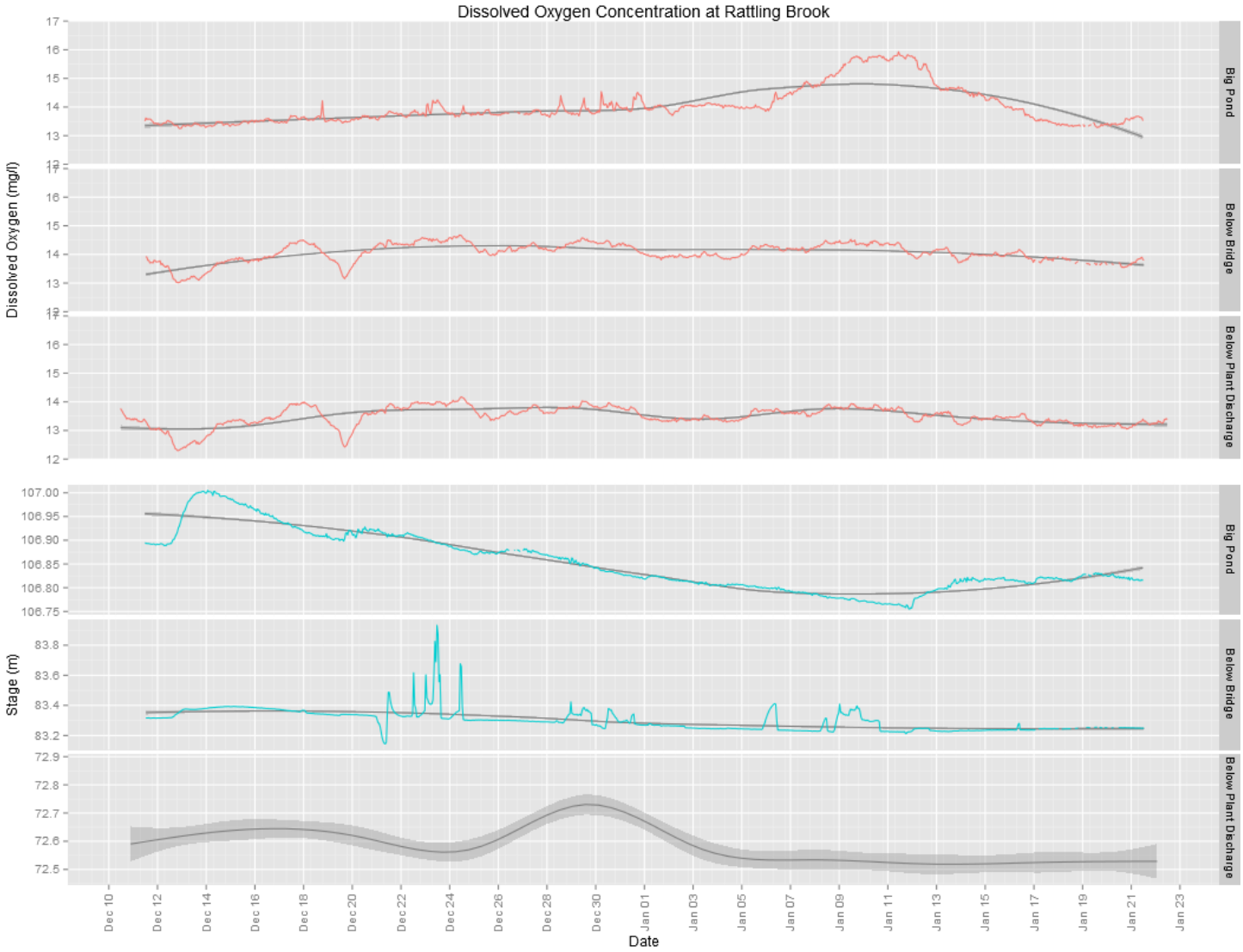
Dissolved Oxygen

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	variable	Mean	Median	Min	Max
Big Pond	DO (mg/l)	14.02	13.81	13.25	15.93
Below Bridge	DO (mg/l)	14.06	14.07	13.01	14.68
Below Plant Discharge	DO (mg/l)	13.49	13.48	12.30	14.17

- Near the end of the deployment period dissolved oxygen concentrations have likely reached their annual maxima as a result of freezing conditions at all stations. Concentrations are expected to decline towards the end of February and March as water temperatures begin to rise into the spring.

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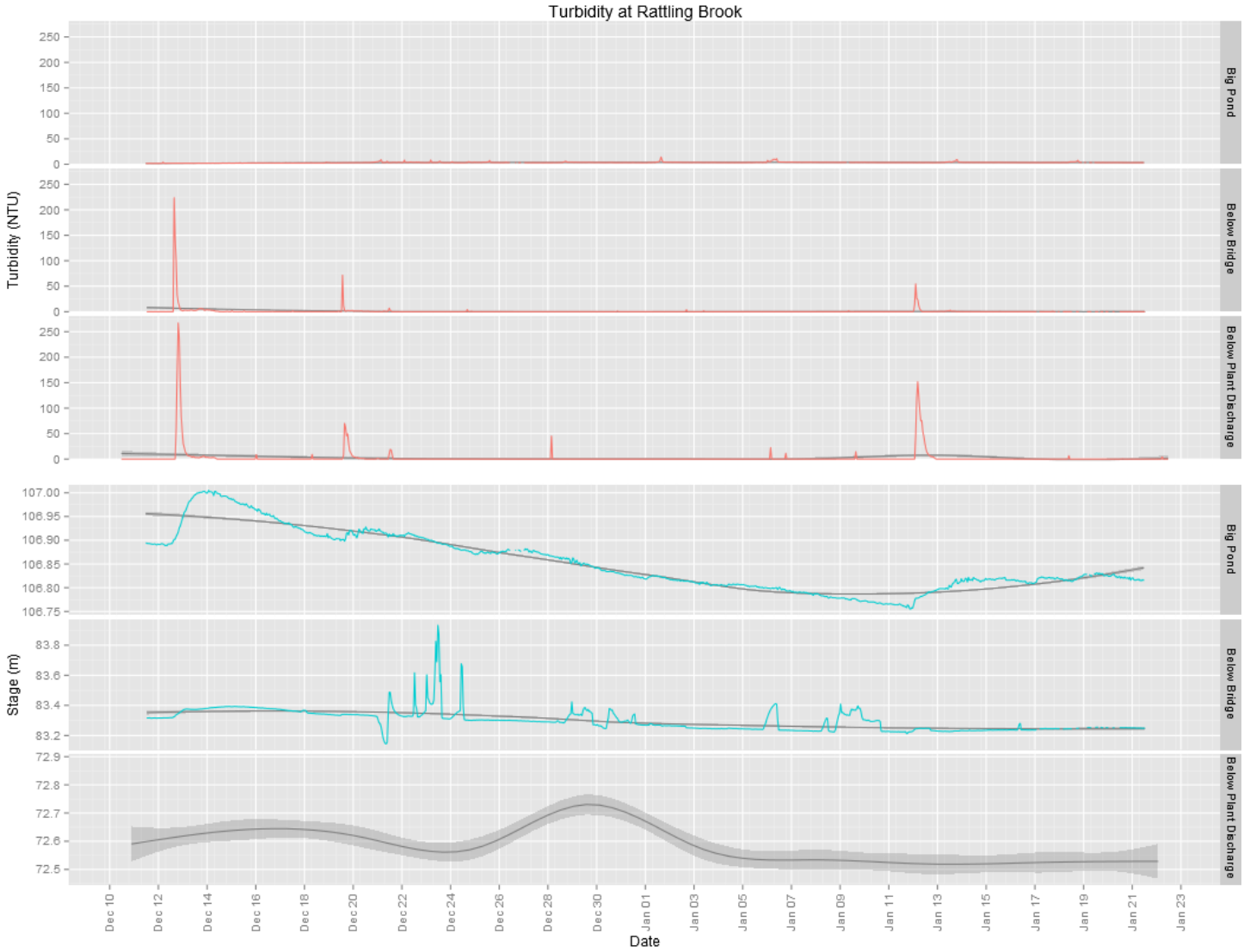
Turbidity

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	3.4	3.4	1.6	14.4
Below Bridge	1.0	0.0	0.0	223.8
Below Plant Discharge	2.5	0.0	0.0	267.3

- As soils are frozen and become stable and ground surfaces are blanketed by snow, turbidity levels tend to fall to annual minima. Contrary to expectations, turbidity levels were highest at Big Pond station and hovered near 3.4 NTU for the majority of the deployment. This low level of turbidity could be the result of seasonal mixing within Big Pond as stratification has broken down and water is able to turn over to a greater degree.

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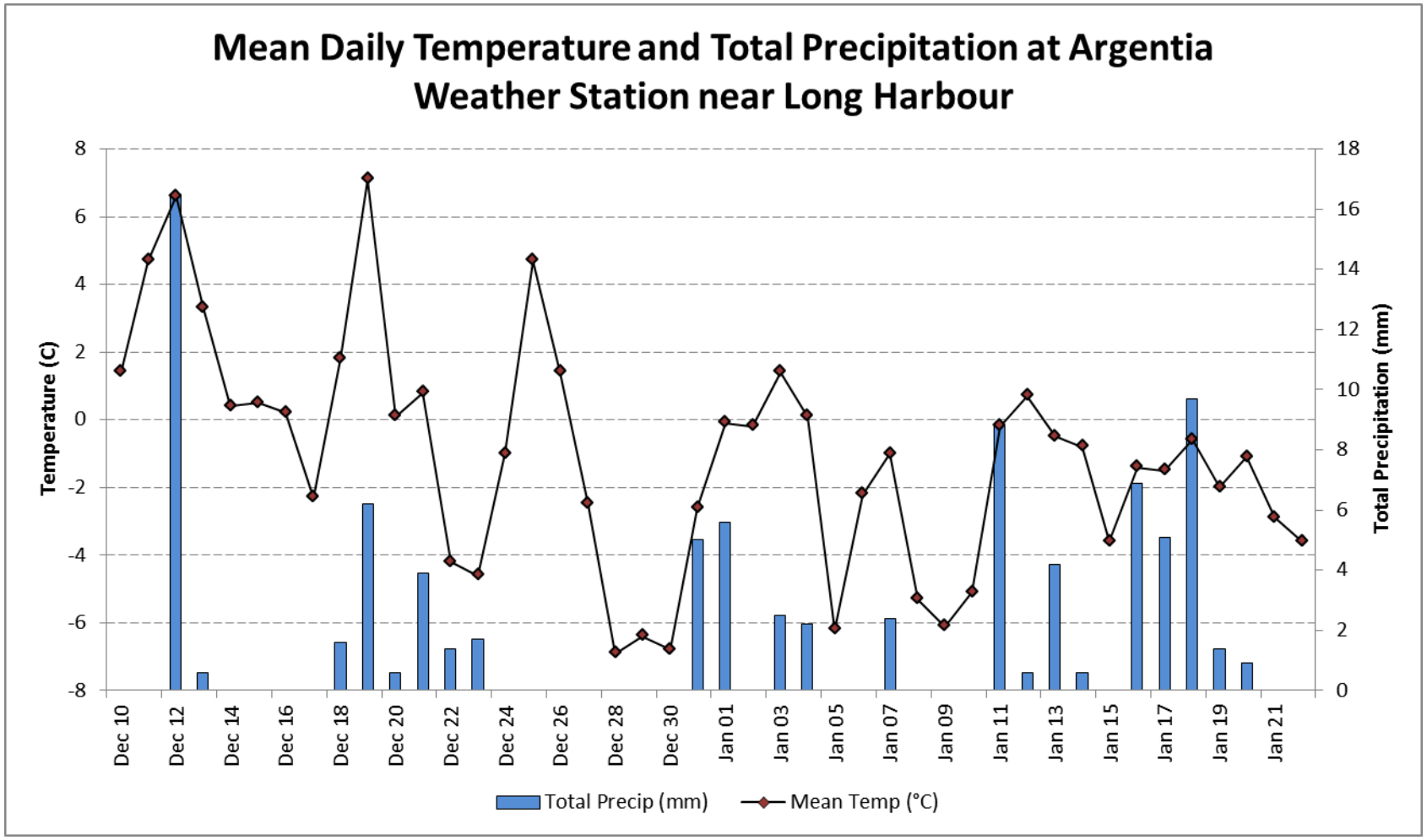
Appendix



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