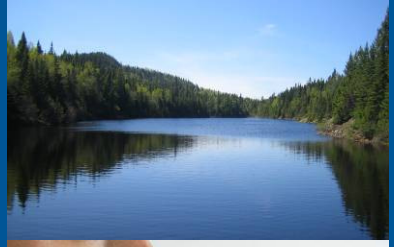
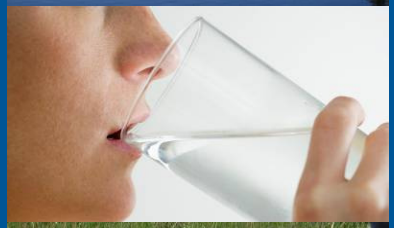






Real-Time Water Quality Deployment Report

Rattling Brook Network

November 21, 2014 to December 22, 2014

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.
- Because of very limited sunlight duration and cold air temperatures, winter challenges the battery supplies of remote stations, especially in Newfoundland. In December, the battery voltage at Bridge station declined to an extent that communications ceased. Most water quality data was retrieved from onboard the Hydrolab, however, water quantity data could not be retrieved.

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

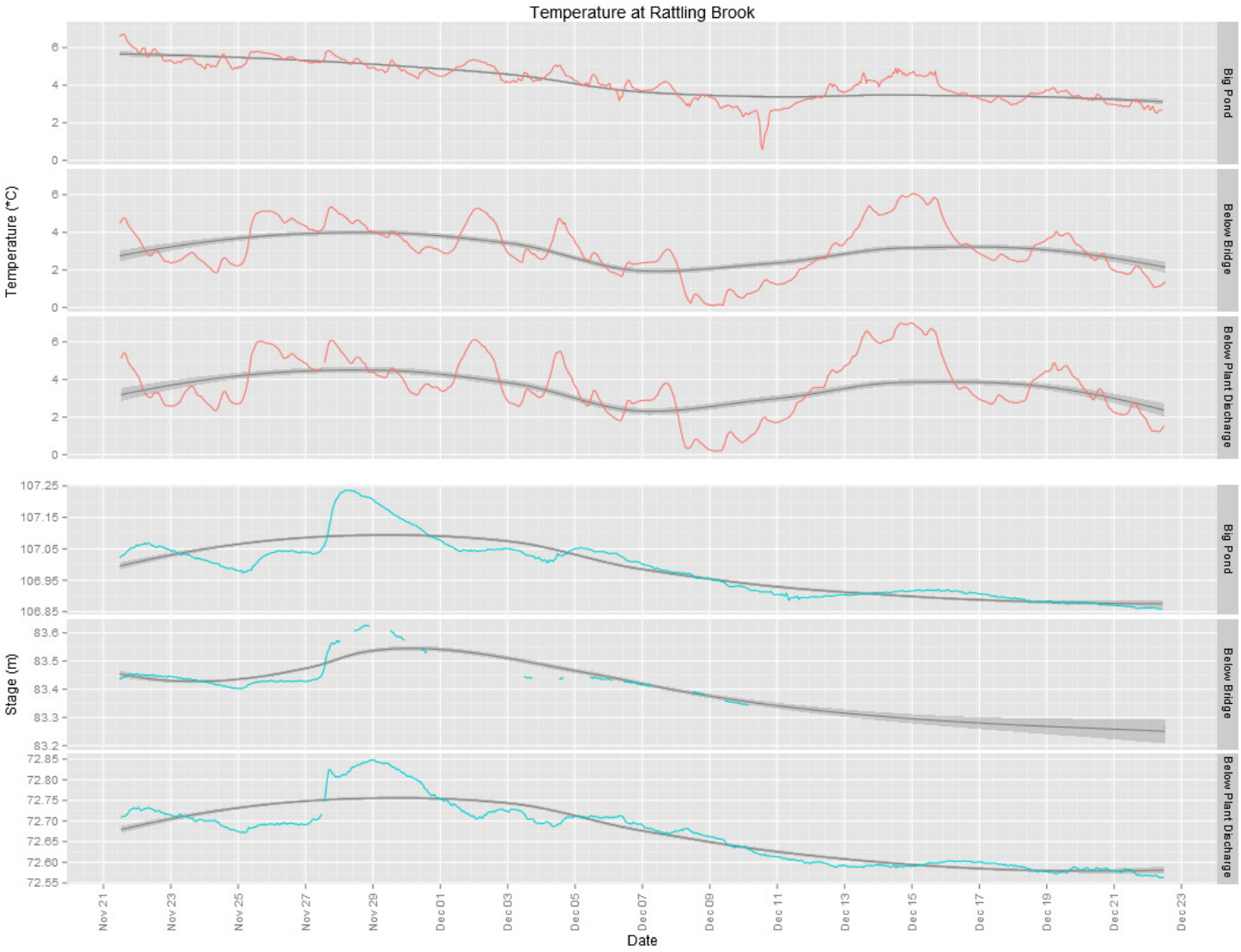
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	November 21, 2014	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	December 22, 2014	Removal	Excellent	Excellent	Excellent	Excellent	Excellent
Rattling Brook below Bridge	November 21, 2014	Deployment	Good	Excellent	Excellent	Excellent	Poor
	December 22, 2014	Removal	Good	Good	Excellent	Excellent	Excellent
Rattling Brook below Plant Discharge	November 21, 2014	Deployment	Poor	Excellent	Excellent	Excellent	Poor
	December 22, 2014	Removal	Good	Excellent	Excellent	Excellent	Excellent

- "Poor" data quality rankings were observed for turbidity during deployment. This is thought to be the result of highly variable readings on both the QAQC and Field sondes at the time since Rattling Brook was in a high flow state with notable turbidity present. Also, a "Poor" ranking was applied to temperature at Plant Discharge station during deployment, though the 0.21^{o}C discrepancy could have been related to slight local differences between QAQC and Field sonde placement.

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.

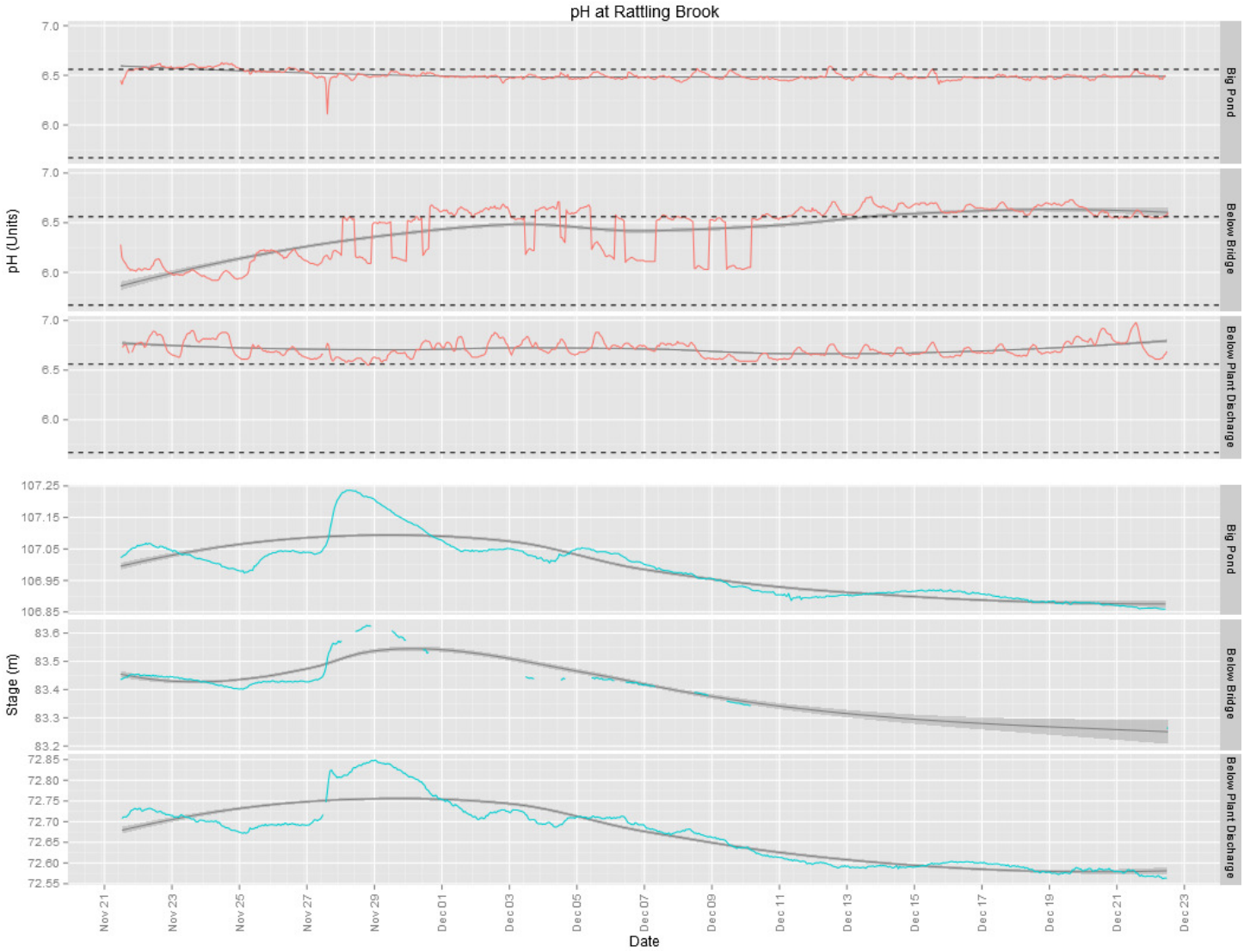


Station	Variable	Mean	Median	Min	Max
Big Pond	Temperature (C)	4.21	4.22	0.59	6.71
Below Bridge	Temperature (C)	3.15	2.97	0.11	6.07
Below Plant Discharge	Temperature (C)	3.66	3.48	0.19	7.02

- Water temperatures showed a slight decline from late November to late December and reached a minimum of 0.11^{o}C at Bridge station.

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.

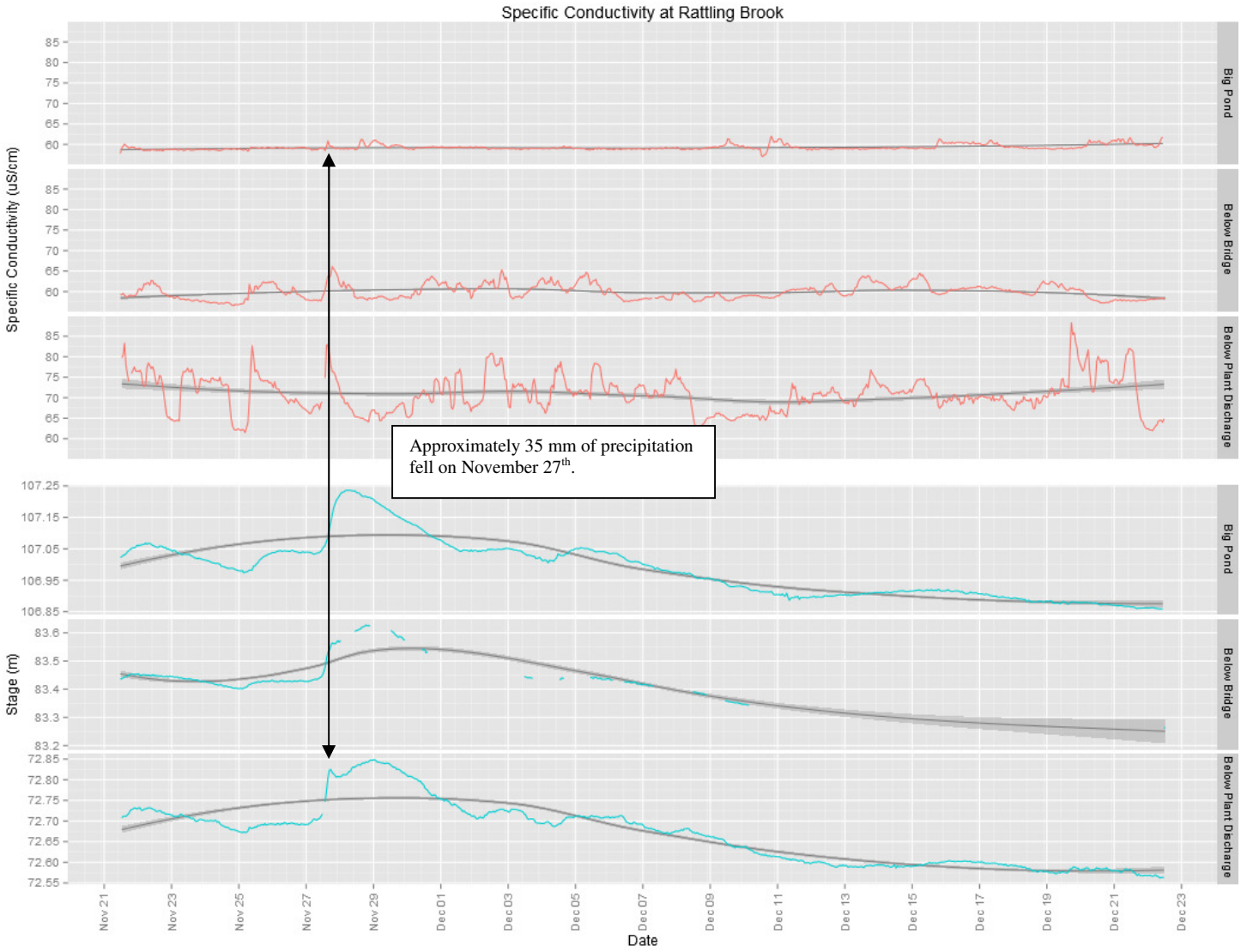


Station	Variable	Mean	Median	Min	Max
Big Pond	pH (Units)	6.50	6.49	6.11	6.63
Below Bridge	pH (Units)	6.43	6.56	5.92	6.76
Below Plant Discharge	pH (Units)	6.71	6.69	6.55	6.98

- pH levels were mostly stable at Big Pond and Plant Discharge stations over the course of the deployment period while Bridge station showed a rise throughout the deployment. A series of rapid increases and decreases were observed at Bridge station as battery power came in and out. It appears that internal data from the Hydrolab used to fill gaps may be somewhat higher than data recorded by the datalogger. More investigation is needed.

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.

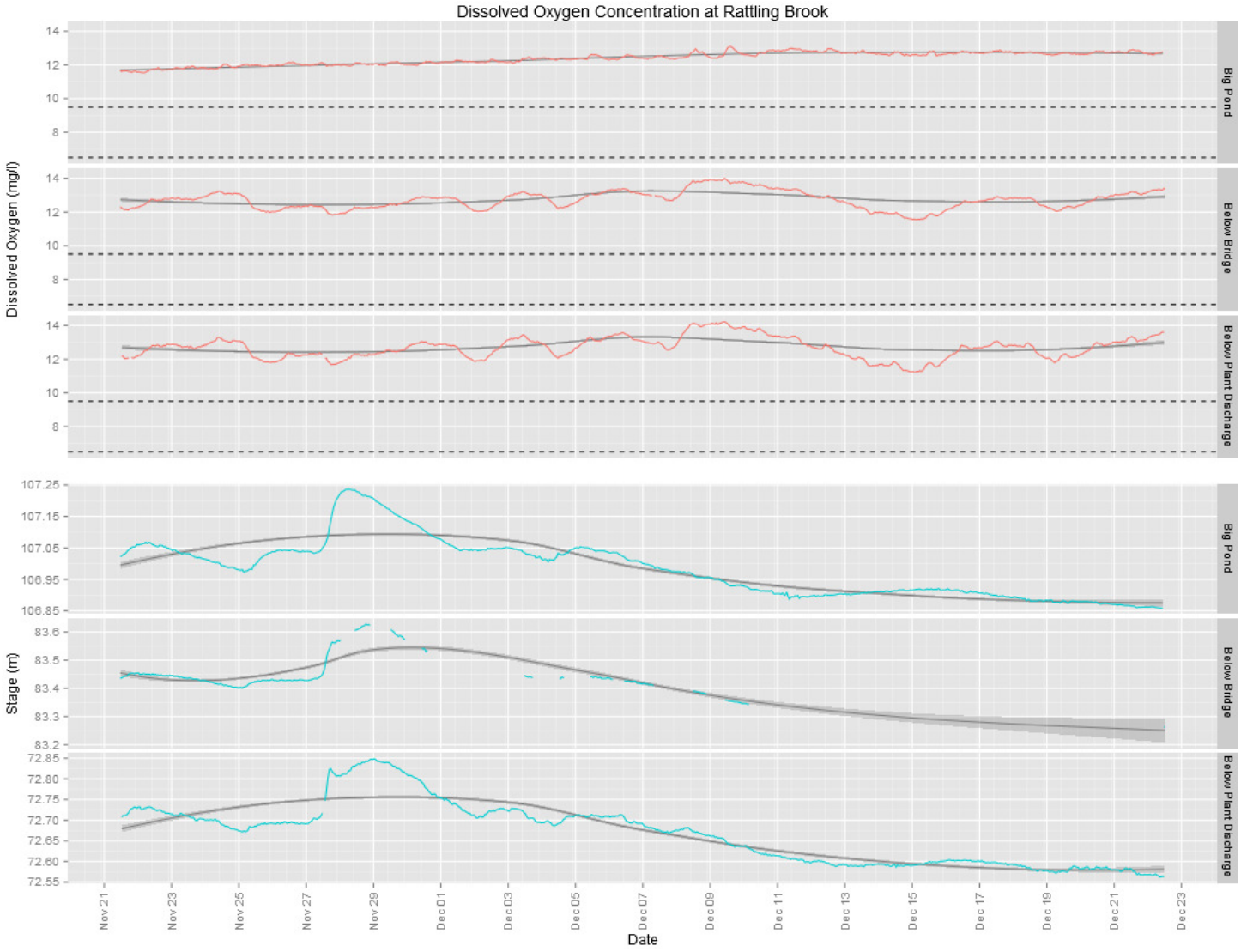


Station	Variable	Mean	Median	Min	Max
Big Pond	Conductivity (uS/cm)	59.3	59.1	57.0	62.0
Below Bridge	Conductivity (uS/cm)	59.9	59.7	56.6	66.1
Below Plant Discharge	Conductivity (uS/cm)	70.9	70.7	61.5	88.3

- Specific Conductivity fluctuated at Bridge and Plant Stations, but showed no major trend upwards or down during the deployment period. Some peaks were identified and related to heavy precipitation.

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.

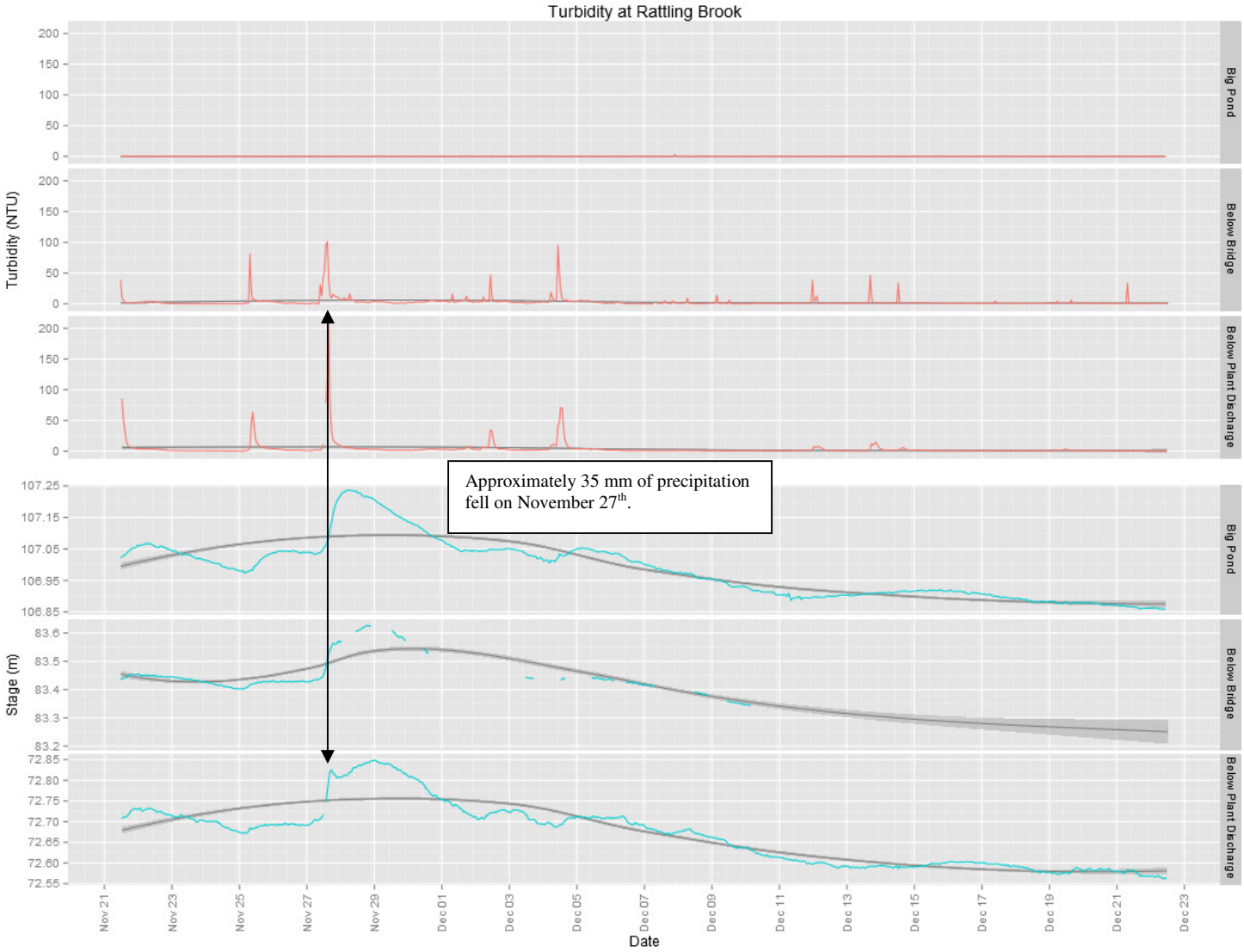


Station	Variable	Mean	Median	Min	Max
Big Pond	DO (mg/l)	12.40	12.43	11.54	13.09
Below Bridge	DO (mg/l)	12.71	12.76	11.54	14.00
Below Plant Discharge	DO (mg/l)	12.69	12.76	11.23	14.22

- By December, dissolved oxygen saturation has generally approached its annual maximum – far above the CCME Guidelines for the protection of aquatic biota. Some fluctuations are present from time to time and are generally related to meltwater or influx of relatively warm precipitation.

Turbidity

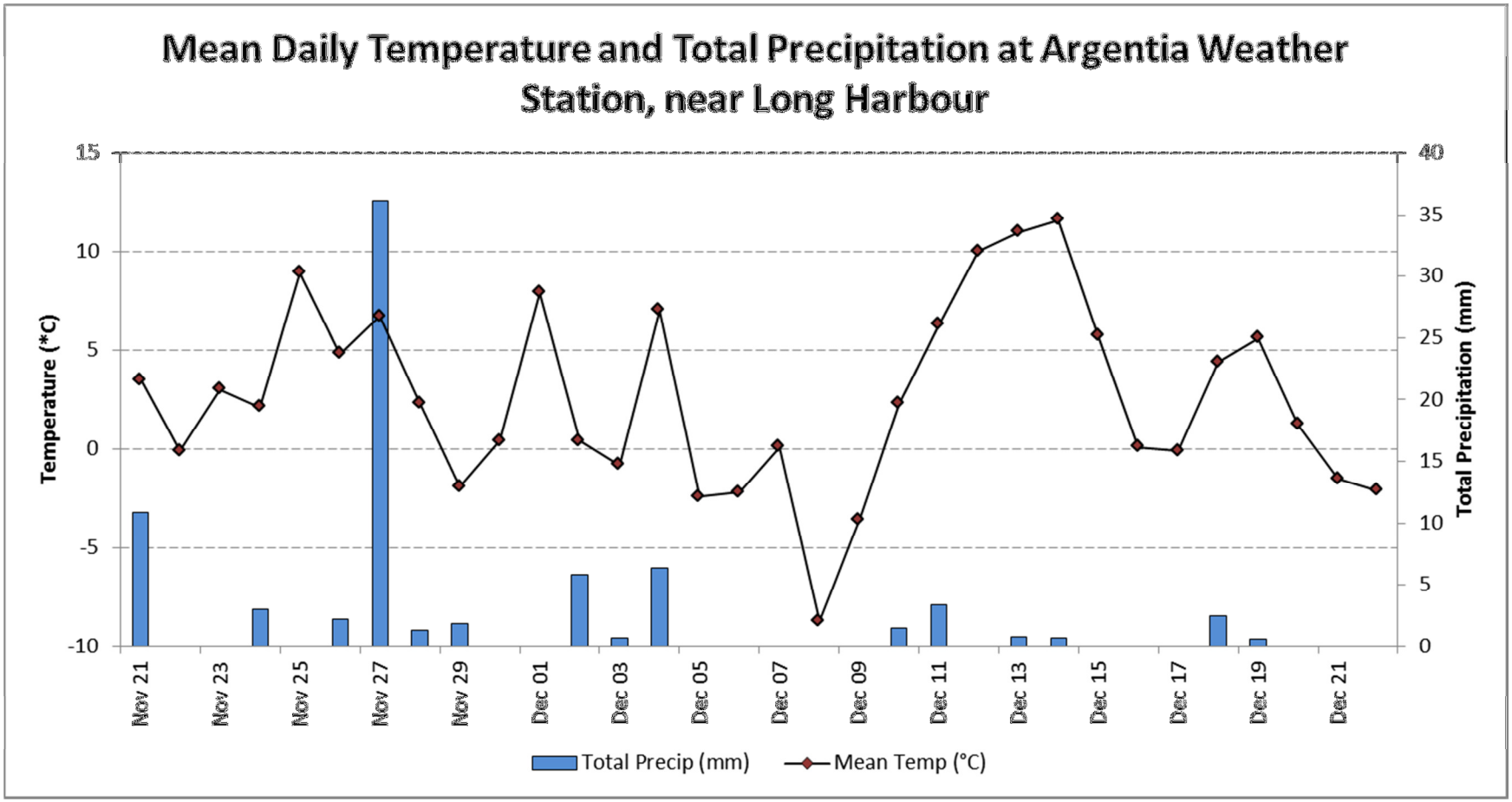
Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover spawning areas.



Station	Variable	Mean	Median	Min	Max
Big Pond	Turb (NTU)	0.0	0.0	0.0	3.1
Below Bridge	Turb (NTU)	3.1	1.0	0.0	101.0
Below Plant Discharge	Turb (NTU)	3.8	1.4	0.4	209.4

- Eleven instances of turbidity greater than 40 NTU were observed at Bridge station during this deployment period while 14 were observed at Plant Discharge station. Two major turbidity events were observed at deployment on November 21st and another on November 27th, both during heavy rainfall periods.

Appendix



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