Real-Time Water Quality Deployment Report

Rattling Brook Network

November 7, 2013 to January 9, 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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2013-11-07 to 2014-01-09

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Prior to the maintenance outing on November 7, the equipment normally deployed at Big Pond and Bridge stations were subjected to annual proficiency testing. Therefore, when these instruments were returned to regular service, they were ready for deployment on the first of the two-day servicing. As a result, no gap was inserted into the monitoring at that time.

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

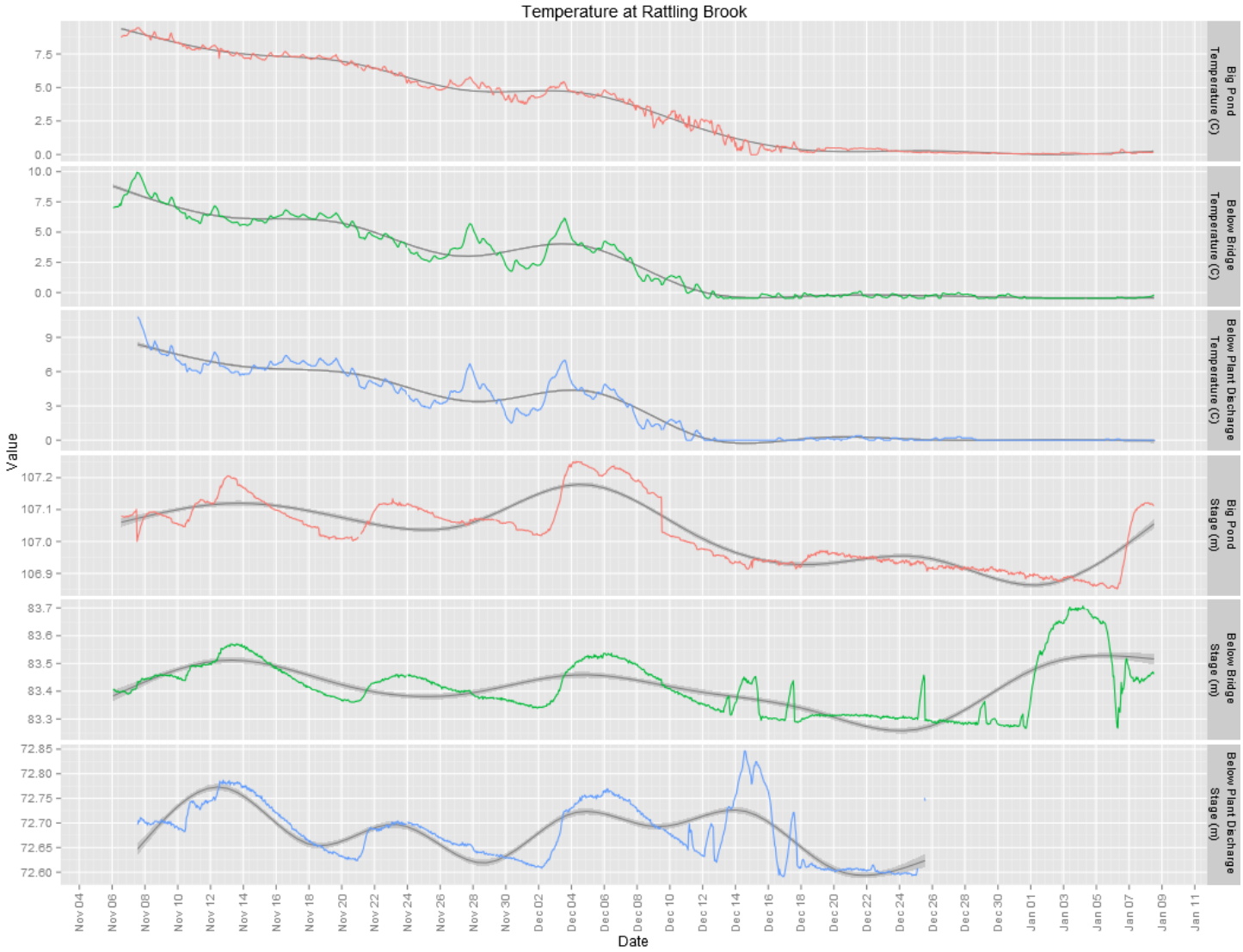
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	2013-11-07	Deployment	Excellent	Fair	Good	Good	Excellent
	2014-01-09	Removal	Good	Marginal	Poor	NA	Excellent
Rattling Brook below Bridge	2013-11-07	Deployment	Excellent	Good	Good	Excellent	Excellent
	2014-01-09	Removal	Good	Good	Excellent	NA	Excellent
Rattling Brook below Plant Discharge	2013-11-08	Deployment	Poor	Good	Marginal	Excellent	Poor
	2014-01-09	Removal	Good	Fair	Good	NA	Excellent

- On January 9, the dissolved oxygen sensor on the QAQC Sonde was found to be faulty and was not included in the QAQC rankings.
- A few instances of "Poor" rankings were observed during deployment, including temperature and turbidity at Plant Discharge station. At that time, high flow and turbid conditions were present, possibly creating localized conditions, despite the two instruments being located near one another. Rankings were significantly improved at removal.
- The rank of conductivity was also found to be "Poor" at Big Pond station during removal. In this instance, a hole was chopped in the ice. This may have suspended particles in the water column near the Field sonde but not the QAQC sonde.

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.

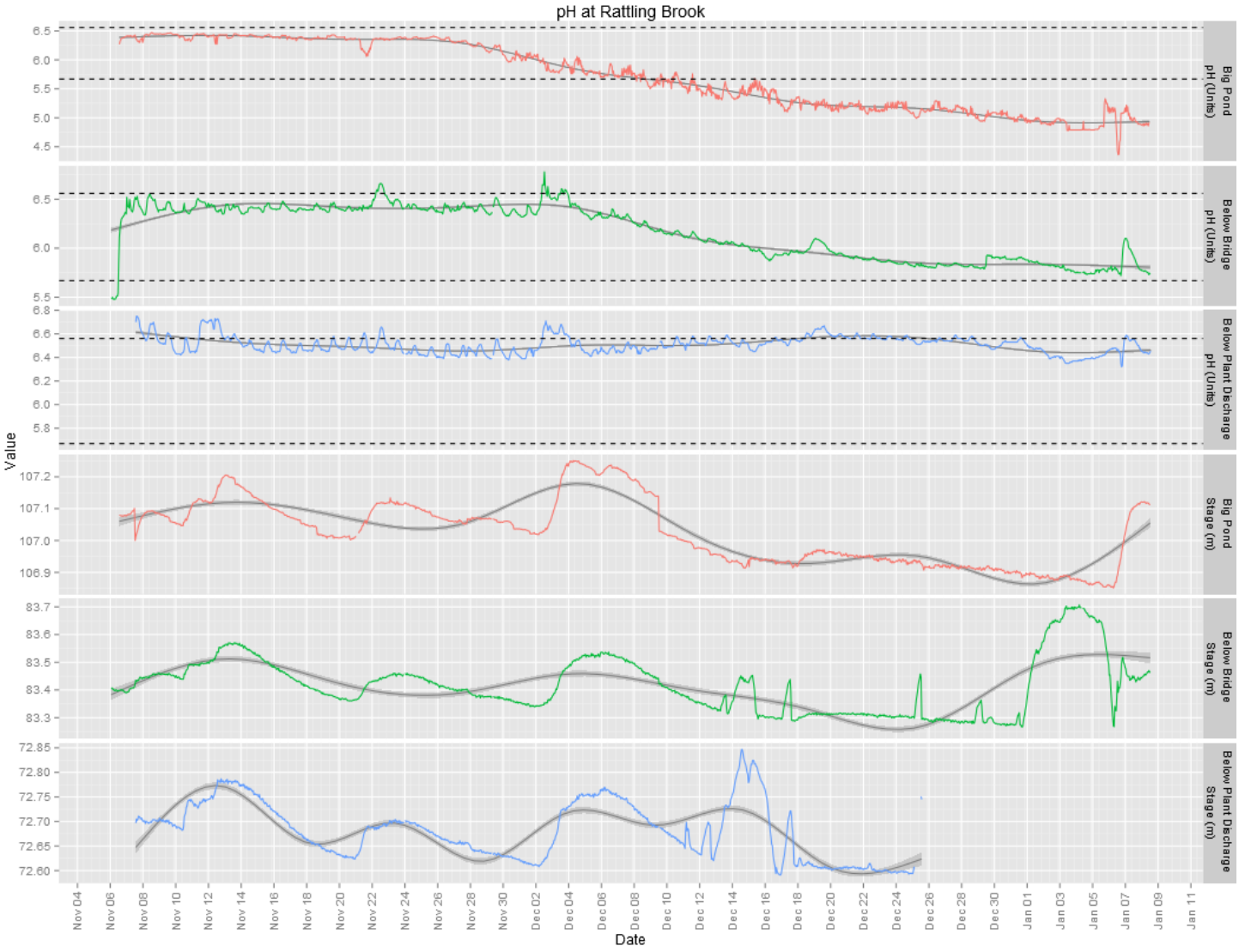


Station	Parameter	Mean	Median	Min	Max
Big Pond	Temperature (C)	3.45	3.57	-0.02	9.46
Below Bridge	Temperature (C)	2.47	1.82	-0.49	9.96
Below Plant Discharge	Temperature (C)	2.69	1.60	0.00	10.80

- Water temperature declined rapidly through the deployment period from a high of 10.80^{o}C to freezing temperatures at all stations by mid-late December. A brief warming trend was observed in early December as air temperatures rose. At removal, Rattling Brook Big Pond had 100% ice cover. Monitoring will resume at this station once ice conditions improve. Bridge and Discharge stations had sufficient open water to permit safe entry into the water as well as avoid instrument damage.

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.

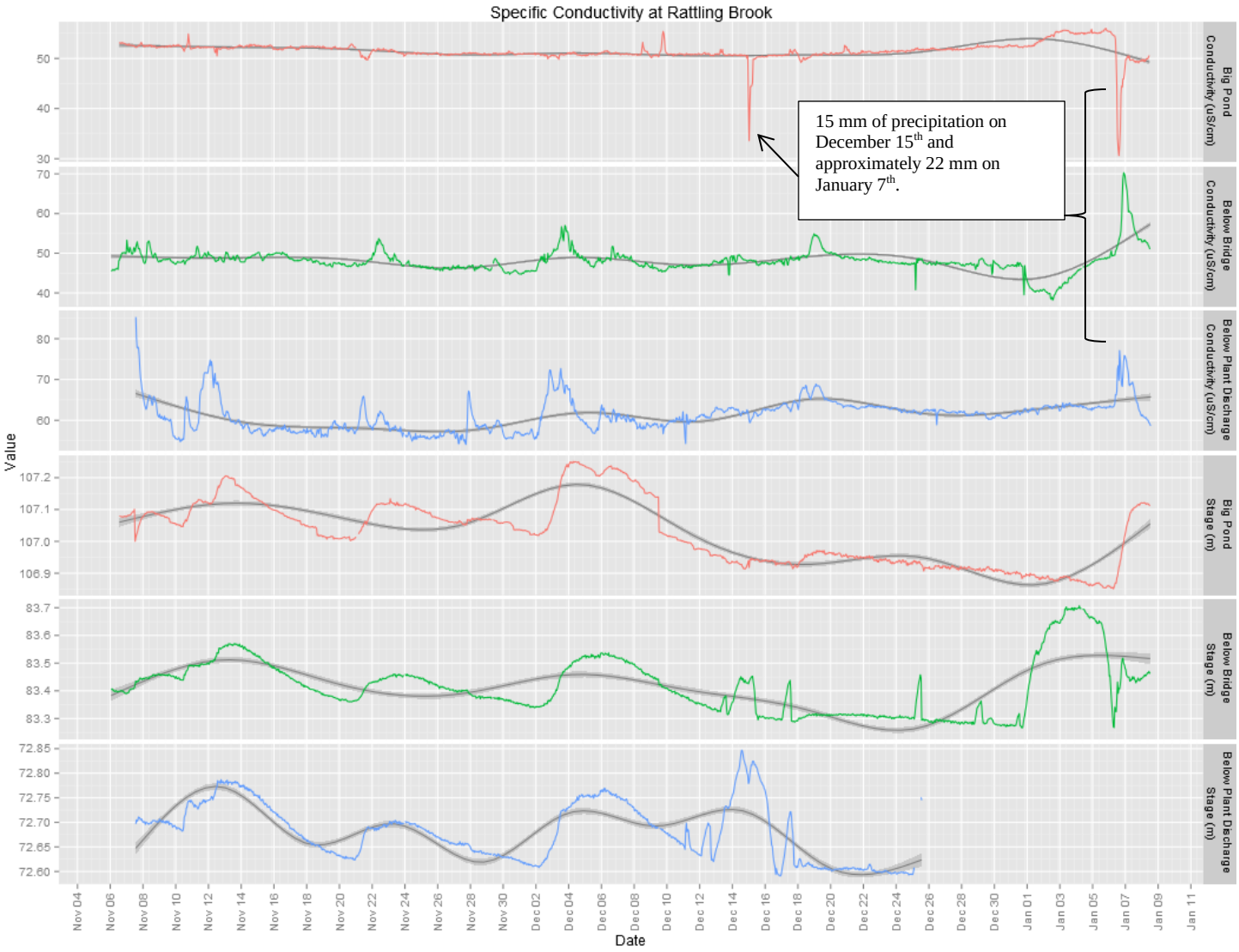


Station	Parameter	Mean	Median	Min	Max
Big Pond	pH (Units)	5.72	5.72	4.36	6.47
Below Bridge	pH (Units)	6.17	6.25	5.48	6.78
Below Plant Discharge	pH (Units)	6.51	6.51	6.32	6.75

- A drop in pH was observed at Big Pond and Bridge stations in early December, possibly due to rising water temperatures and/or precipitation. At Big Pond station, this decline in pH was enough to cause the pH to fall – and remain – below the Site Specific Guidelines (SSGs, indicated by the dotted lines). At Bridge and Plant Discharge stations, most pH values were found to fall within the SSGs.

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.

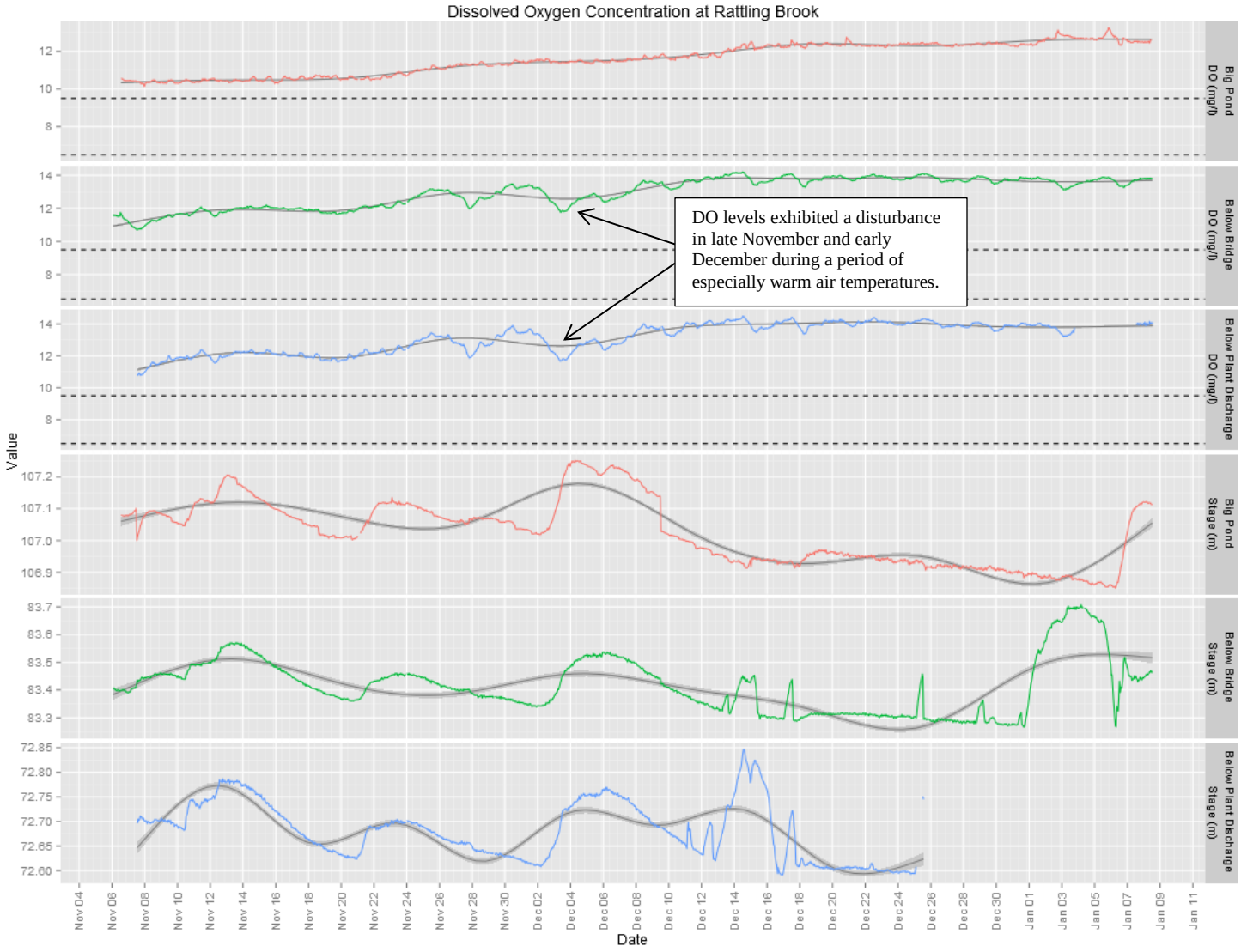


Station	Parameter	Mean	Median	Min	Max
Big Pond	Conductivity (uS/cm)	51.5	51.4	30.6	56.0
Below Bridge	Conductivity (uS/cm)	48.0	47.8	38.2	70.3
Below Plant Discharge	Conductivity (uS/cm)	61.3	61.4	54.1	85.3

- Conductivity was stable for much of the deployment period at Big Pond and Bridge stations. An upward trend, however, was observed at Plant Discharge station, possibly due to inflow from settling ponds.

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.

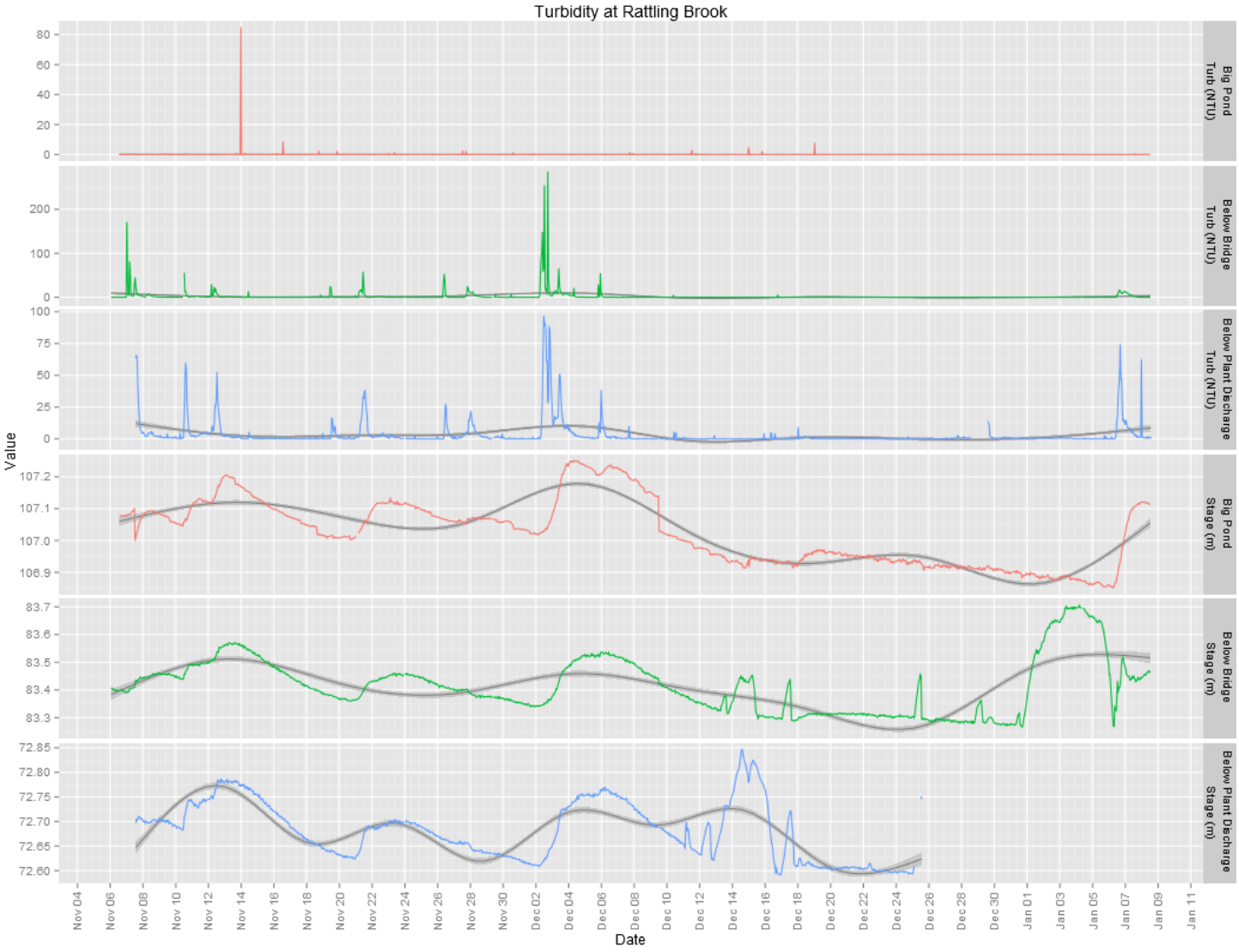


Station	Parameter	Mean	Median	Min	Max
Big Pond	DO (mg/l)	11.60	11.58	10.13	13.27
Below Bridge	DO (mg/l)	12.97	13.27	10.70	14.21
Below Plant Discharge	DO (mg/l)	13.13	13.355	10.76	14.49

- With a dropping temperature, dissolved oxygen concentration increased to approximately 14 mg/l at Bridge and Plant Discharge stations. At Big Pond station, the concentration of dissolved oxygen approached 13 mg/l.

Turbidity

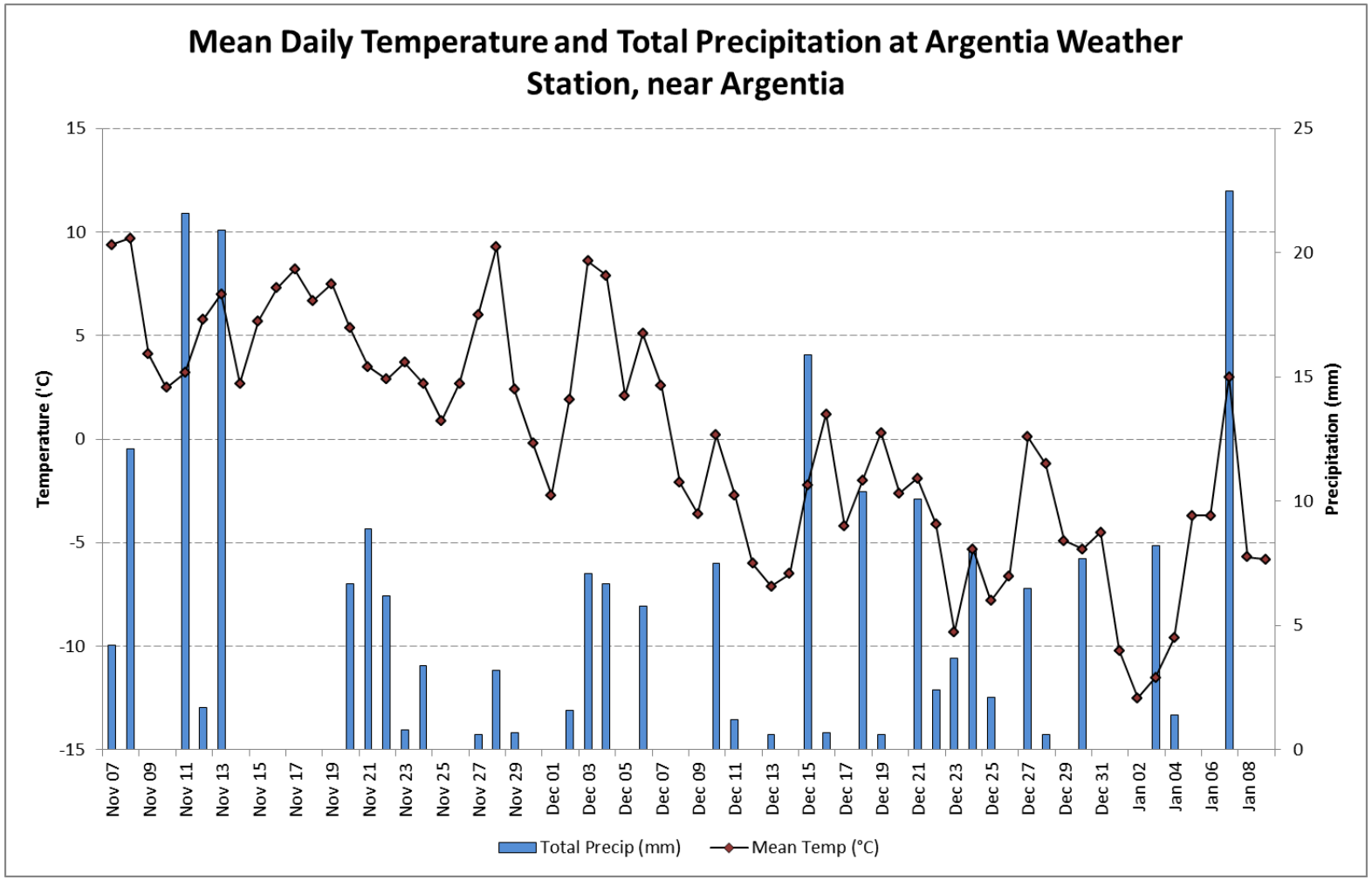
Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover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



Station	Parameter	Mean	Median	Min	Max
Big Pond	Turb (NTU)	0.1	0	0.0	84.8
Below Bridge	Turb (NTU)	2.3	0	0.0	285.1
Below Plant Discharge	Turb (NTU)	3.1	0.4	0.0	96.5

- Turbidity levels were relatively low at each station, with a significant peak during warm temperatures, and precipitation in late November to early December. Following the peak turbidity level, values returned to low levels.

Appendix



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