Real-Time Water Quality Deployment Report

Rattling Brook Network

February 19, 2014 to March 20, 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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2014-02-19 to 2014-03-20

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- Ratting Brook Big Pond station remained offline this month due to unusually persistent ice conditions. This station is generally out of service for a month or two each year in order to avoid possible damage to instrumentation by drifting ice. At this time, the station has been out of service for almost three months.
- During this deployment period, some minor but unusual fluctuations in water quality parameters and stage level were observed – especially around March 11th. After consulting with Vale staff in Long Harbour, it was determined that these fluctuations may have been the result of periodic dewatering of settling ponds that enter Rattling Brook just upstream of Plant Discharge station.

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

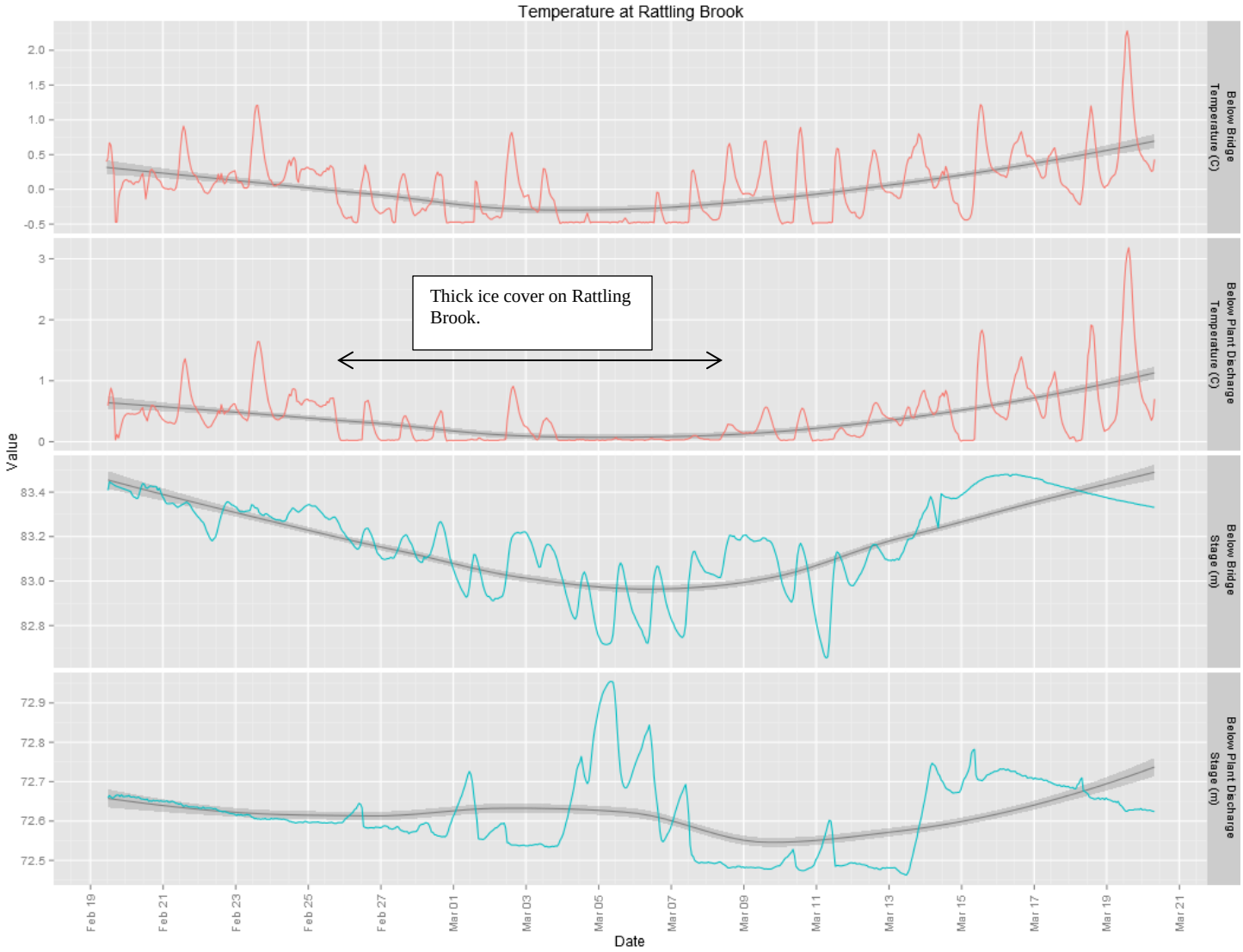
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook below Bridge	February 19, 2014	Deployment	Good	Good	Excellent	Excellent	Excellent
	March 20, 2014	Removal	Good	Poor*	Excellent	Fair	Excellent
Rattling Brook below Plant Discharge	February 19, 2014	Deployment	Excellent	Excellent	Marginal	Excellent	Excellent
	March 20, 2014	Removal	Excellent	Marginal*	Marginal	Good	Excellent

- * During removal, the QAQC sonde pH sensor was slow to respond. Though readings were taken after the sonde appeared to under stable conditions, it may have taken several hours before true stability was reached by the pH probe. “Poor” and “Marginal” readings may have resulted from low QAQC sonde readings.

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.

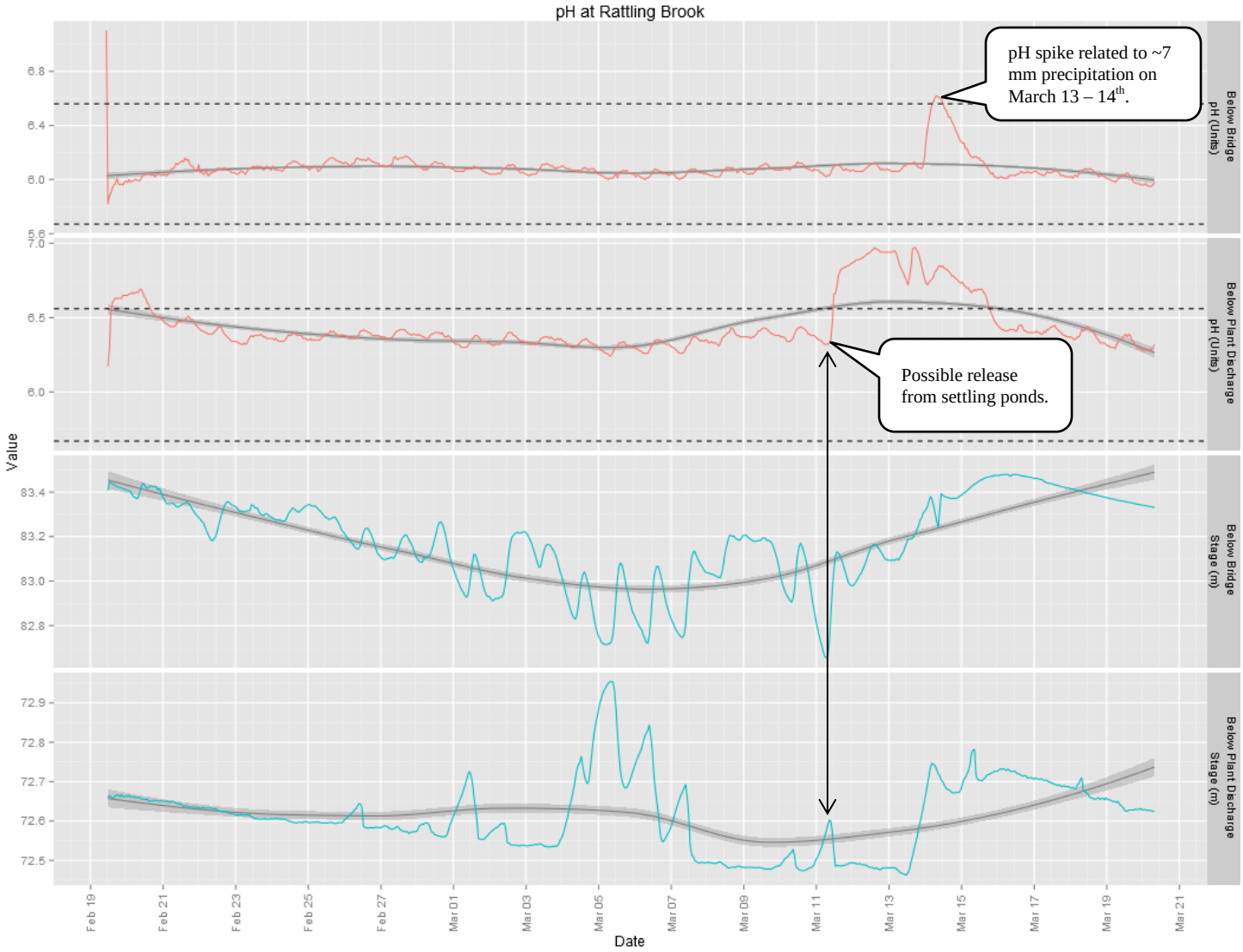


Station	*variable*	*Mean*	*Median*	*Min*	*Max*
Below Bridge	Temperature (C)	0.04	0.02	-0.50	2.28
Below Plant Discharge	Temperature (C)	0.38	0.29	0.01	3.18

- Temperatures ranged from freezing to a max of 3.18^{o}C towards the end of the deployment period. During the deployment, ice cover was persistent along the riverbank; however, mid-deployment saw significant mid-channel ice-cover as shown by the flat-line water temperature during the time indicated.

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.

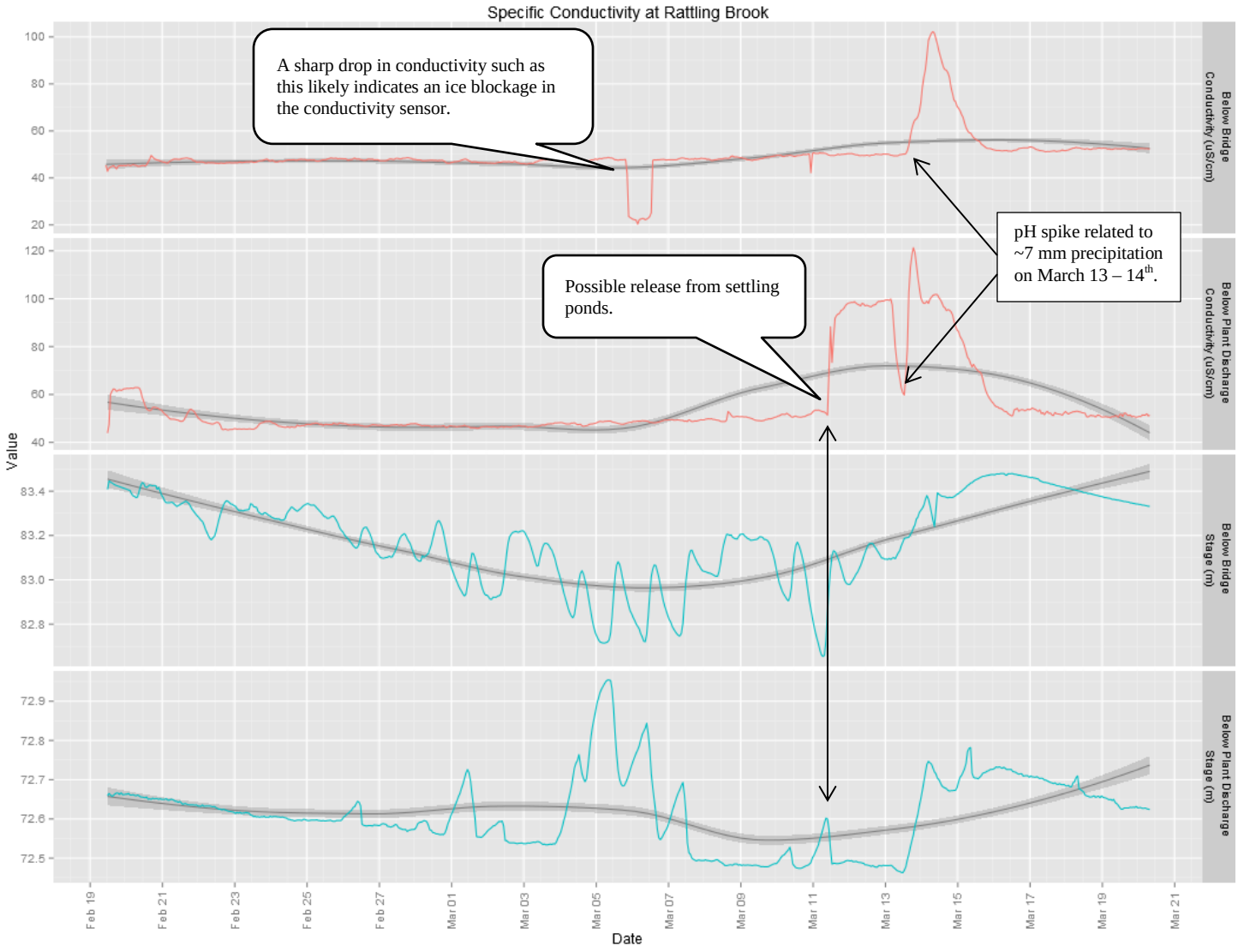


Station	*variable*	*Mean*	*Median*	*Min*	*Max*
Below Bridge	pH (Units)	6.08	6.07	5.82	7.10
Below Plant Discharge	pH (Units)	6.45	6.38	6.17	6.97

- Most pH values fell between the upper and lower site specific guidelines at Rattling Brook (dashed lines). A sharp rise in pH coincided with an 11 – 12 cm rise in stage level at Plant Discharge station on March 11th (see inset arrow above). Neither event was observed upstream at Bridge station – possibly indicating that there may have been an input into the river between Bridge and Plant Discharge stations – possibly from the plant site settling ponds.

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.

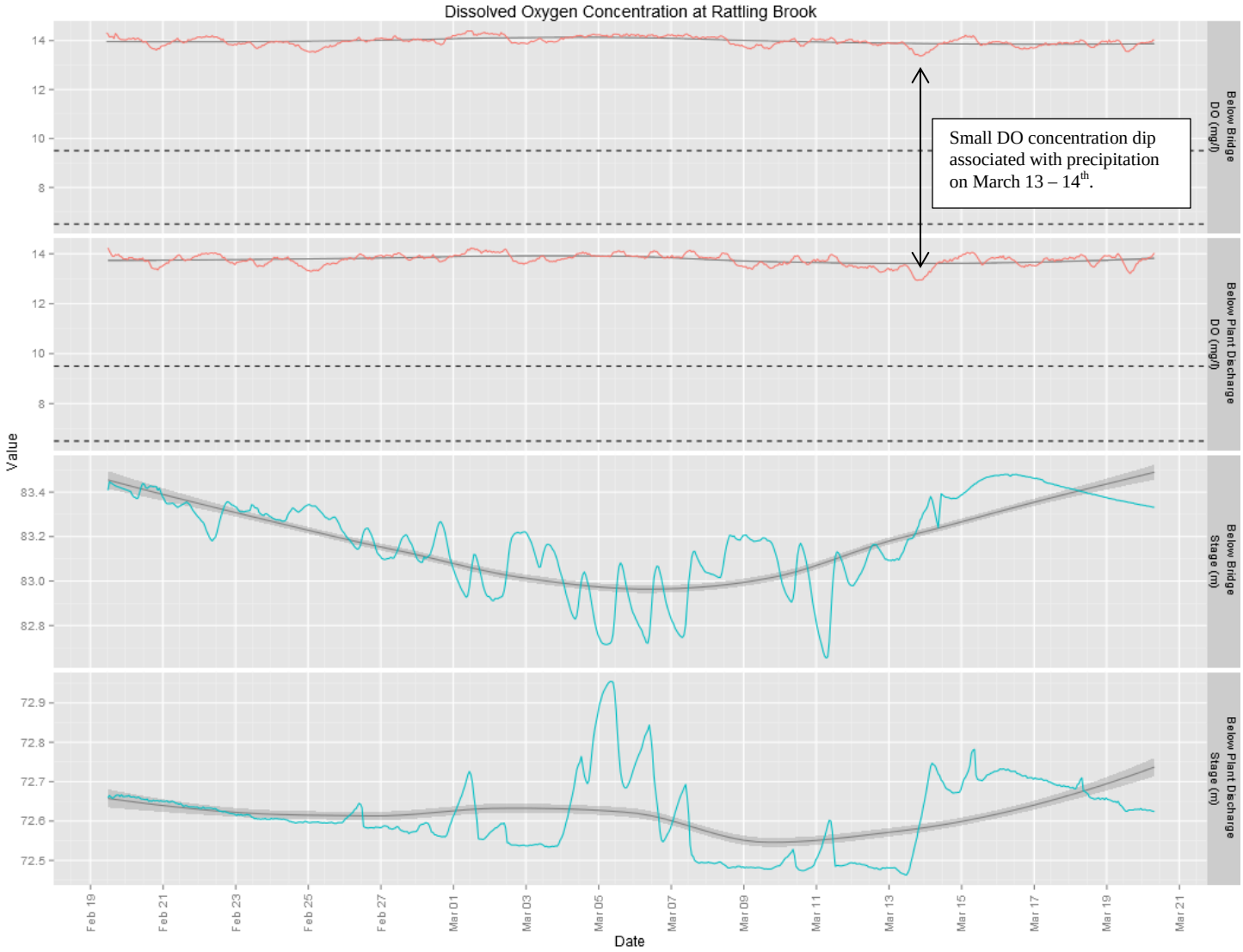


Station	*variable*	*Mean*	*Median*	*Min*	*Max*
Below Bridge	Conductivity (uS/cm)	49.7	48.1	20.3	102.3
Below Plant Discharge	Conductivity (uS/cm)	55.9	49.4	43.9	121.3

- Conductivity was mostly stable at Bridge and Plant Discharge stations during this deployment period, with two major perturbations observed: one at Plant Discharge station corresponding to the pH event described above (see inset arrow above) and another event observed at both Bridge and Plant Discharge stations on March 13th – 14th, related to 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.

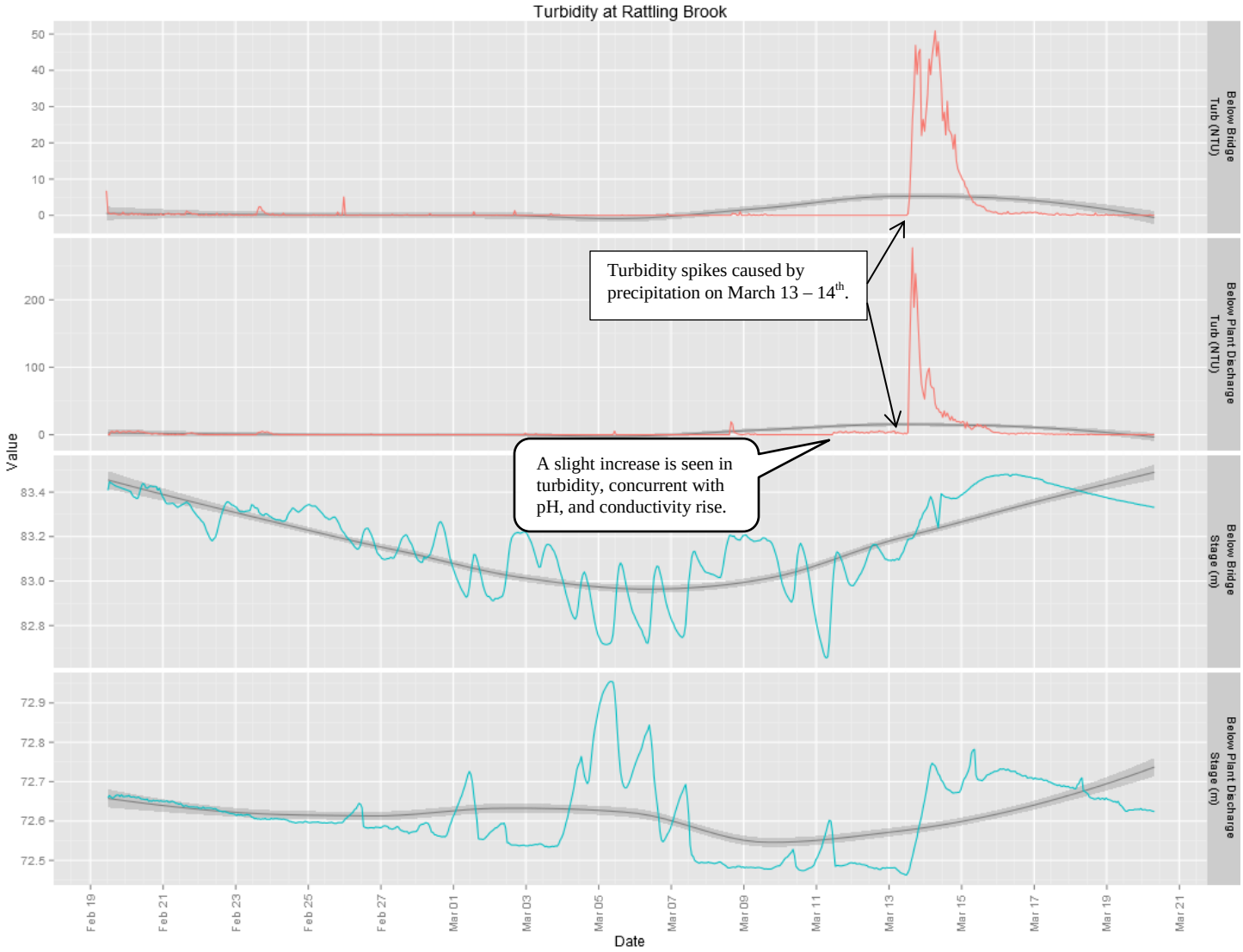


Station	*variable*	*Mean*	*Median*	*Min*	*Max*
Below Bridge	DO (mg/l)	13.97	13.97	13.37	14.40
Below Plant Discharge	DO (mg/l)	13.75	13.79	12.94	14.24
Below Bridge	DO ('%-Sat')	95.3	95.3	92.7	98.7
Below Plant Discharge	DO ('%-Sat')	94.7	94.8	89.5	99.3

- All dissolved oxygen values were well above the CCME DO guideline for the protection of early and other life stage aquatic biota (9.5 mg/l and 6.5 mg/l, respectively – see dashed lines above).

Turbidity

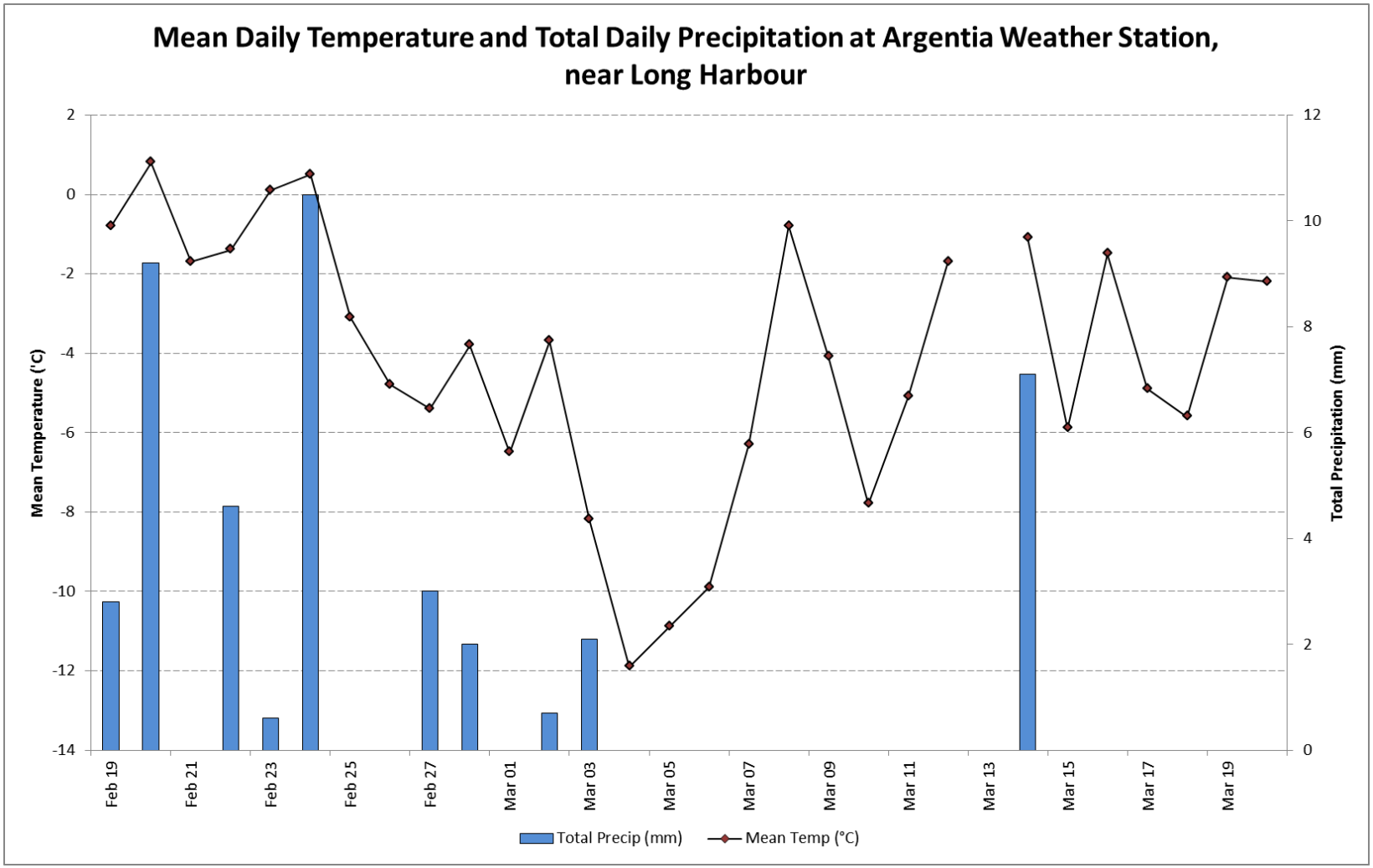
Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover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



Station	*variable*	*Mean*	*Median*	*Min*	*Max*
Below Bridge	Turb (NTU)	1.7	0.0	0.0	50.9
Below Plant Discharge	Turb (NTU)	4.9	0.0	0.0	277.2

- Turbidity levels were predominantly low at Bridge and Plant Discharge stations. Max peaks were observed simultaneously at both stations in relation to precipitation in mid-March.

Appendix



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