Real-Time Water Quality Deployment Report

Rattling Brook Network

January 6, 2017 to February 27, 2017

Newfoundland Labrador

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

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2017-01-06 to 2017-02-27

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Big Pond station remains offline for the winter season in an effort to prevent ice damage to sensitive equipment. pH data is not available at Bridge station for this deployment period due to a sensor failure.
- 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

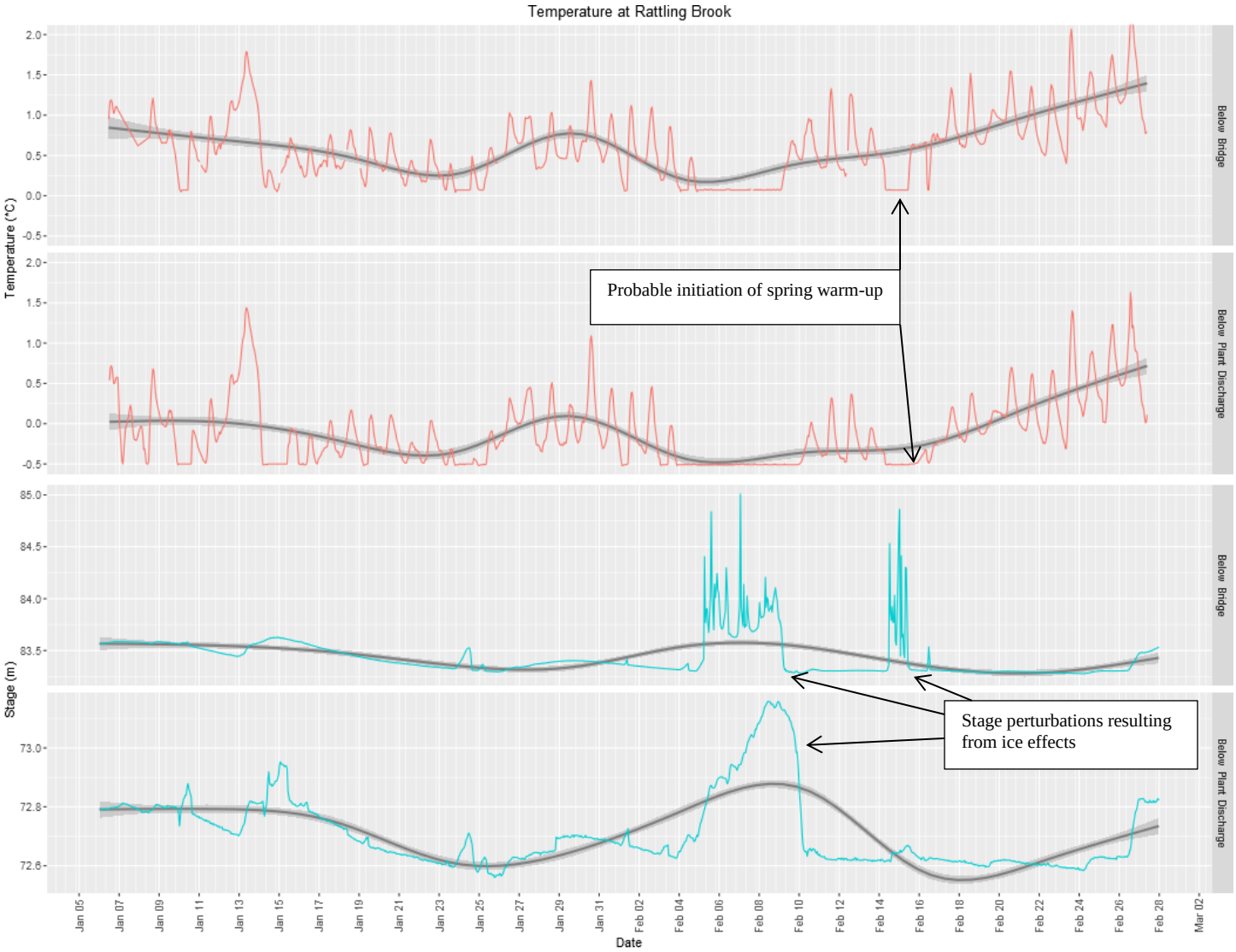
Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook below Bridge	January 6, 2017	Deployment	Excellent	NA	Good	Poor	Excellent
	February 27, 2017	Removal	Good	NA	Excellent	Excellent	Excellent
Rattling Brook below Plant Discharge	January 6, 2017	Deployment	Excellent	Good	Good	Excellent	Excellent
	February 27, 2017	Removal	Excellent	Poor	Excellent	Excellent	Poor

- No QAQC rankings were calculated for pH at Bridge station due to a sensor failure during the deployment. A “Poor” QAQC ranking was calculated for pH during removal at Plant Discharge station. This is due to a probable calibration drift occurring during deployment period (see section discussing pH below).
- A “Poor” QAQC ranking was returned for dissolved oxygen during deployment at Bridge station. This appears to be due to a temporary inaccuracy of the QAQC sonde as the field sonde was returning a sensible value. Additionally, the dissolved oxygen values were comparable between Bridge and Discharge stations.
- A “Poor” QAQC ranking was returned for turbidity at Discharge station during removal. During field work, aquatic conditions were turbid following warm temperatures and precipitation. Readings for both QAQC and Field sondes were likely reasonable for conditions at the time, accounting for some spatial variability (Field Sonde = 2.8 NTU, QAQC Sonde = 15.9 NTU).

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.



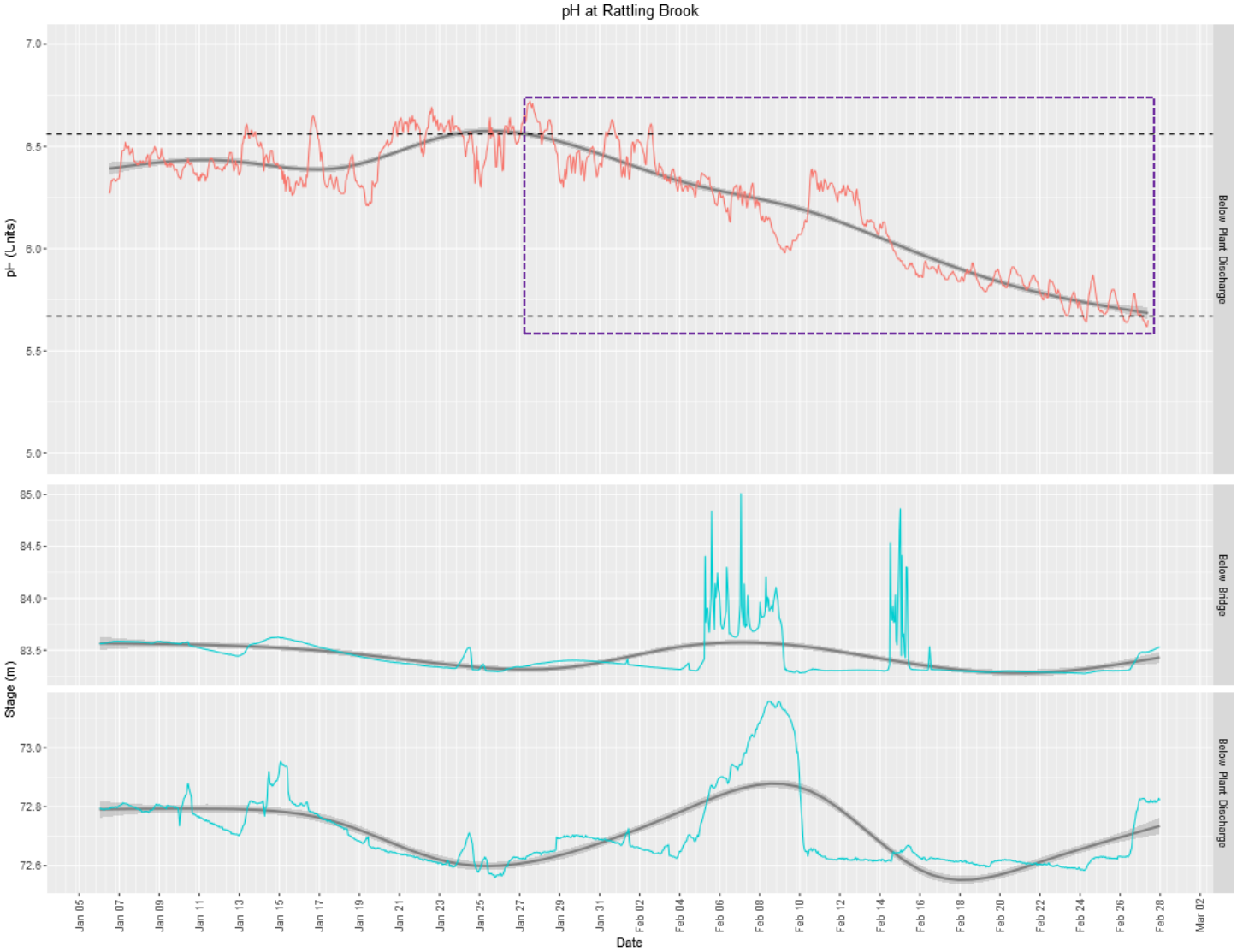
Station	Mean	Median	Min	Max
Below Bridge	0.59	0.54	0.04	2.15
Below Plant Discharge	-0.11	-0.22	-0.52	1.63

- Following February 16th, water temperatures appear to transition from winter lows to the spring warming season. While additional cold spells can be expected, expansion of ice cover at this point is likely to be minimal.
- Oscillating perturbations at Bridge station and a ramp-up of stage level at Plant Discharge station are related to ice dam conditions where water level rises before subsequent release as ice collapses or melts.

*All hydrometric data is provisional and is subject to correction. Please consult Water survey of Canada for finalized data and interpretation.

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
Below Plant Discharge	6.25	6.33	5.62	6.72

- Most pH values fell within the Site Specific Guidelines of 5.67 to 6.56 (dashed lines) for this deployment period. A falling trend was observed from January 27th, onwards. This falling trend began with a simultaneous conductivity and turbidity spike during warm air temperatures and precipitation. pH at the start of the following deployment (beginning February 28) was found to be near the pre-drift level, indicating that the decline was sensor-related and not necessarily indicative of actual conditions. Data has been retained as an indication of change during the deployment.
- The purple area above is included for illustrative purposes and will be removed from the permanent dataset.

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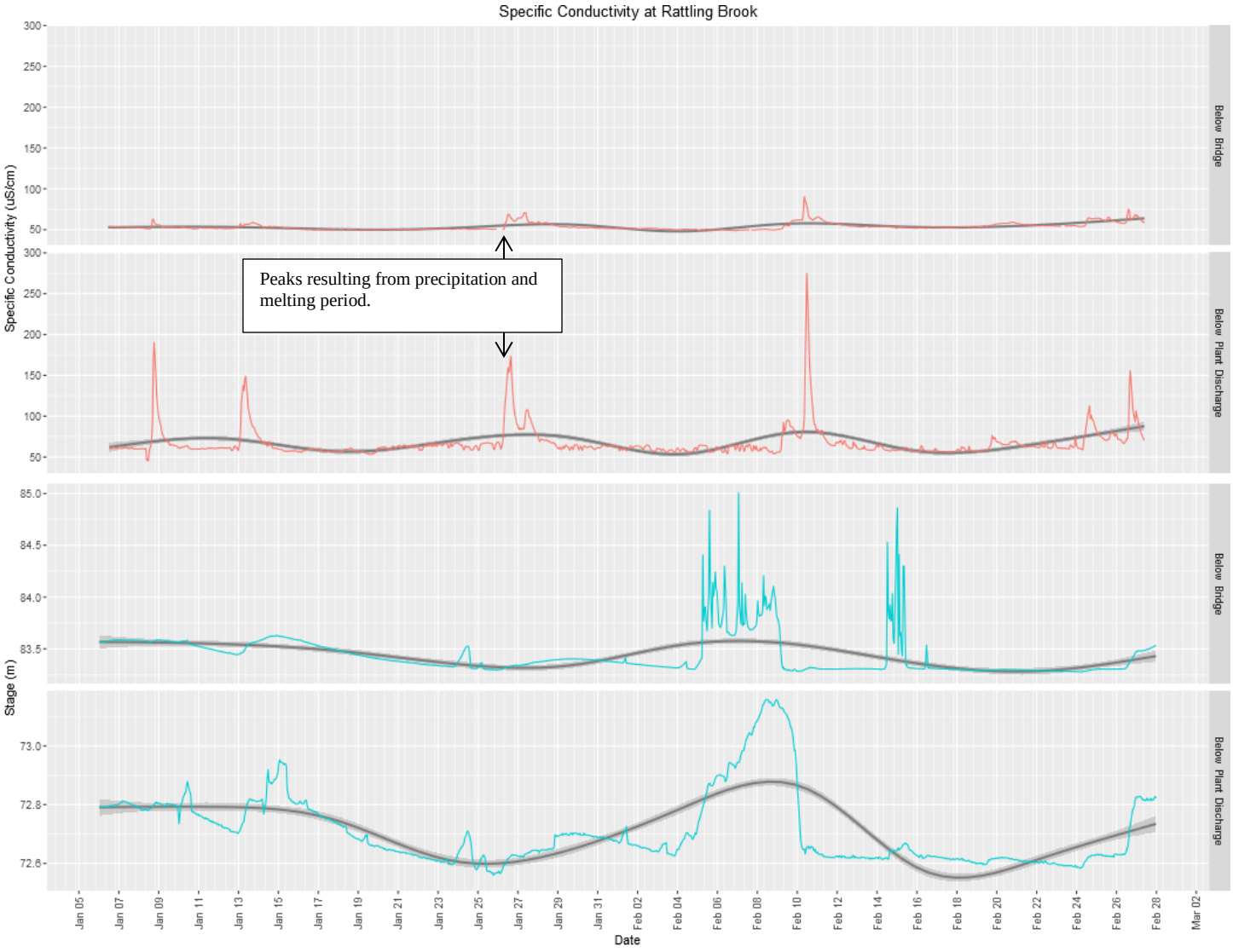
Specific Conductivity

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
Below Bridge	53.7	52.3	48.2	90.6
Below Plant Discharge	67.3	61.8	45.4	275.0

- A specific conductivity event was observed on January 26th at both Bridge and Plant Discharge stations. While conductivity reached almost 75 uS/cm at Bridge station, it was found to be much higher at Plant Discharge station, reaching nearly 175 uS/cm. Inflow from the plant site settling pond is likely responsible for the difference in conductivity at both stations.
- Other conductivity peaks were observed with corresponding flux in stage due to ice conditions or melt.

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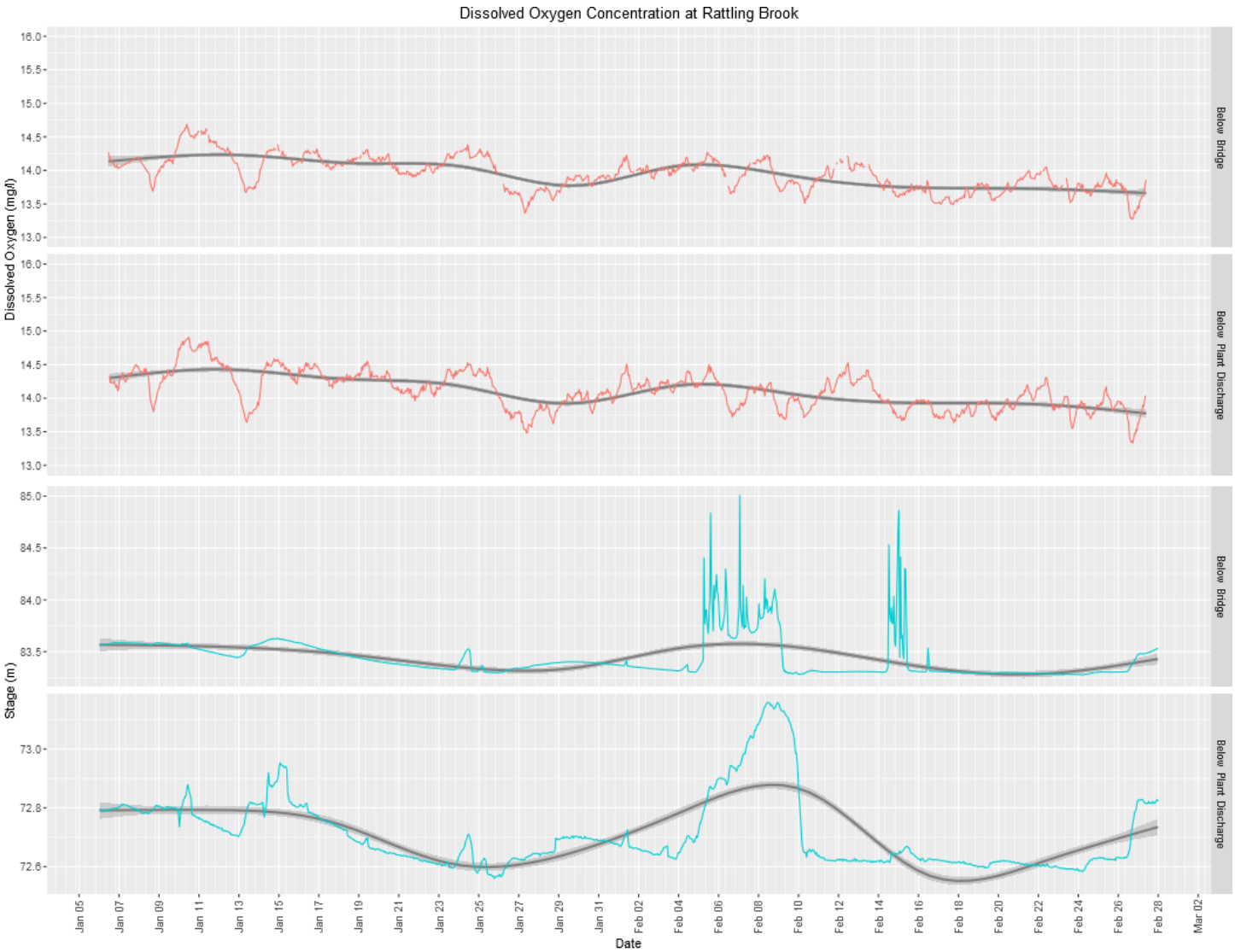
Dissolved Oxygen

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 the presence of oxidizing materials.



Station	Mean	Median	Min	Max
Below Bridge	13.95	13.96	13.27	14.69
Below Plant Discharge	14.11	14.12	13.33	14.91

- While a slight downward trend over the course of the deployment is observed, dissolved oxygen levels remained high during the cold season. Dissolved oxygen levels can be expected to continue their decline as water temperatures increase into the spring season.

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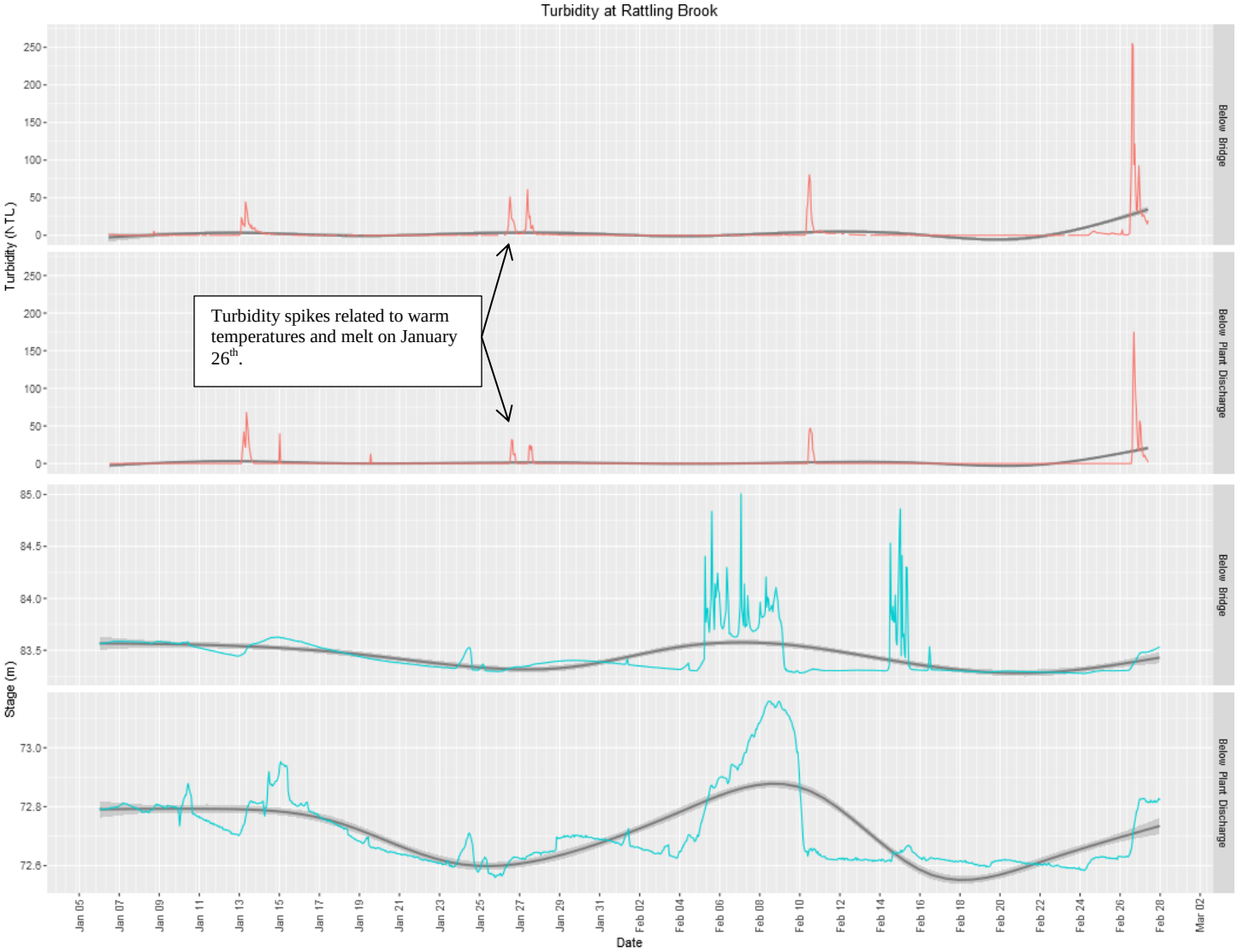
Turbidity

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
Below Bridge	2.7	0.0	0.0	255.2
Below Plant Discharge	1.4	0.0	0.0	174.7

- Median turbidity levels were 0.0 NTU at both stations this deployment period and most substantial peaks are associated with melting conditions or ice dam effects. An especially notable turbidity event was observed at the end of the deployment period during precipitation and melting when turbidity rose to 255 NTU at Bridge station and 175 NTU at Plant Discharge station.

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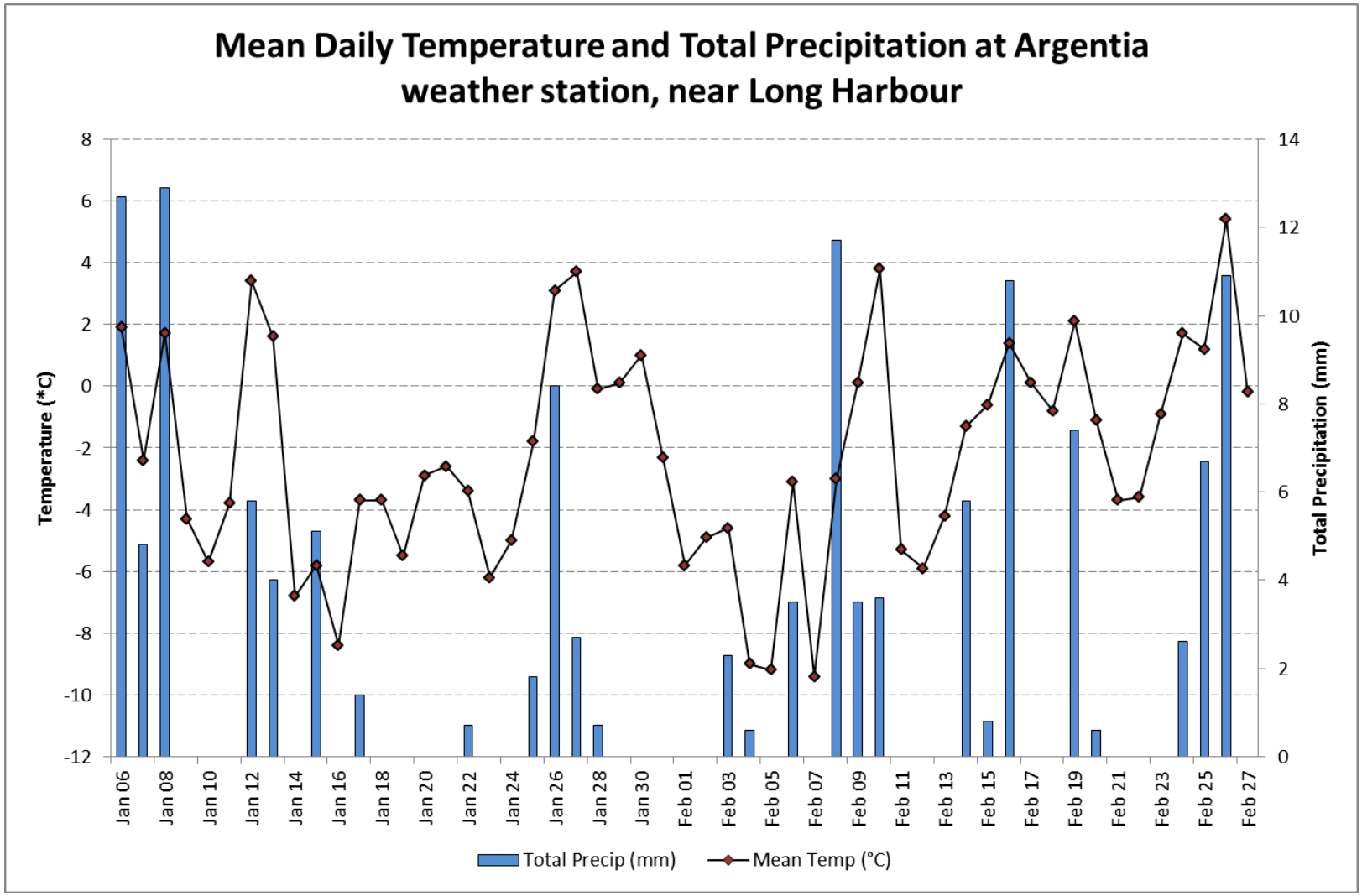
Appendix


Mean Daily Temperature and Total Precipitation at Argentia weather station, near Long Harbour
Temperature (*C)
Total Precipitation (mm)
8
6
4
2
0
-2
-4
-6
-8
-10
-12
14
12
10
8
6
4
2
0
Jan 06
Jan 08
Jan 10
Jan 12
Jan 14
Jan 16
Jan 18
Jan 20
Jan 22
Jan 24
Jan 26
Jan 28
Jan 30
Feb 01
Feb 03
Feb 05
Feb 07
Feb 09
Feb 11
Feb 13
Feb 15
Feb 17
Feb 19
Feb 21
Feb 23
Feb 25
Feb 27
Total Precip (mm)
Mean Temp (°C)