Real-Time Water Quality Deployment Report

Teck: Duck Pond Operations

November 16, 2018 to May 15, 2018

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

Newfoundland Labrador

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General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- Tributary to Gills Pond Brook station experienced a transmission failure in the last week of the deployment resulting in a partial data loss.
- All real-time water quality parameters were found to be within expected ranges for the time of year covered by the deployment period.
- 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.

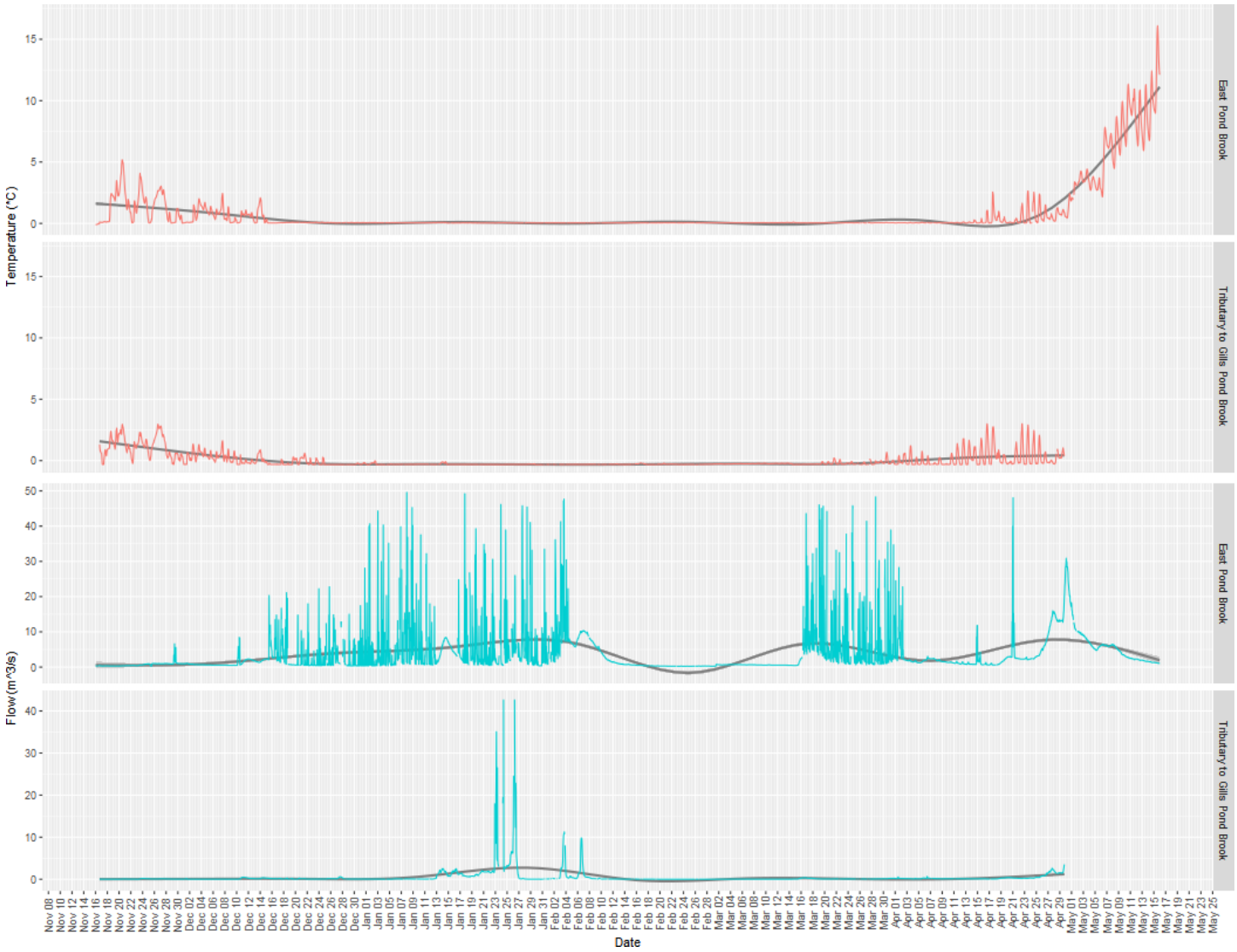
Table 1: Qualitative QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Tributary to Gills Pond Brook	2017-11-16	Deployment	Good	Good	Excellent	Fair	Excellent
	2018-05-15	Removal	Excellent	Good	Excellent	Fair	Excellent
East Pond Brook below East Pond	2017-11-16	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	2018-05-15	Removal	Excellent	Good	Excellent	Fair	Excellent

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
East Pond Brook	0.80	0.05	-0.11	16.10
Tributary to Gills Pond Brook	-0.01	-0.28	-0.34	3.01

- This deployment period spans the entirety of the cold winter season beginning in mid- to late-December until late March. The season is longer at East Pond Brook station by a week at either end of the.

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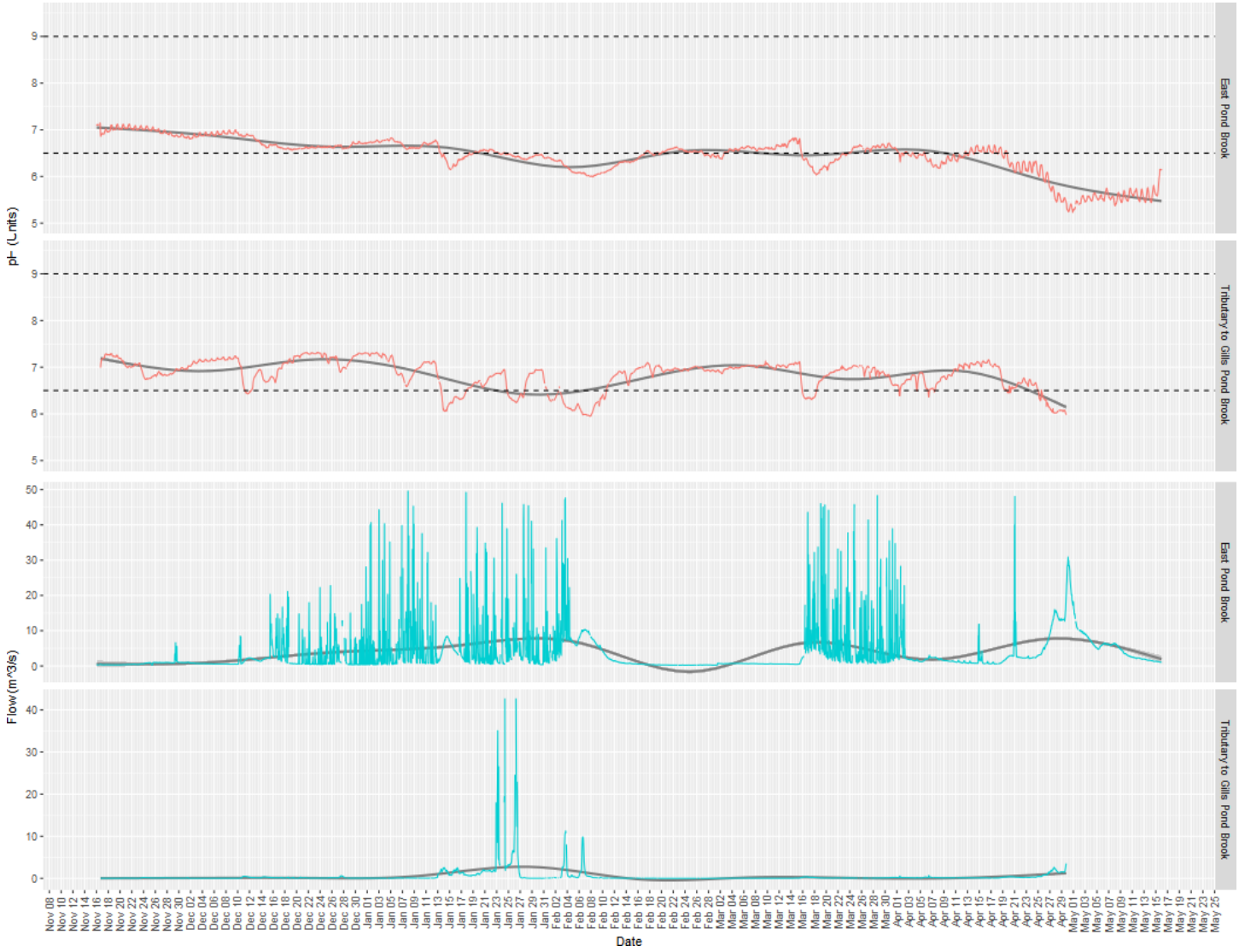
pH

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
East Pond Brook	6.45	6.53	5.23	7.14
Tributary to Gills Pond Brook	6.84	6.93	5.95	7.32

- pH levels declined over the course of the deployment period at East Pond Brook and Tributary to Gills Pond Brook stations. This is a common occurrence during the winter season and may be related to an increase in carbon dioxide concentration (a decrease in carbon dioxide uptake by aquatic vegetation). A higher level of carbon dioxide results into a greater concentration of carbonic acid, pushing pH down slightly. With warming spring temperatures and vegetative production, pH is expected to increase slightly.
- Most pH values were found to be within the CCME guidelines indicated by dashed lines in the figure above.

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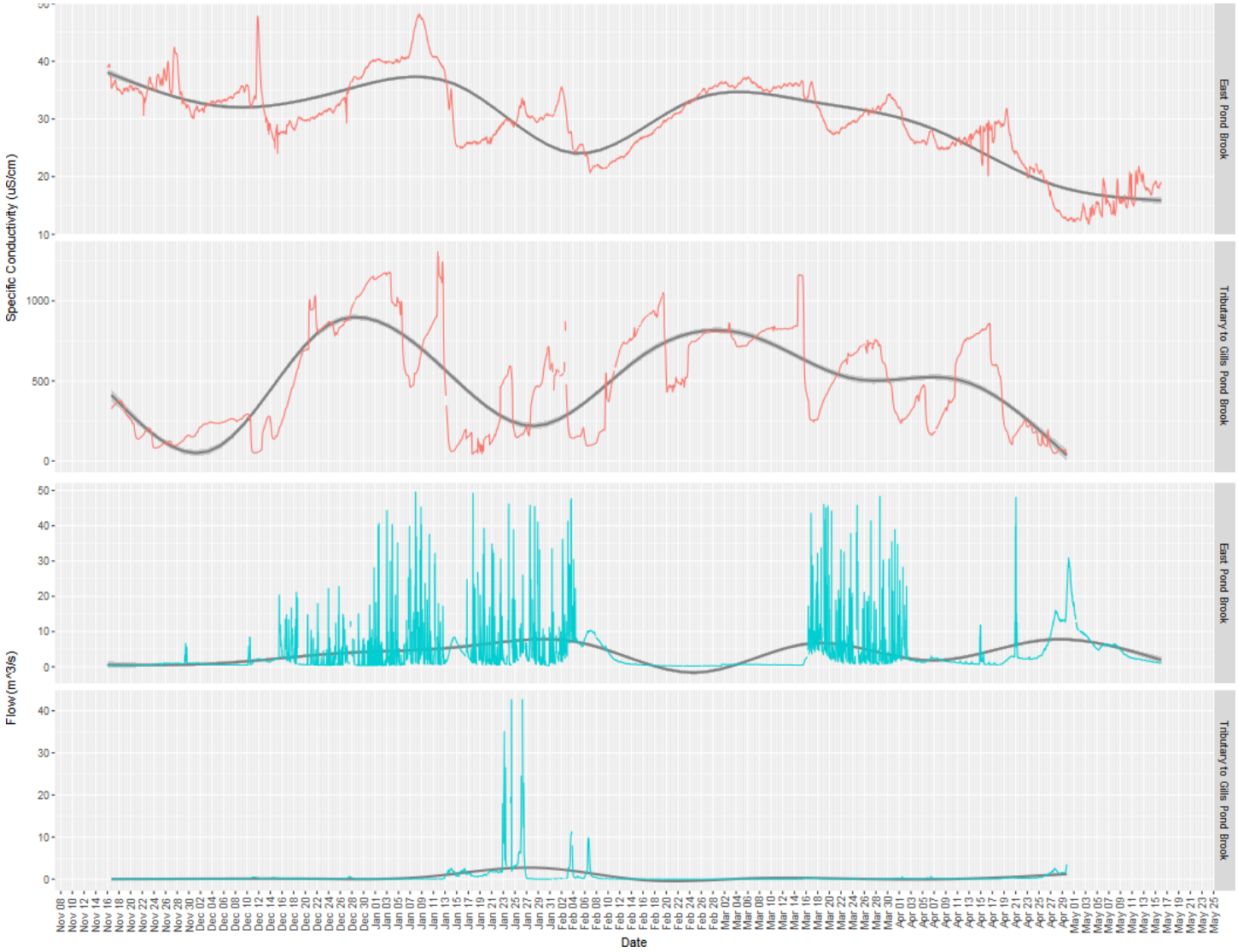
Specific Conductivity

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
East Pond Brook	29.7	30.3	11.8	48.2
Tributary to Gills Pond Brook	496.5	470.0	42.0	1309.0

- A downward trend in specific conductivity at East Pond Brook was observed while no substantial trend was seen at Tributary to Gills Pond Brook. In a 'pristine' environment such as East Pond Brook, the downward winter trend makes sense as dissolved solid inputs are minimalized due to frozen soils. Tributary to Gills Pond Brook, however, is largely fed by an effluent source where dissolved solids concentrations are controlled. A controlled effluence can be expected to remain relatively stable.

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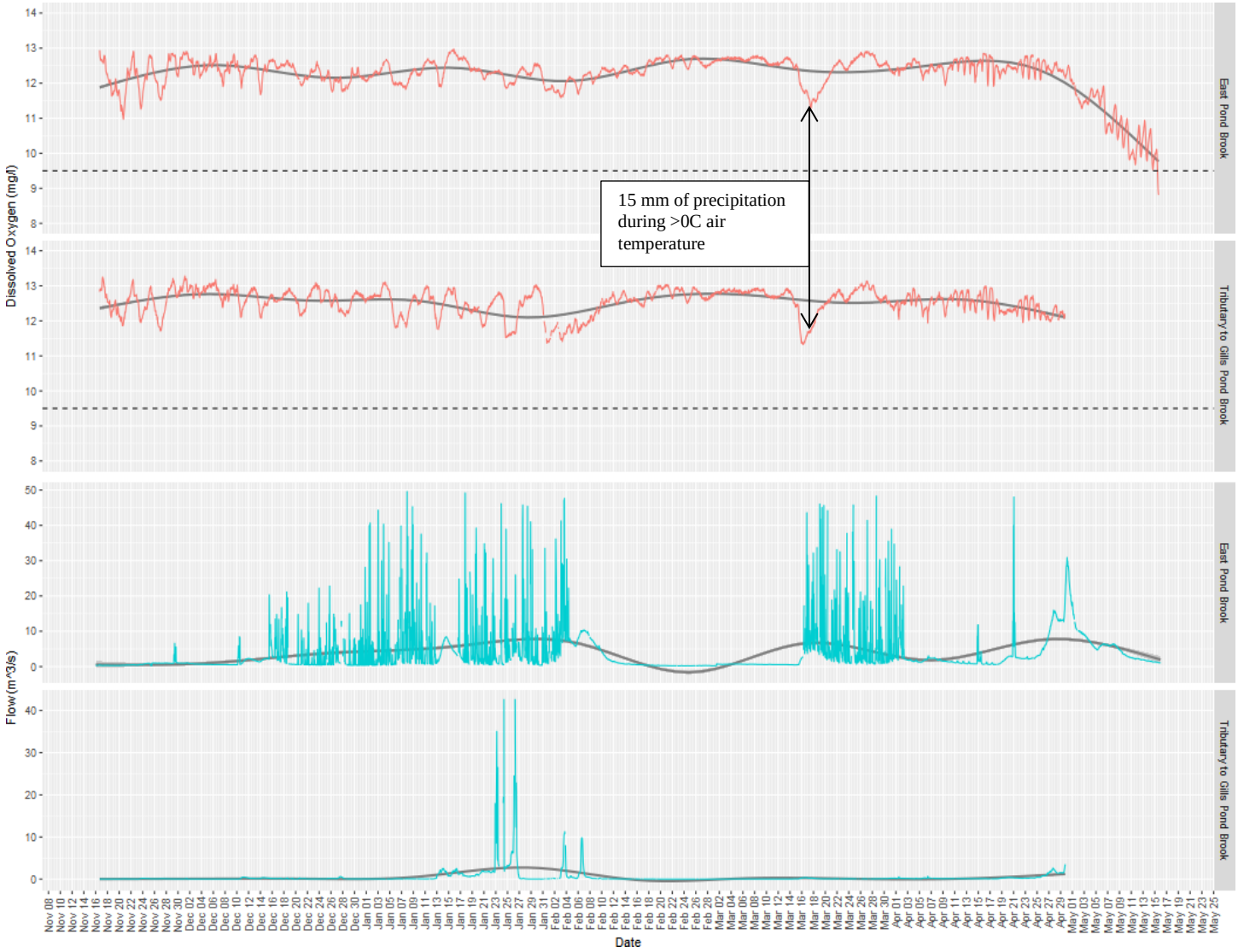
Dissolved Oxygen

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
East Pond Brook	12.25	12.38	8.81	12.98
Tributary to Gills Pond Brook	12.53	12.62	11.33	13.28

- Prior to the transmission failure at Tributary to Gills Pond Brook station, dissolved oxygen concentration trends appeared to be very similar between both stations. A sharp decline and recovery in DO concentration was seen in late during a weather event. A lag of nearly one day between DO low points both stations: Gills Pond Brook reached a minimum on March 18th, while East Pond Brook saw the minimum on March 19th.

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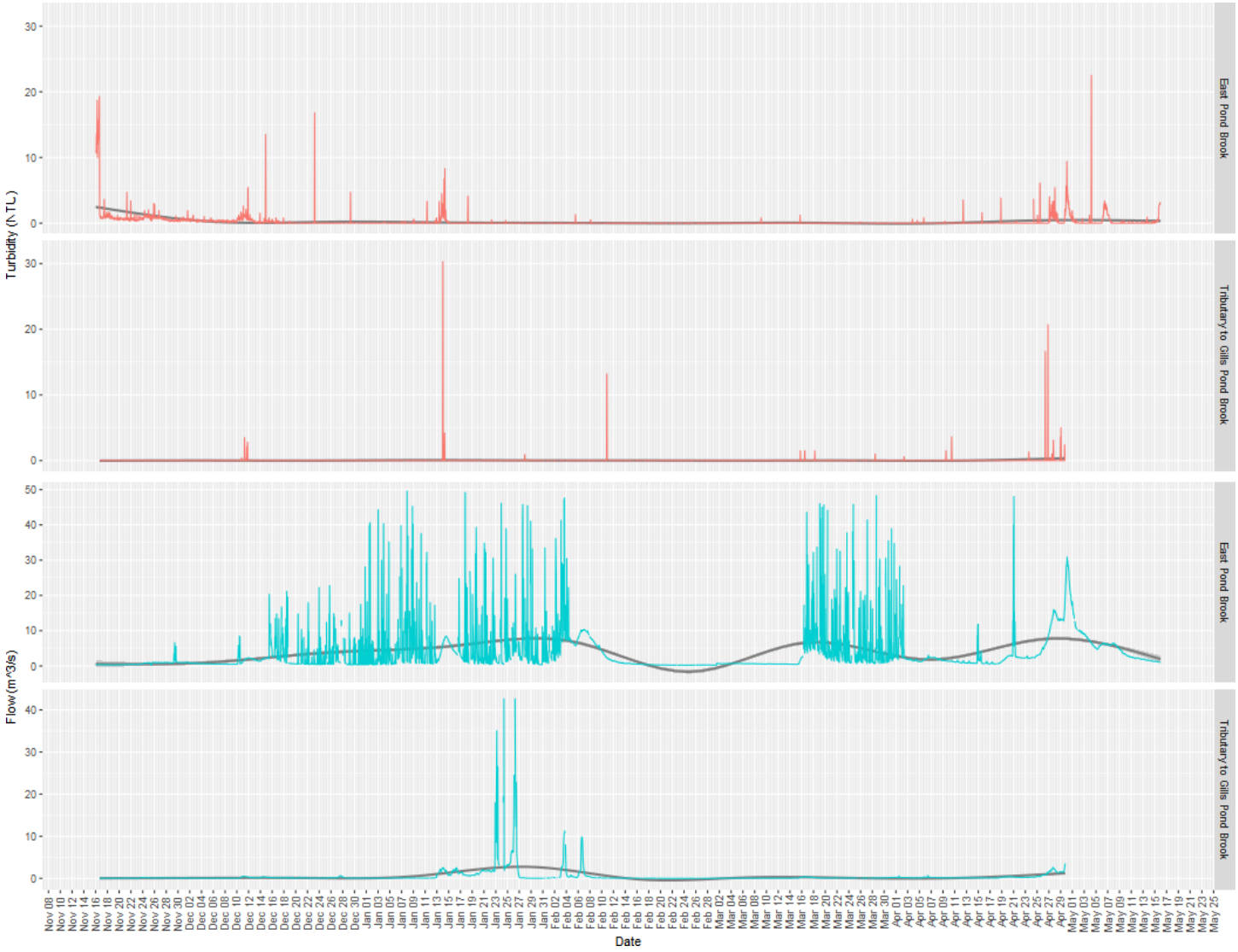
Turbidity

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
East Pond Brook	0.23	0.00	0.00	22.50
Tributary to Gills Pond Brook	0.03	0.00	0.00	30.30

- Median turbidity levels at both monitoring stations were found to be 0.0 NTU during this deployment period, although a number of sporadic turbidity events were recorded over the course of nearly six months. No substantial turbidity events were encountered during the deployment interval.

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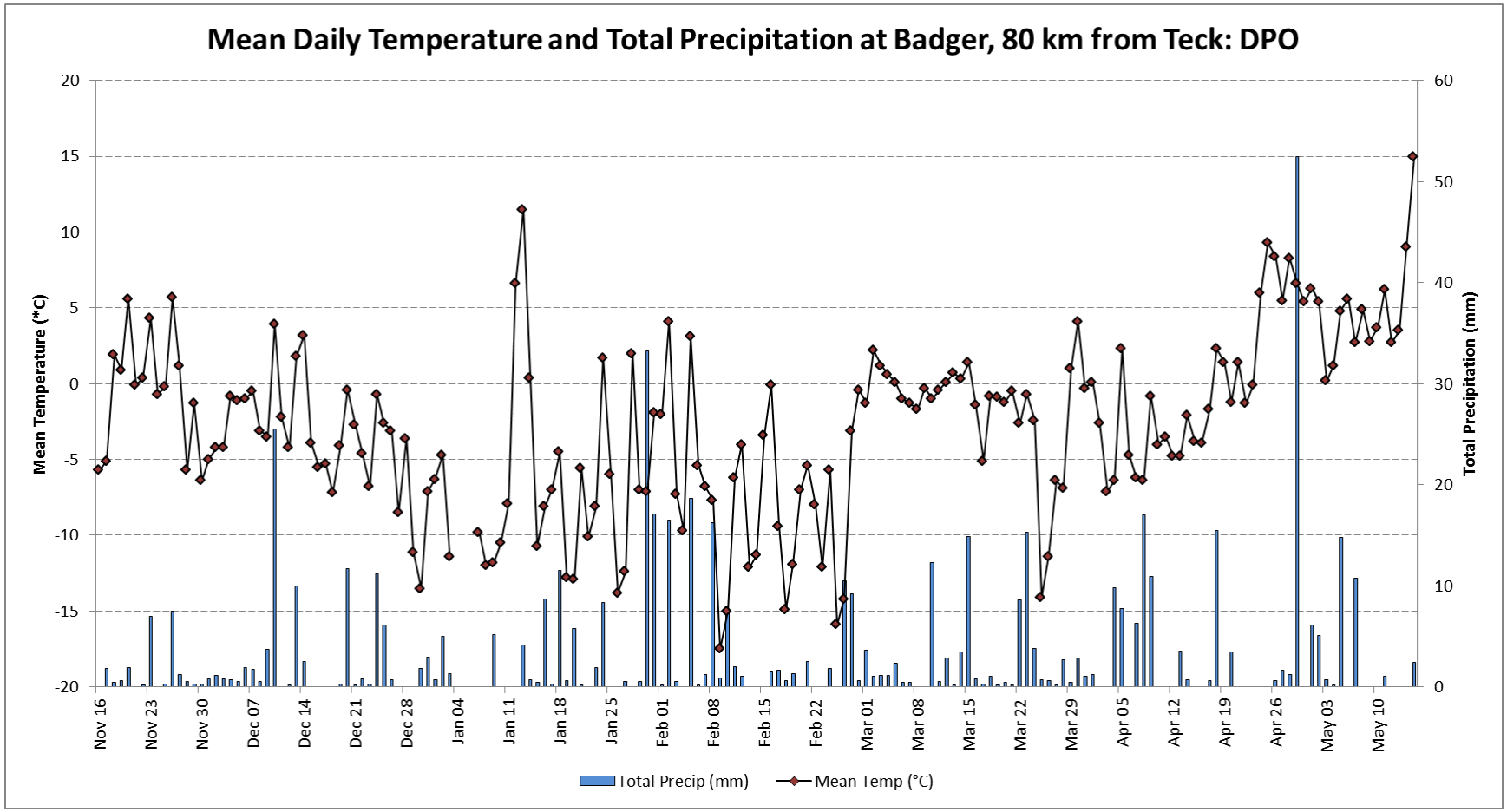
Appendix


Mean Daily Temperature and Total Precipitation at Badger, 80 km from Teck: DPO
Mean Temperature (*C)
Total Precipitation (mm)
20
15
10
5
0
-5
-10
-15
-20
60
50
40
30
20
10
0
Nov 16
Nov 23
Nov 30
Dec 07
Dec 14
Dec 21
Dec 28
Jan 04
Jan 11
Jan 18
Jan 25
Feb 01
Feb 08
Feb 15
Feb 22
Mar 01
Mar 08
Mar 15
Mar 22
Mar 29
Apr 05
Apr 12
Apr 19
Apr 26
May 03
May 10
Total Precip (mm)
Mean Temp (°C)