

Real Time Water Quality Report Teck Duck Pond Operations

Deployment Period 2013-01-01 to 2013-05-10

2013-05-17



Government of Newfoundland & Labrador Department of Environment and Conservation Water Resources Management Division

General

- Water Resources Management Division (WRMD) staff monitors the real-time web page on a daily basis. Any unusual observations are investigated, with site visits being carried out as warranted.
- Management at Teck Duck Pond Operations are informed of any significant water quality events or instrumentation problems by WRMD.
- There was planned discharge of effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) for several intervals during the deployment period: discharge ceased on December 31, 2012; January 7 to January 21, 2013; April 2 to April 7, 2013; April 15 to April 22, 2013; and April 27, 2013 to the end of the deployment period.

Maintenance and Calibration of Instrumentation

- Following a maintenance overhaul and software upgrade, and after being cleaned and freshly calibrated the regular **DataSondes**[®](s/n 43245) for Tributary to Gills Pond Brook and (s/n 43794) for East Pond Brook were installed on November 14, 2012, and remained deployed continuously until May 10, 2013. Due to icing conditions, these instruments remained deployed throughout the winter and until after spring break-up and runoff. The reporting period for these instruments is January 1, 2013 to May 10, 2013; 129 days.
- The regular **MiniSonde**[®] (s/n 47591) was used for QA/QC purposes during the installation of the instruments. It too, was cleaned and freshly calibrated prior to each use.
- The regular Quanta G[®] (s/n 00035) was deployed on October 3, 2012 after being cleaned and freshly calibrated. It remains deployed continuously in Monitoring Well After Tailings Dam Station (MW1) past the end of the current reporting period. The reporting period for this instrument is January 1, 2013 to May 10, 2013; 129 days.
- There are several periods of missing data from the Monitoring Well After Tailings Dam Station (MW1). This has been a reoccurring problem for the past several winters. While numerous mitigative measures have been employed, these periods of missing data continue to plague us, and continue to be investigated.

Quality Assurance / Quality Control (QA/QC) Measures

• As part of the QA/QC protocol, 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. See **Table 1**.

	Rank				
Parameter	Excellent	Good	Fair	Marginal	Poor
Temperature (oC)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	<+/-1
pH (unit)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Sp. Conductance (µS/cm)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Sp. Conductance > 35 μ S/cm (%)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Dissolved Oxygen (mg/L) (% Sat)	<=+/-0.3	>+/-0.3 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Turbidity <40 NTU (NTU)	<=+/-2	>+/-2 to 5	>+/-5 to 8	>+/-8 to 10	>+/-10
Turbidity > 40 NTU (%)	<=+/-5	>+/-5 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20

- For the Surface Water Stations, upon deployment and removal, a QA/QC MiniSonde[®] is usually temporarily deployed along side the Field DataSonde[®]. Values for each recorded parameter are compared between the two instruments. Based upon the difference between the parameters recorded by the Field DataSonde[®] and QA/QC MiniSonde[®] a qualitative statement (Ranking) is usually made on the data.
- The ranking at the beginning of the deployment is documented in the previous deployment report. The ranking for the end of the deployment period is shown in **Table 2** for Tributary to Gill's Pond Brook and **Table 3** for East Pond Brook.
- Because the deployment set-up for Well After Tailings Dam (MW1) is different, comparison with another instrument is not possible. In this case, a grab sample is usually collected at the beginning and end of the deployment period, and the ranking is calculated for pH and Specific Conductance based upon live data and laboratory data. The ranking for the beginning of the deployment period is documented in a previous report. No ranking can be determined for the end of the deployment period, as the unit remains deployed.
- With the exception of water quantity data (Stage and Flow), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Tributary to Gills Pond Brook Station (NF02YO0190)					
Date (yyyy-mm-dd)	Parameter	Ranking			
2013-05-10 Removal	Temp (°C)	Good			
	pH (units)	Excellent			
	Sp. Conductivity (uS/cm)	Excellent			
	Dissolved Oxygen (mg/L)	Excellent			
	Turbidity (NTU)	Excellent			

Table	2
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East Pond Brook Station (NF02YO0192)				
Date (yyyy-mm-dd)	Parameter	Ranking		
2013-05-10 Removal	Temp (°C)	Excellent		
	pH (units)	Good		
	Sp. Conductivity (uS/cm)	Excellent		
	Dissolved Oxygen (mg/L)	Good		
	Turbidity (NTU)	Excellent		

Table 3

Data Interpretation

TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of -0.43 °C to a maximum of 17.87 °C.
- Temperature tended to remain constant near freezing until the first week of April, when it began to increase.
- There appears to be little correlation with stage.



Figure 1

- Throughout the deployment period pH values (Figure 2) ranged from a minimum of 5.87 to a maximum of 7.43 with values fluctuating around the lower limit of the recommended range (6.5 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- An inverse relationship with stage is obvious during most events throughout the deployment period.
- There is a slight increase in pH during, and shortly after, the periods when there was discharge from the Polishing Pond: January 7 to January 21, 2013; April 2 to April 7, 2013; April 15 to April 22, 2013; and April 27, 2013 to the end of the deployment period.
- The background pH of this stream is normally around the lower limit of the recommended range.



Figure 2

- The specific conductivity (Figure 3) ranged from a minimum of 18.6 μS/cm to a maximum of 1171.0 μS/cm over the deployment period.
- There is a marked increase in specific conductance during, and shortly after, the periods when there was discharge from the Polishing Pond: January 7 to January 21, 2013; April 2 to April 7, 2013; April 15 to April 22, 2013; and April 27, 2013 to the end of the deployment period.



Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 8.60 mg/L to a maximum of 13.36 mg/L over the deployment period, with the percent saturation ranging between 72.2 and 94.3.
- Dissolved oxygen is generally inversely proportional to water temperature.
- Nearly all of the dissolved oxygen values fell above the upper limit recommended by CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (cold water/other life stages – above 6.5 mg/L; cold water/early life stages – above 9.5 mg/L).
- Based upon the fact that Dissolved Oxygen % saturation had minimal change over the deployment period, we can be confident that the Dissolved Oxygen mg/L values are accurate.



Figure 4

- The turbidity values (Figure 5) ranged from a minimum of 0.0 NTU to a maximum of 334.2 NTU.
- Based upon previous investigation, it has been determined that turbidity values may be artificially increased due to air entrainment during higher flows.
- There were two significant peaks in turbidity (April 21 and April 28, 2013) which both occurred during discharges from Polishing Pond. These peaks was short lived; only a few hours. However, subsequent discharges from Polishing Pond must be monitored to ensure that increased turbidity does not become a reoccurring and continuing problem.
- The other minor individual turbidity spikes are likely due to air bubbles or natural in-stream debris passing over the sensor.
- Neither in-situ nor grab sample measurements nor visual observation indicated turbidity issues.



Figure 5

- The changes in stage and flow are not entirely evident or correspond to the cessation of discharge from the Polishing Pond. A number of precipitation/runoff event affect the stage and flow more significantly.
- All values are within the normal range.



Figure 6

EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 0.03 °C to a maximum of 18.91 °C.
- Temperatures remained constant near zero until the third week of March when they began to increase.
- There appears to be little correlation with stage



Figure 7

- Throughout the deployment period pH values (Figure 8) ranged from a minimum of 5.11 to a maximum of 6.35.
- An inverse relationship with stage is obvious for several runoff events, particularly after the beginning of March.
- pH values were all below the lower limit of the recommended range (6.5 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life.*
- The background pH of this stream is normally quite low, and values near and below the lower limit are not unusual.



Figure 8

- The specific conductivity (Figure 9) ranged from a minimum of 12.6 μS/cm to a maximum of 45.0 μS/cm.
- Highest values were evident prior to the beginning of March, which typically represent the influence of groundwater inputs into the stream which have a higher specific conductance.
- An inverse relationship with stage is obvious for several runoff events, particularly after the beginning of March.
- All values are within the normal range.



Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 8.62 mg/L to a maximum of 13.16 mg/L over the deployment period, with the percent saturation ranging between 78.0 and 94.1.
- Dissolved oxygen is generally inversely proportional to water temperature.
- Throughout the deployment period, nearly all dissolved oxygen values fell above the upper limit recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (cold water/other life stages – above 6.5 mg/L; cold water/early life stages – above 9.5 mg/L).
- Based upon the fact that Dissolved Oxygen % Saturation had limited drift, we can be confident that the Dissolved Oxygen mg/L values are accurate.



Figure 10

- The turbidity values (Figure 11) ranged from a minimum of 0.0 NTU to a maximum of 14.8 NTU.
- The periods when turbidity was above zero correspond to higher flows and are likely attributed to natural in-stream debris.
- Neither in-situ nor grab sample measurements nor visual observation indicated turbidity issues.



Figure 11

- The stage or water level ranged from a minimum of 1.01 m to a maximum of 5.07 m. The flow or discharge ranged from a minimum of 0.44 m³/s to a maximum of 13.5 m³/s (Figure 12).
- Prior to the beginning of March, there were several marked increases in stage and flow. These increases are attributed to the backwater effect resultant from ice in this stream.
- All values for stage and flow are within the normal range.



Figure 12

WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 5.28 °C to a maximum of 6.03 °C with a decrease over the deployment period.
- There appears to be no correlation with water elevation.



Figure 13

- The pH (Figure 14) ranged from a minimum of 8.17 to a maximum of 8.32 with a slight increase over the deployment period.
- There does not appear to be any correlation with water elevation.



Figure 14

- The specific conductivity (Figure 15) ranged from a minimum of 0.711 mS/cm to a maximum of 0.743 mS/cm.
- There was a slight decrease over the deployment period.
- There does not seem to be any correlation with water elevation.



Figure 15

- The Water Elevation (Figure 16) ranged from a minimum of 270.84 m to a maximum of 271.06 m.
- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by runoff from precipitation.



Figure 16

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