

# Real Time Water Quality Report Teck Duck Pond Operations

Deployment Period 2015-05-27 to 2015-07-03

2015-07-14



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 no discharge of effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) over this deployment period.

### Maintenance and Calibration of Instrumentation

- DataSonde<sup>®</sup>(s/n 43245) was deployed in Tributary to Gills Pond Brook on May 27, 2015 after being cleaned and freshly calibrated, and remained deployed continuously until July 3, 2015; a 36 day period.
- **DataSonde**<sup>®</sup>(s/n 43794) was deployed in East Pond Brook on May 27, 2015 after being cleaned and freshly calibrated, and remained deployed continuously until July 3, 2015; a 36 day period.
- MiniSonde<sup>®</sup> (s/n 47591) was used for QA/QC purposes during the installation of the instruments. This unit, having the same technical specifications as the DataSondes<sup>®</sup>, was cleaned and freshly calibrated prior to each use.
- Quanta G<sup>®</sup> (s/n 00035) was deployed on November 19, 2014 after being freshly cleaned and calibrated and remained deployed continuously in Monitoring Well After Tailings Dam Station (MW1) over-winter, and was removed on June 1, 2015. A second until Quanta G<sup>®</sup> (s/n 000653) was deployed from June 1, 2015 until June 16, 2015. Unfortunately, this unit failed upon deployment, and no valid data were obtained. Quanta G<sup>®</sup> (s/n 00035) was re-deployed on June 16, 20115 and remained deployed until past the end of the current reporting period.

## 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 $\mu$ 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<sup>®</sup> is usually temporarily deployed along side the Field DataSonde<sup>®</sup>. Values for each recorded parameter are compared between the two instruments. Based upon the difference between the parameters recorded by the Field DataSonde<sup>®</sup> and QA/QC MiniSonde<sup>®</sup> a qualitative statement (Ranking) is usually made on the data.
- The rankings at the beginning and end of the deployment period are shown in **Table 2** for Tributary to Gill's Pond Brook and **Table 3** for East Pond Brook. **Table 4** for depicts the ranking for Well After Tailings Dam (MW1) upon removal in June 1, 2015 and installation on June 16, 2015.
- For Tributary to Gills Pond Brook a 'Marginal' ranking for Specific Conductivity was calculated upon installation of the instrument. The deployed Sonde recorded 46.7  $\mu$ S/cm, while the QA/QC Sonde recorded 39.1  $\mu$ S/cm, a difference of 16.3  $\mu$ S/cm.
- 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 Conductivity based upon live data and laboratory data.
- As **Quanta G**<sup>®</sup> (s/n 00035) was deployed in this well, prior to the beginning of this reporting period, the ranking for the initial deployment is documented in a previous report. Upon removal on June 1, 2015, there was a 'Marginal' ranking for pH. The deployed unit had a measurement of 8.73, while the grab sample was reported to be 7.91.
- A second until **Quanta**  $G^{(0)}$  (s/n 000653) was deployed from June 1, 2015 until June 16, 2015. Unfortunately, this unit failed upon deployment, and no valid data were obtained. Accordingly, rankings for this deployment cannot be calculated.
- Quanta G<sup>®</sup> (s/n 00035) was re-deployed on June 16, 20115 and remained deployed until past the end of the current reporting period.
- 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		
2015-05-27 Installation	Temp (°C)	Good		
	pH (units)	Excellent		
	Sp. Conductivity ( $\mu$ S/cm)	Marginal		
	Dissolved Oxygen (mg/L)	Excellent		
	Turbidity (NTU)	Excellent		
2015-07-03 Removal	Temp (°C)	Good		
	pH (units)	Excellent		
	Sp. Conductivity ( $\mu$ S/cm)	Good		
	Dissolved Oxygen (mg/L)	Excellent		
	Turbidity (NTU)	Excellent		

# Table 2

East Pond Brook Station (NF02YO0192)				
Date (yyyy-mm-dd)	Parameter	Ranking		
2015-05-27 Installation	Temp (°C)	Excellent		
	pH (units)	Good		
	Sp. Conductivity (µS/cm)	Excellent		
	Dissolved Oxygen (mg/L)	Good		
	Turbidity (NTU)	Excellent		
2015-07-03 Removal	Temp (°C)	Excellent		
	pH (units)	Excellent		
	Sp. Conductivity (µS/cm)	Excellent		
	Dissolved Oxygen (mg/L)	Excellent		
	Turbidity (NTU)	Excellent		

Table 3

Well After Tailings Dam (MW1) Station (NF02YO0193)				
Date (yyyy-mm-dd)	Parameter	Ranking		
2015-06-01	pH (units)	Marginal		
Removal	Sp. Conductivity ( $\mu$ S/cm)	Good		
2015-06-16	pH (units)	Good		
Installation	Sp. Conductivity (µS/cm)	Good		

Table 4

### **Data Interpretation**

# TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) ranged from a minimum of 6.89°C to a maximum of 23.35°C.
- Water temperatures rose slightly during the deployment period.
- Water temperatures were slightly lower, with less diurnal variation during periods of increased stage during this deployment period.



Figure 1

- Throughout the deployment period, pH values (Figure 2) ranged from a minimum of 5.97 to a maximum of 7.05.
- During this deployment period pH remained just above or below 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 throughout the deployment period.



Figure 2

- The specific conductivity (Figure 3) ranged from a minimum of 29.3 μS/cm to a maximum of 70.6 μS/cm over the deployment period.
- Although subtle, there appears to be an inverse relationship between specific conductivity and stage.
- There was no discharge of treated effluent from Polishing Pond during the deployment period.



Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 7.87 mg/L to a maximum of 11.25 mg/L over the deployment period, with the percent saturation ranging between 85.7 and 97.6.
- Dissolved oxygen (mg/L) decreased towards the end of the deployment period, inversely proportional to the increase in water temperature (see Figure 1).
- All of the dissolved oxygen values fell above the minimum for Other Life Stages (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). This range is typical based upon water temperatures.
- Based upon the fact that dissolved oxygen % saturation had minimal and predictable 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 0.9 NTU.

Figure 5

- Increases in stage and flow are the result of precipitation/runoff events.
- Stage and flow are all within normal ranges.
- Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.



Figure 6

## EAST POND BROOK

- The water temperature (**Figure 7**) ranged from a minimum of 9.37 °C to a maximum of 23.56 °C.
- Water temperatures rose slightly over the deployment period.
- There does not appear to be any correlation with stage during this deployment period, however there is less diurnal variation during periods of higher stage.



Figure 7

- Throughout the deployment period pH values (Figure 8) ranged from a minimum of 6.19 to a maximum of 6.87.
- Throughout the deployment period, pH values were right 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*.
- There is a slight inverse relationship between pH and stage throughout most of the period.
- 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 17.9 μS/cm to a maximum of 32.9 μS/cm.
- There was little correlation between specific conductivity and stage evident during this deployment period.



Figure 9

- The dissolved oxygen (**Figure 10**) values ranged from a minimum of 7.88mg/L to a maximum of 10.66 mg/L over the deployment period, with the percent saturation ranging between 88.2 and 95.6.
- Dissolved oxygen (mg/L) decreased towards the end of the deployment period, inversely proportional to the increase in water temperature (see Figure 7).
- All of the dissolved oxygen values fell above the minimum for Other Life Stages (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). This range is typical based upon water temperatures.
- Based upon the fact that dissolved oxygen % saturation had minimal and predictable change over the deployment period, 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 1654.0 NTU.
- Apart from the one significant spike on July 1, 2015, turbidity readings were at or near zero NTU. The only spike (only one hourly measurement) is likely the result of instream debris caught in the sensor, or some short term natural event.



Figure 11

- Increase in stage and flow are the result of precipitation/runoff events.
- Stage and flow are all within normal ranges.
- Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.



Figure 12

### WELL AFTER TAILING DAM (MW1)

- The water temperature (**Figure 13**) ranged from a minimum of 4.86 °C to a maximum of 5.05 °C with a general decrease over the reporting period.
- There appears to be no correlation with water elevation.



Figure 13

- The pH (**Figure 14**) ranged from a minimum of 7.57 to a maximum of 8.72.
- The rapid increase in pH following the June 16, 2005 instrument deployment is typical and has been well documented previously.
- There does not appear to be any correlation with water elevation.



Figure 14

- The specific conductivity (Figure 15) ranged from a minimum of 0.771 mS/cm to a maximum of 0.792 mS/cm.
- There was little change over the reporting period.



Figure 15

- The Water Elevation (**Figure 16**) ranged from a minimum of 270.75 m to a maximum of 270.86 m.
- Water elevation in this well corresponds to increased water level in an adjacent stream, and is influenced by precipitation/runoff events, as well as the water elevation in the nearby Tailings Management Area.



Figure 16

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