

Real Time Water Quality Report Duck Pond Operations (Teck Cominco Limited)

Deployment Period 2008-12-17 to 2009-01-14

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 Duck Pond Operations are informed of any significant water quality events or instrumentation problems by WRMD.
- Tributary to Gills Pond Brook Station is located 1700 m downstream of the final discharge point for the mine's Polishing Pond. This station is located such that any impacts from the mine discharge on receiving waters can be measured.
- East Pond Brook Station is located several kilometres downstream of the Tailings Management Area. This station is located such that any surface water impacts from the Tailing Management Area via seepage through Dam A may be measured.
- Monitoring Well After Tailings Dam Station is located near Tailings Dam A. This station is located such that any ground water impacts from the Tailing Management Area via seepage through Dam A may be measured.
- The two DataSondes (Tributary to Gills Pond Brook Station and East Pond Brook Station) are set up to measure Ammonium and Nitrate however, technical problems with the instrumentation render readings of these parameters unreliable. Therefore, these parameters will not be discussed or interpreted until the technical problems have been overcome and the data are reliable.
- Many of the graphs below show vertical lines from the data string to zero or the bottom of the graph. These lines indicate when a probe was off-line or removed from service.
- There was effluent from Polishing Pond into the receiving waters (Tributary to Gills Pond Brook) from the beginning of the deployment period until mid day on January 8, 2009, when discharge was stopped due to an exceedance of regulated discharge criteria.
- Raw (uncorrected) data has been used in the preparation of the graphs and subsequent discussion below.

Maintenance and Calibration of Instrumentation

- The regular DataSondes were deployed in Tributary to Gills Pond Brook and East Pond Brook on December 17, 2008, after being cleaned, serviced and freshly calibrated. Both instruments remain deployed beyond the reporting period (28 day period), and will remain deployed throughout the winter months.
- The Quanta G probe remains deployed in Monitoring Well After Tailings Dam Station (MW1) after being installed on November 14, 2008. Due to this well freezing at surface, this probe will remain deployed throughout the winter months. The report covers a 28 day period from December 17, 2008 to January 14, 2009.
- *In-situ* measurements of ambient water quality were undertaken with a freshly calibrated MiniSonde each time a DataSonde was installed. No *in situ* measurements can be taken in the Monitoring Well.
- The comparative results between the MiniSonde and DataSonde values at the beginning of the deployment period are shown in **Table 1** for Tributary to Gill's Pond Brook and **Table 2** for East Pond Brook.

Table 1: QA/QC Data Comparison Ranking During Deployment Period

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
Tributary to Gill's Pond Brook	2008-12-17	Installation	Excellent	Poor	Excellent	Poor

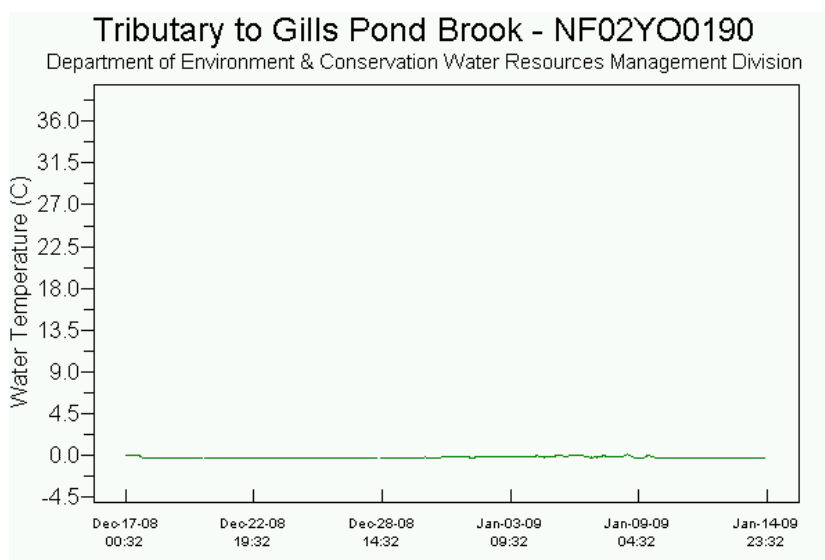
Table 2: QA/QC Data Comparison Ranking During Deployment Period

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
East Pond Brook	2008-12-17	Installation	Excellent	Excellent	Excellent	Good

Data Interpretation

TRIBUTARY TO GILLS POND BROOK

- The water temperature (**Figure 1**) remained constant throughout the deployment period. Temperature values ranged from a minimum of - 0.31 °C to 0.12 °C over the deployment period.

**Figure 1**

- Throughout the deployment period pH values (**Figure 2**) ranged from a minimum of 6.75 to a maximum of 8.02 with all of the values falling within 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 around the lower limit of the recommended range, however, discharge from Polishing Pond results in an increased pH. There is a curious spike in pH around January 5, 2009. We are still awaiting information from Duck Pond Operations as to what may have caused this spike. The pH decreases following the cessation of discharge from Polishing Pond on January 8, 2009.

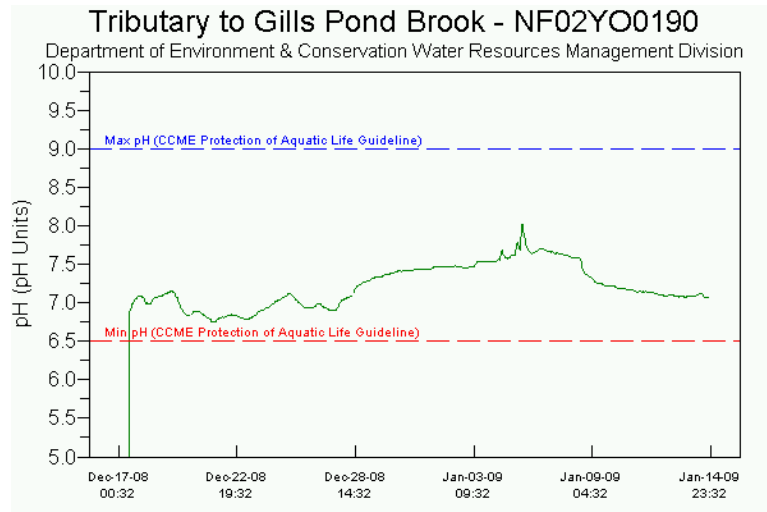


Figure 2

- The specific conductance (**Figure 3**) ranged from a minimum of 96.7 $\mu\text{S}/\text{cm}$ to a maximum of 721 $\mu\text{S}/\text{cm}$ over the deployment period. From the beginning of the deployment period until the cessation of discharge from Polishing Pond on January 8, 2009, there is a constant increase in conductivity. Conductivity falls off dramatically in the six (6) days following the cessation of discharge. A small dip around December 25, 2008 corresponds to a major precipitation event. Conductivity at East Pond Brook shows a general increase over the same deployment period (**Figure 11**)

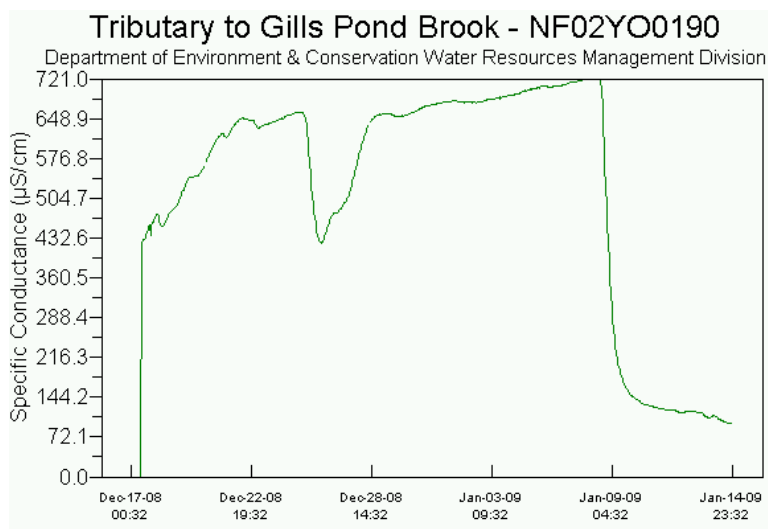


Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 11.61 mg/L to a maximum of 13.64 mg/L over the deployment period. All dissolved oxygen values fall within the recommended 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).

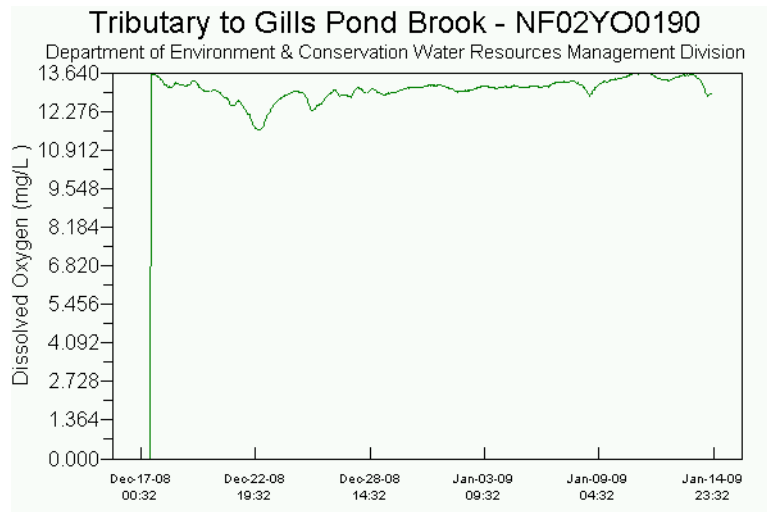


Figure 4

- The turbidity values (**Figure 5**) ranged from a minimum of 0.0 NTU to a maximum of 317.4 NTU. One *in situ* measurement was taken by staff of Department of Environment and Conservation at the beginning of the deployment period. This value was 2.3 NTU. Results of grab samples have not yet been received.
- Based upon previous investigation, it has been determined that turbidity values are artificially increased due to air entrainment. Accordingly, the on-line real time turbidity graph for this station now contains the following comment “*Turbidity values may be exaggerated due to air entrainment (turbulent flow)*”.
- Due to the fact that the DataSonde has previously moved from its placed location (presumably due to the high water velocity) a fixed anchor point has been installed mid-stream by staff of Duck Pond Operations. On December 19, 2008 a 1.0 meter tether cable (**Figure 6**) was attached to the bottom of the DataSonde’s stainless steel protective casing, and attached to the fixed anchor point. It is anticipated that this will keep the probe in the deepest part of the pool to keep it fully submerged and hopefully protected from freezing during the winter months. The probe was placed so as to minimize the impacts of air entrainment, while keeping it in the deepest part of the pool (**Figure 7**).

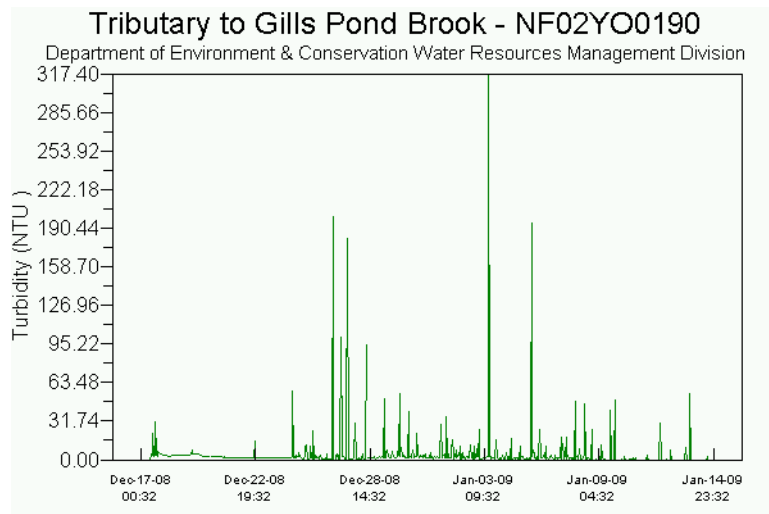


Figure 5

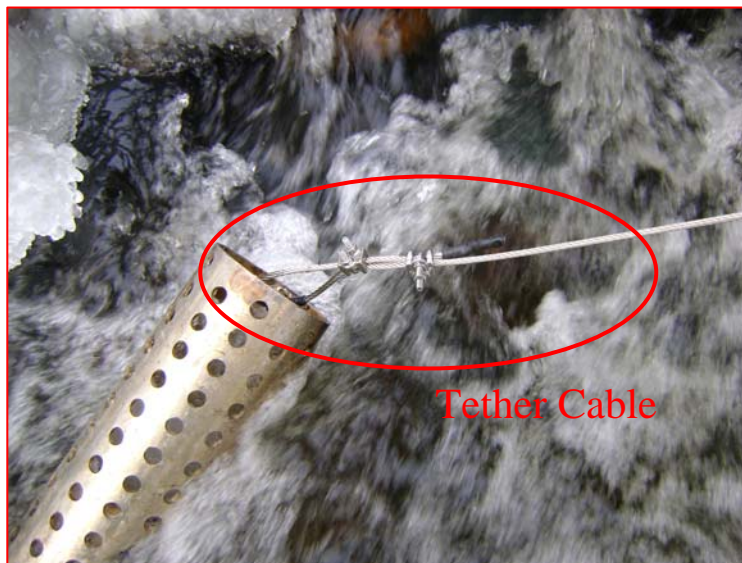


Figure 6

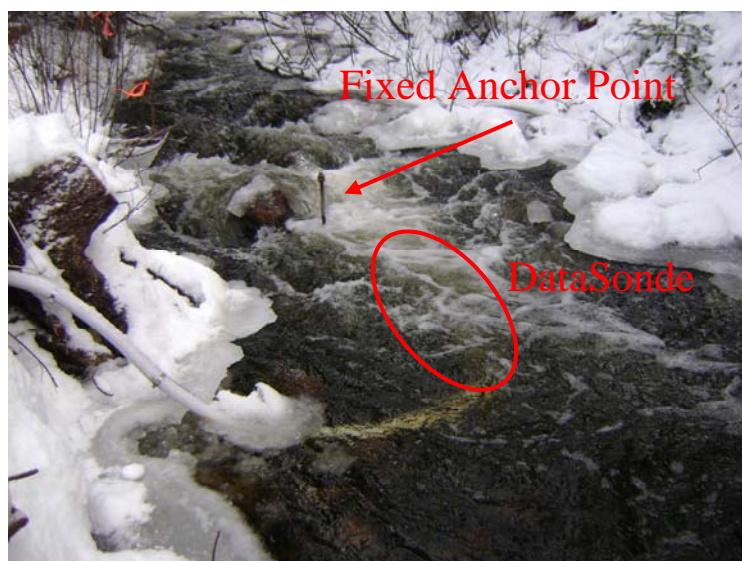


Figure 7

- The stage (**Figure 8**) or water level ranged from a minimum of 1.23 m to a maximum of 1.63 m. The peak from beginning of deployment period until December 23, 2008 is the result of backwater caused by ice formation in the stream. A little peak on December 25, 2008 is the result of a rainfall event. The flat period from December 28, 2008 until January 8, 2009 is stability under ice cover. The end of the discharge period from Polishing Pond on January 8, 2009 is also obvious.

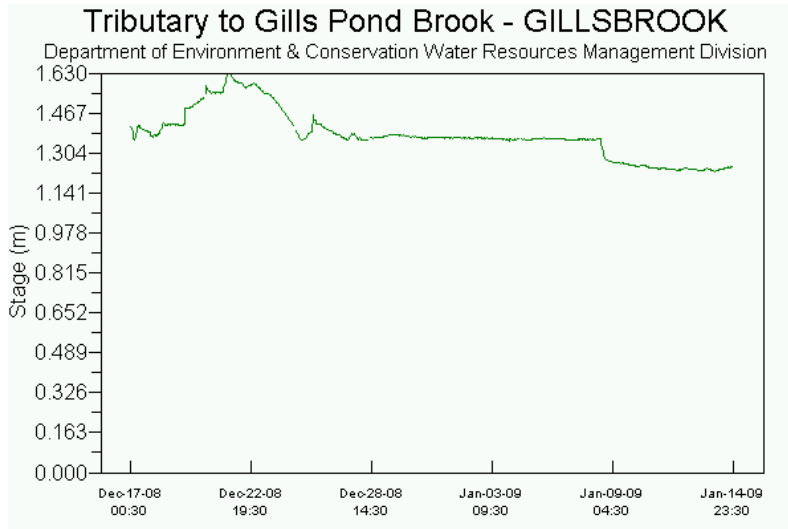


Figure 8

EAST POND BROOK

- The water temperature (**Figure 9**) remained constant throughout the deployment period, ranging from a minimum of -0.13°C to a maximum of -0.08°C .

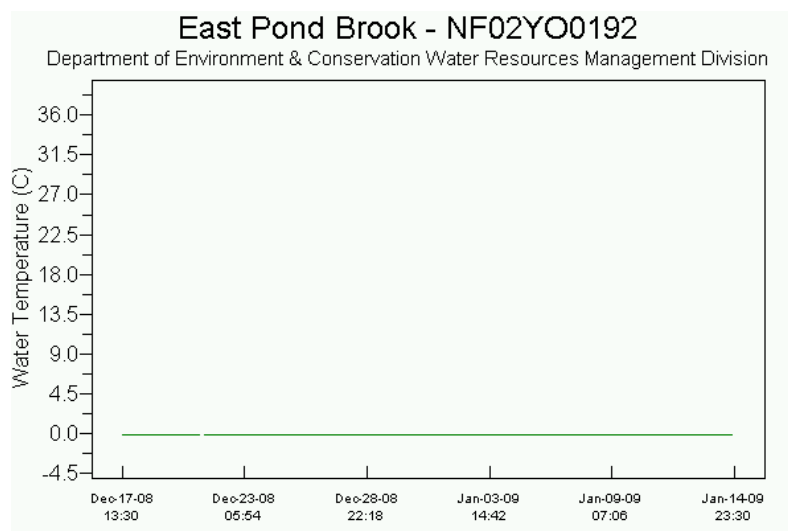


Figure 9

- pH values (**Figure 10**) increased slightly over the deployment period, ranging between 6.06 and 6.62. During the initial part of the deployment period, pH values fell outside 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.

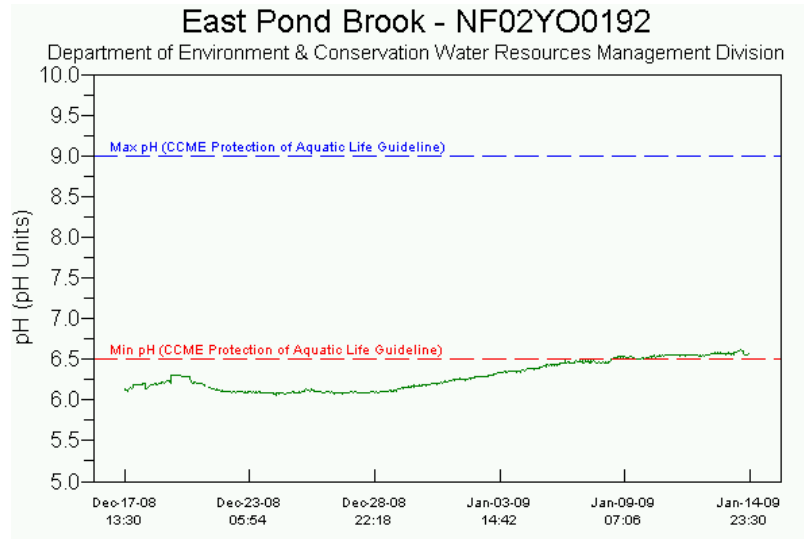


Figure 10

- The specific conductance (**Figure 11**) increased significantly over the deployment period. Values ranged from a minimum of 9.8 $\mu\text{S}/\text{cm}$ to a maximum of 33.0 $\mu\text{S}/\text{cm}$.

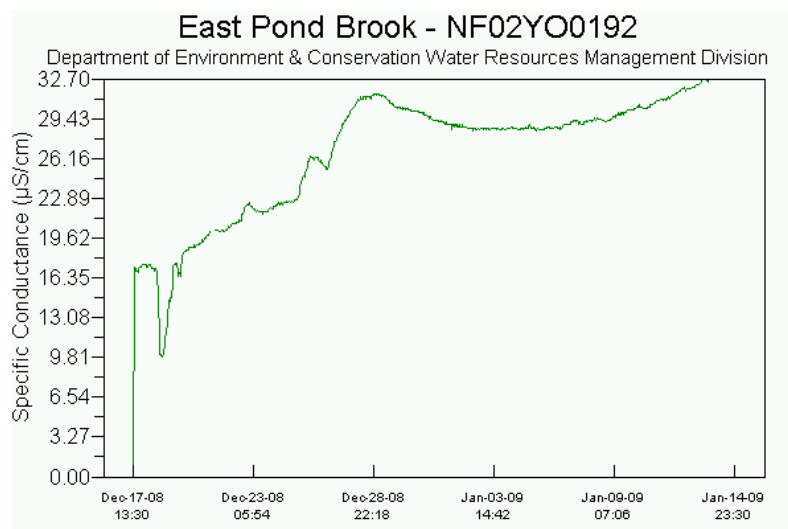


Figure 11

- The dissolved oxygen (**Figure 12**) values ranged from a minimum of 12.73 mg/L to a maximum of 14.13 mg/L over the deployment period. All dissolved oxygen values fall within the recommended 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).

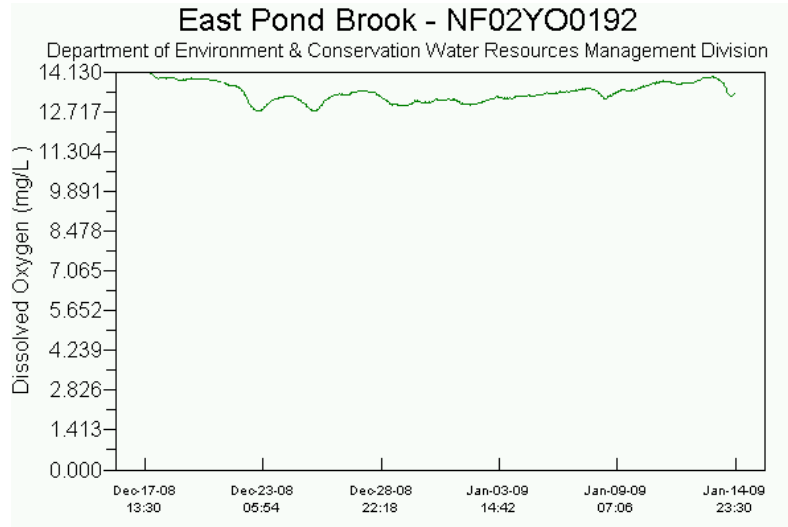


Figure 12

- The turbidity values (**Figure 13**) ranged from 0 NTU to 9.6 NTU throughout the deployment period. There were only two minor spikes. As these turbidity measurements were not sustained, there is no water quality impairment. Higher values can be attributed to natural sediment and debris in the stream. There was no evidence of water quality impairment.

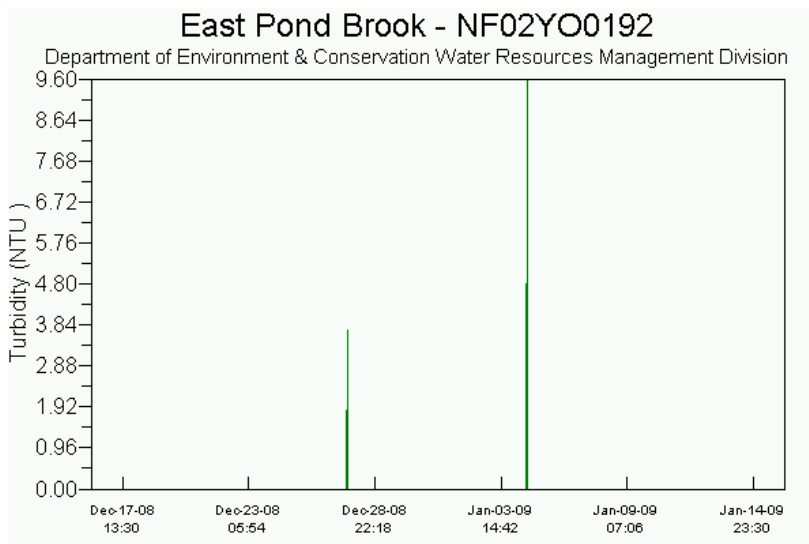


Figure 13

- The stage (**Figure 14**) or water level ranged from a minimum of 1.01 m to a maximum of 2.79 m. The higher peaks are the result of backwater during ice formation. It is unlikely that this stream would ever reach a stage of 2.79 m.

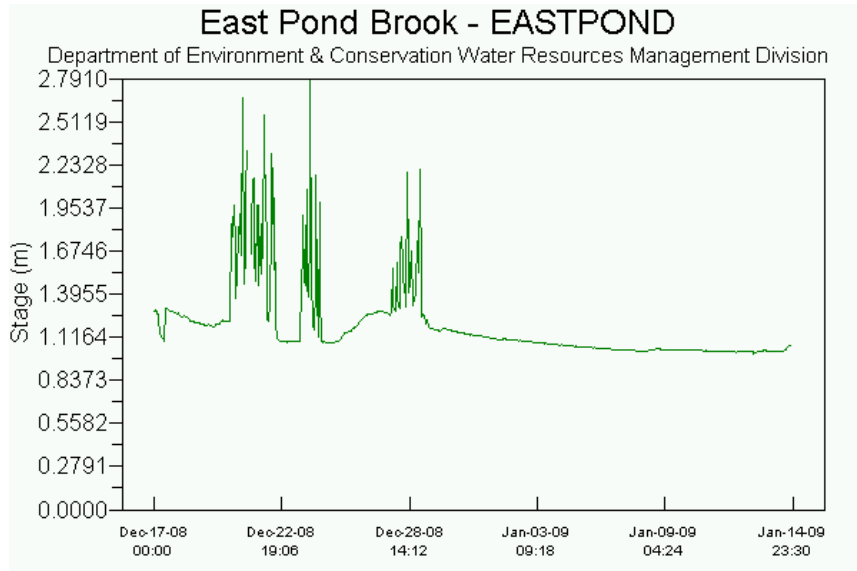


Figure 14

WELL AFTER TAILING DAM A

- Throughout the deployment period, water temperature (**Figure 15**) remained constant ranging between 5.59 °C and 5.61 °C.

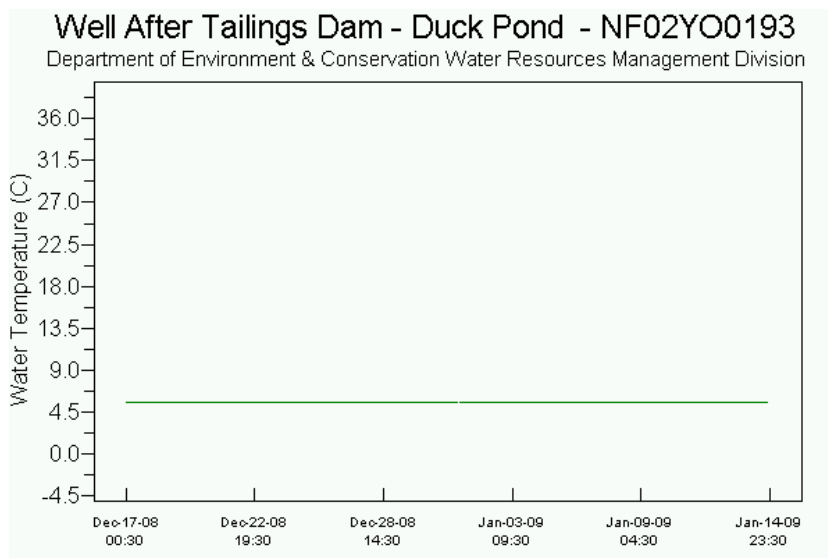


Figure 15

- pH (**Figure 16**) increased slightly throughout the deployment period, ranging from a minimum of 8.85 to a maximum of 8.95. This deployment period did not show the initial decrease and subsequent recovery in pH, as has been evident over the last deployment period. This is because this instrument was not removed, nor the well purged and sampled prior to this deployment period.

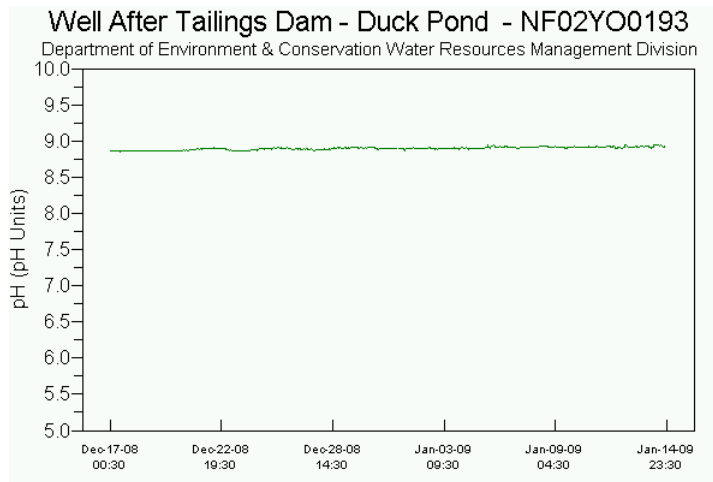


Figure 16

- Specific Conductance (**Figure 17**) remained very constant over the deployment period ranging from a minimum of 0.416 mS/cm to a maximum of 0.422 mS/cm.

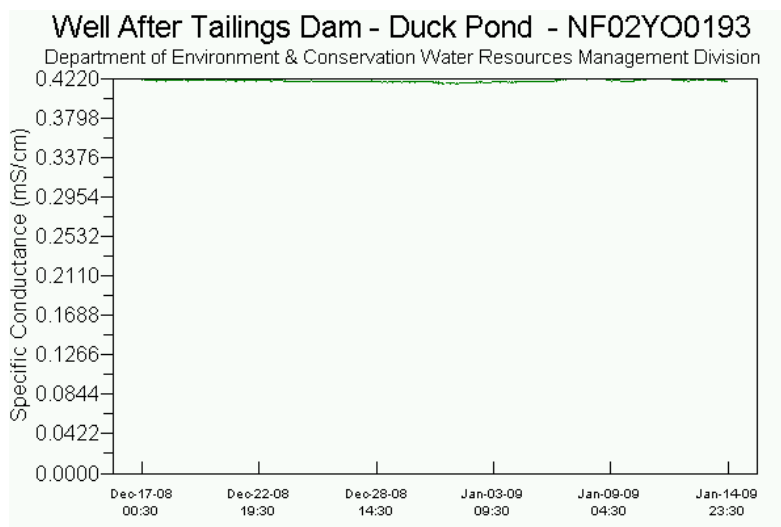


Figure 17

- The water level (**Figure 18**) generally decreased throughout the deployment period, ranging from a minimum of 0.595 m to a maximum of 0.741 m. There are a number of small peaks in water level. One corresponds to a major rainfall event on December 25, 2008. Due to this well being frozen at surface it is impossible to confirm or measure the static water level.

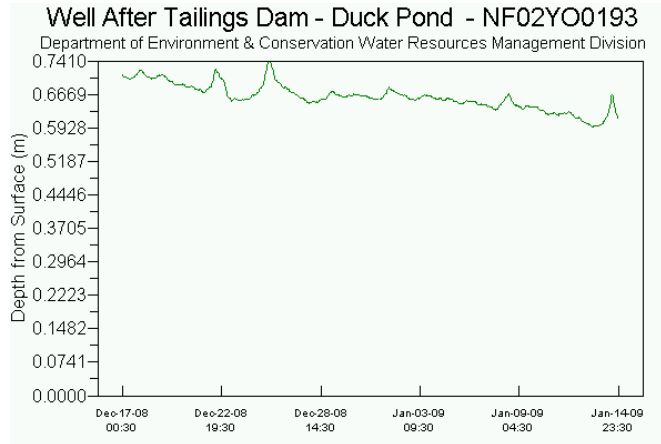


Figure 18

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