

Real Time Water Quality Deployment Report for Vale Inco Newfoundland and Labrador Ltd. August to October 2008

General

- The Water Resources Management Division staff monitors the real-time web page on a daily basis.
- Vale Inco Newfoundland and Labrador Ltd. will continue to be informed of any significant water quality events in the future in the form of a monthly deployment report.
- Environment Canada (EC) staff visited the real-time stations on September 21st, 2008.
- Department of Environment and Conservation (DOEC) staff visited the mine site for a face-to-face meeting on October 27th, 2008.

Maintenance and Calibration of Instrumentation

- Vale Inco staff visited the four stations on August 20th and returned all instruments to the water after having been cleaned and calibrated.
- Upon redeployment at all stations in August, Minisonde readings were taken for QA/QC purposes. The results from comparing the Minisonde values to the Datasonde values can be seen in **Table 1**. For the most part during reinstallation, the rankings fall in the “Good” and “Excellent” range. However, it appears as though the Minisonde readings taken during reinstallation at the Lower Reid Brook station were not stable with the temperature having a “marginal” ranking and the dissolved oxygen having a “poor” ranking. In all likelihood, the Minisonde could not establish accurate readings due to the silty bottom.
- The instruments were deployed for an extended period from August 17th – October 24th. Vale Inco staff could not get out to the stations during the month of September, therefore it was decided by both parties to leave the instruments in until the end of October when they would be removed for the winter months.
- As was expected due to the extended deployment period (66 days), the QA/QC rankings at removals ranged from “Excellent” to “Poor”. It was expected that the sensors would drift (without regular calibration) over this time frame, however, the system would still work to catch emerging water quality issues as they happened.

Table 1: QA/QC Data Comparison Rankings upon reinstallation in Aug. ‘08 and removal in Oct. ‘08

Station	Date	Action	Minisonde vs. Datasonde Comparison Ranking			
			Temperature	pH	Conductivity	Dissolved Oxygen
Upper Reid Brook	Aug. 20 th , 2008	Installation	Good	Good	NA*	Good
	Oct. 24 th , 2008	Removal	Excellent	Fair	Poor	Poor
Lower Reid Brook	Aug. 20 th , 2008	Installation	Marginal	Good	NA*	Poor
	Oct. 24 th , 2008	Removal	Good	Poor	Marginal	Excellent
Tributary to Lower Reid Bk	Aug. 20 th , 2008	Installation	Excellent	Excellent	NA*	Excellent
	Oct. 24 th , 2008	Removal	Excellent	Fair	Poor	Excellent
Camp Pond Brook	Aug. 20 th , 2008	Installation	Good	Excellent	NA*	Excellent
	Oct. 26 th , 2008	Removal	Fair	Excellent	Fair	Poor

* Conductivity probe on Minisonde was not working properly.

Note: There is no climate data (daily precipitation records) available for this time frame from Environment Canada.

Data Interpretation

REID BROOK AT OUTLET OF REID POND (UPPER REID BROOK)

- As was expected for this time of the year, the water temperature (**Figure 1**) decreased over the deployment period while the dissolved oxygen (**Figure 2**) increased. There were no significant water quality events captured. All dissolved oxygen values (9.38 mg/L – 12.22 mg/L) remained just at or above the minimum CCME Water Quality Guideline for the Protection of Aquatic Life. The water temperature ranged from 17.1 – 3.6°C from August to October.

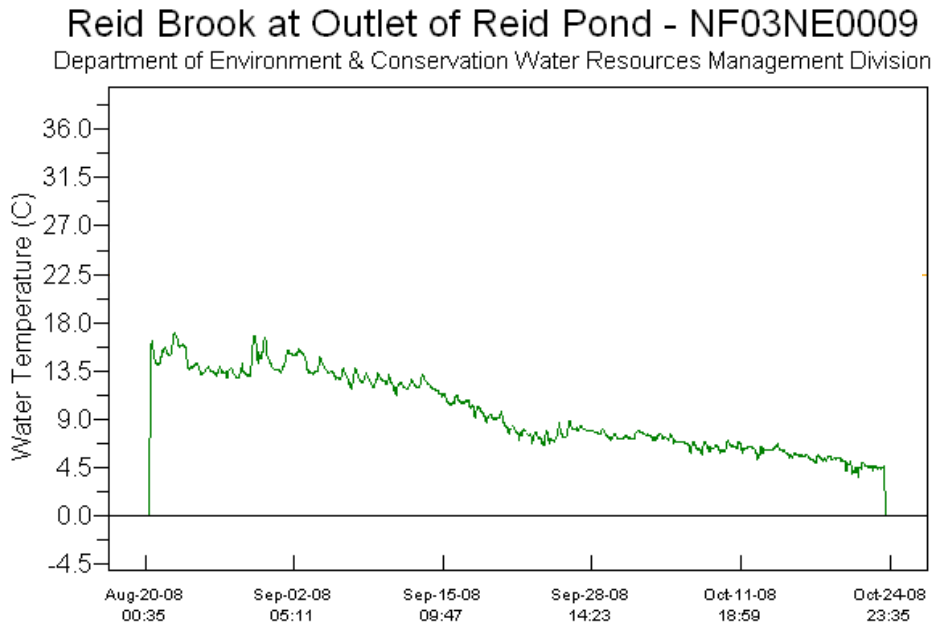


Figure 1

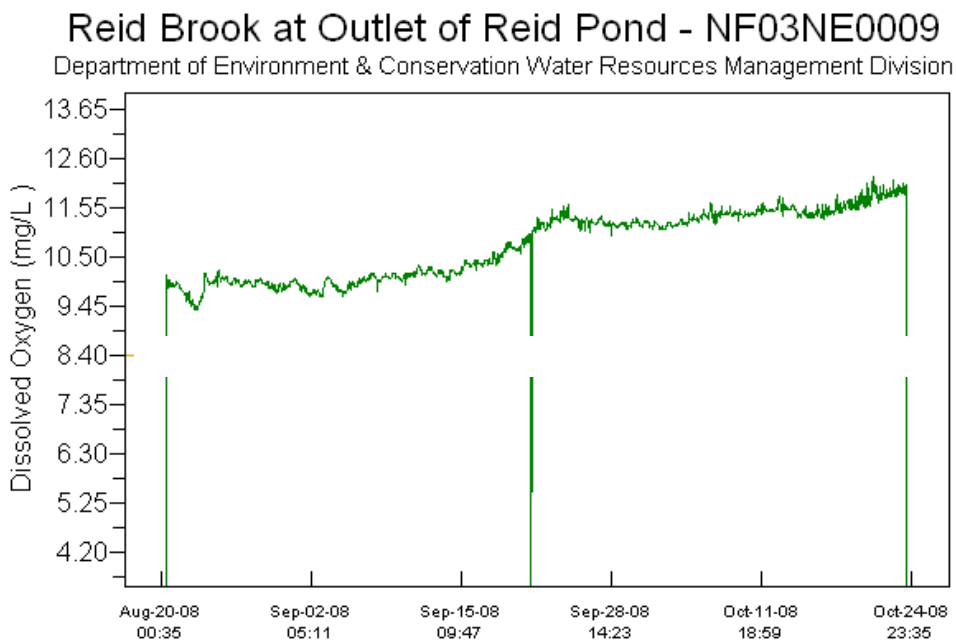
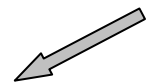
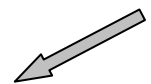


Figure 2



- The conductivity values (**Figure 3**) remained very consistent throughout the deployment period only ranging from 8.5 – 9.4 $\mu\text{S}/\text{cm}$. The Upper Reid station is fairly pristine with very little development as seen by the naturally low specific conductivity values. There were no significant water quality events captured.

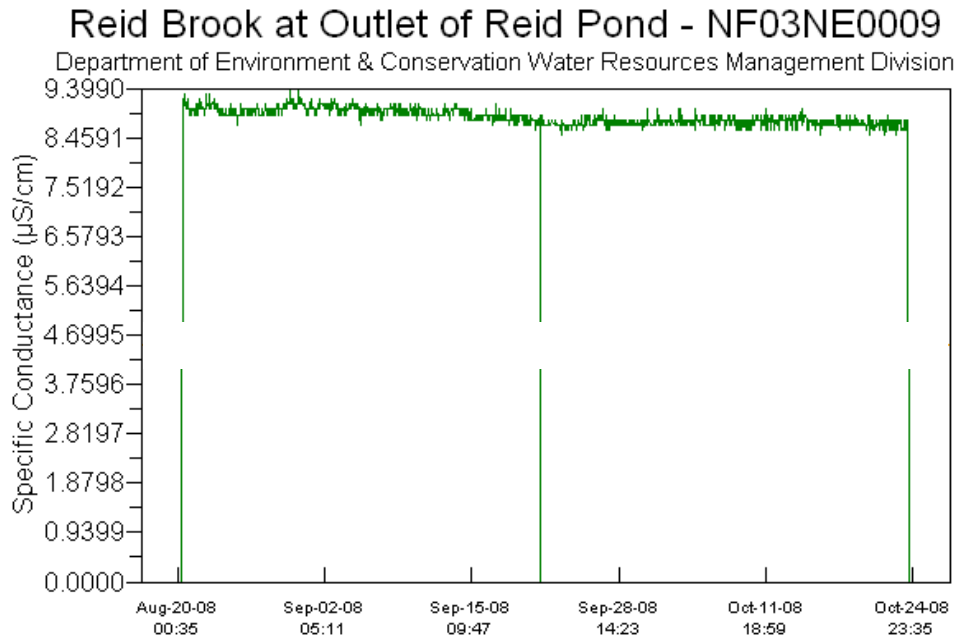
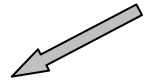


Figure 3



- The pH values (**Figure 4**) decreased over the extended deployment period as expected. The range of pH values is from 6.079 – 7.1 pH units. The sensor drifted causing the pH values to fall just slightly outside the CCME Water Quality Guidelines for Aquatic Life recommended range. There was a noticeable decrease in the pH values around Oct. 18th which likely corresponds with a period of significant precipitation which can later be viewed in the stage graph.

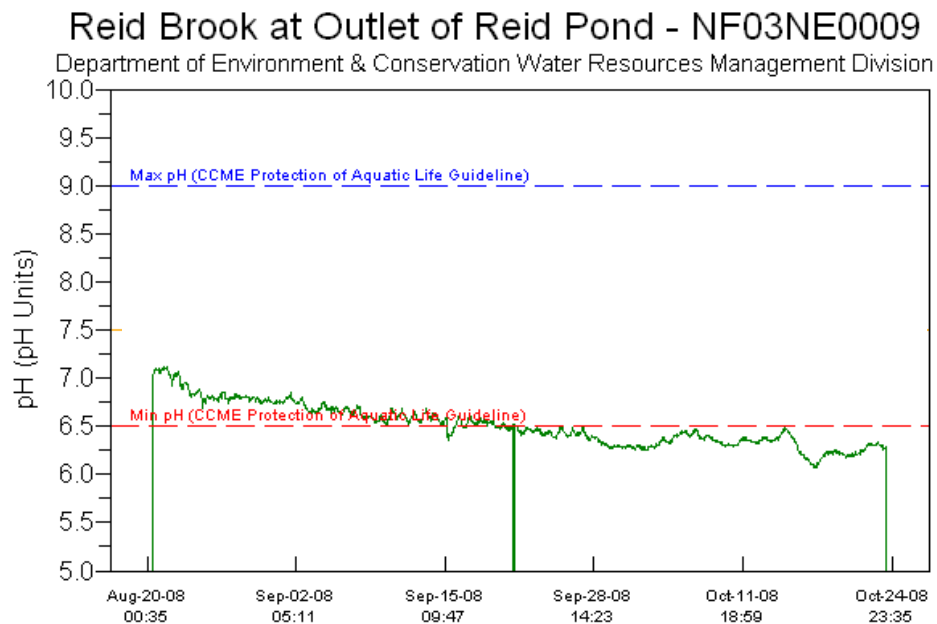
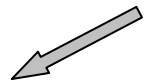
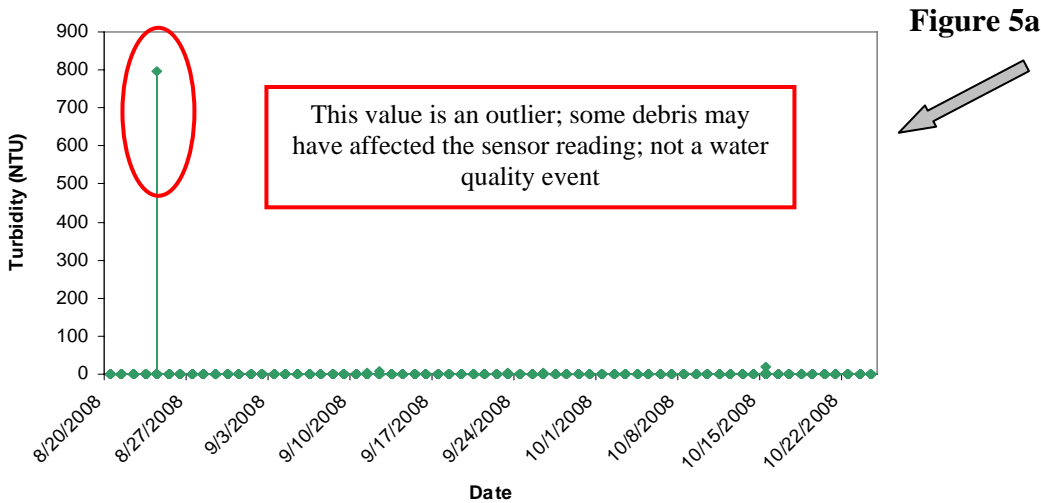


Figure 4



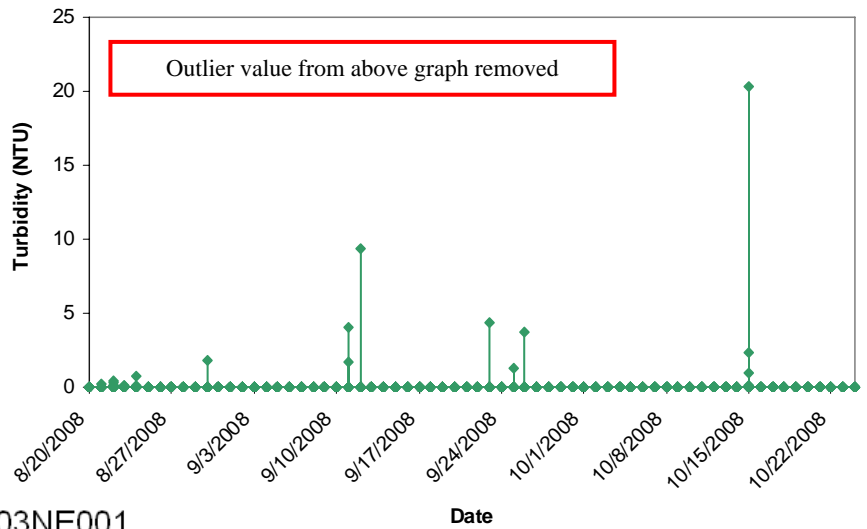
- Turbidity values remained at a very low level throughout the deployment period. As can be seen in **Figure 5a**, there was an outlier reading recorded on August 24th (794.9 NTU). It is likely that some debris affected the measurement. **Figure 5b** graphs the turbidity values over the deployment period with the high outlier value removed. As can be seen, the turbidity values fluctuated slightly with the majority of values below 10 NTU. There were some small spikes in turbidity which can be attributed to increased precipitation at that these times as seen on the stage graph (**Figure 6**).

Reid Brook at Outlet of Reid Pond - NF03NE0009



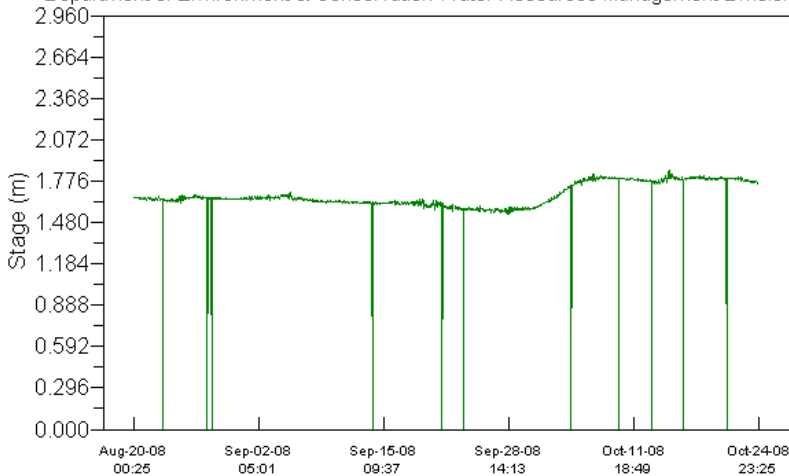
Reid Brook at Outlet of Reid Pond - NF03NE0009

Figure 5b



Reid Brook at Outlet of Reid Pond - 03NE001

Department of Environment & Conservation Water Resources Management Division



CAMP POND BROOK BELOW CAMP POND

- The water temperature and dissolved oxygen values (**Figures 7 & 8** respectively) were somewhat variable throughout the deployment period with temperatures ranging from 20.77 to -0.08 °C. As the water temperatures decreased there was a corresponding increase in dissolved oxygen. The minimum dissolved oxygen value was 7.44mg/L over the deployment period.

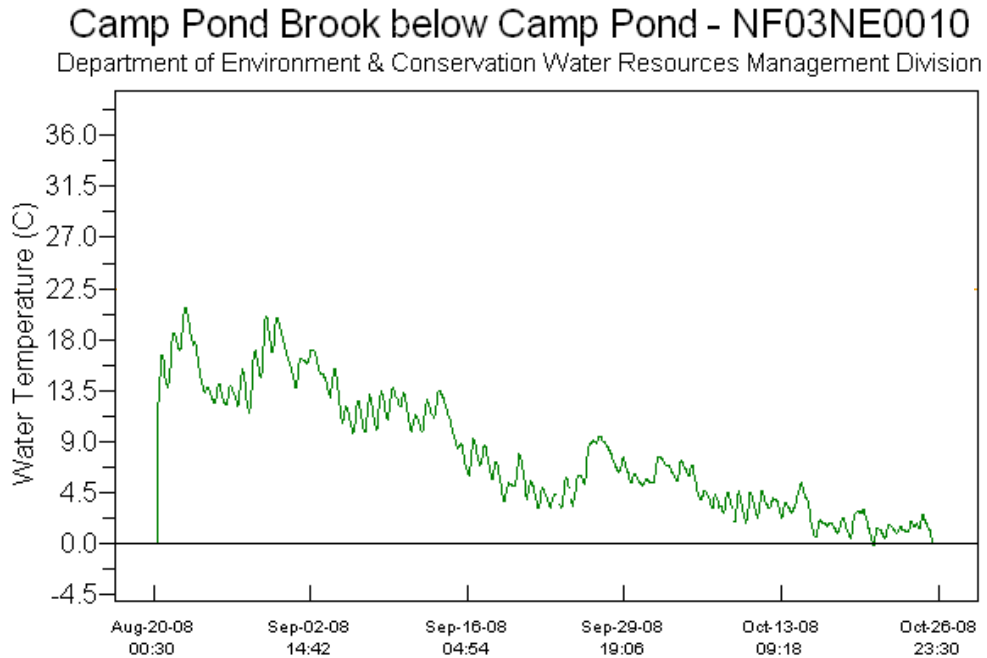


Figure 7

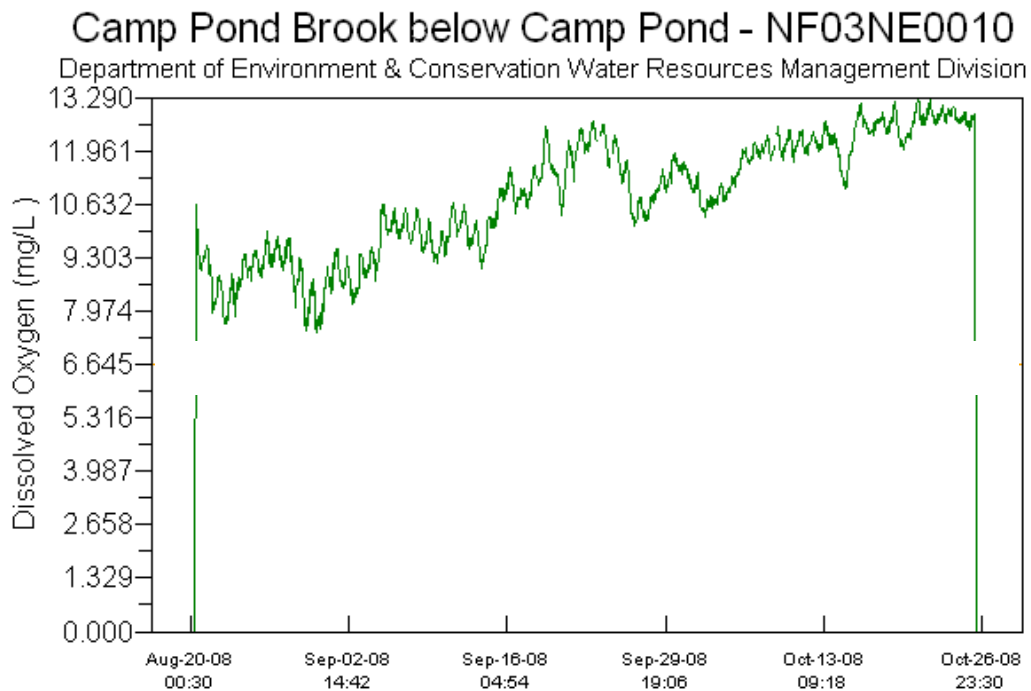
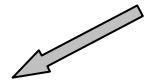
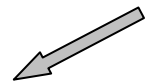


Figure 8



- The conductivity values (**Figure 9**) remained relatively consistent throughout the deployment period with the exception of an increase in values in early October when the conductivity reached a maximum value of 47.3 uS/cm but returned to background levels within a 48 hour time period. This increase in conductivity is reflected as an increase in the stage graph (**Figure 10**) and was likely affected by precipitation in the area. There are some other fluctuations throughout the deployment period that can possibly be attributed to increased precipitation as well.

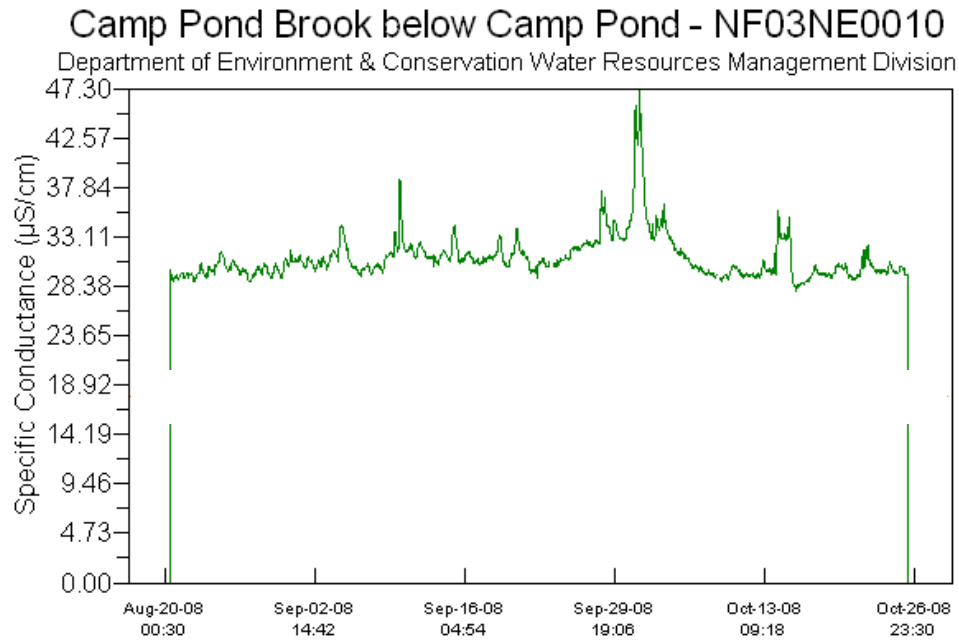


Figure 9

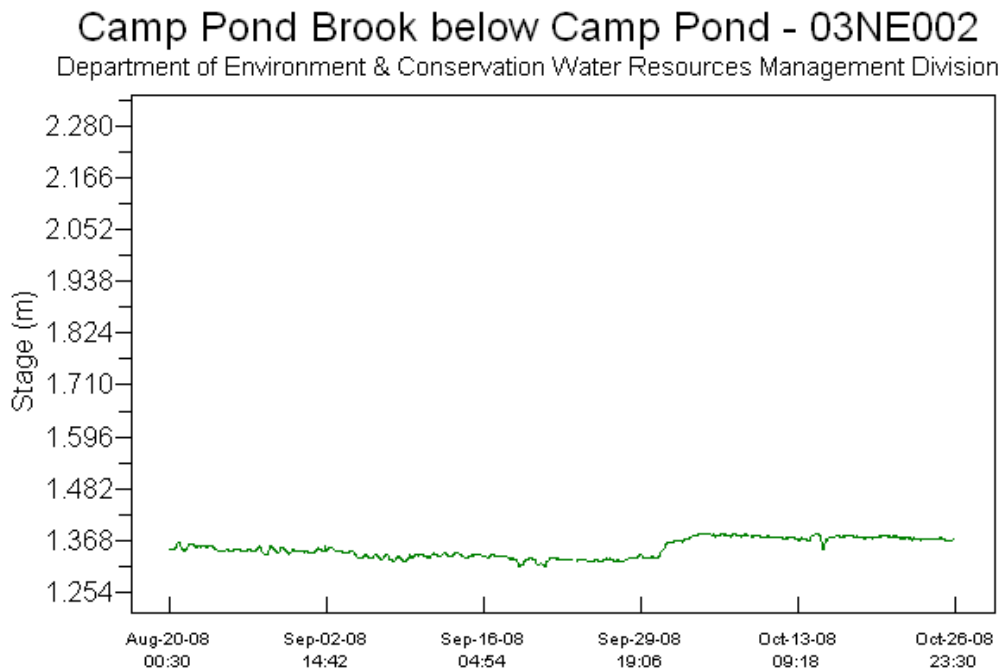


Figure 10

- The pH (**Figure 11**) values remained consistent throughout the deployment period and remained within CCME Water Quality Guidelines for Aquatic Life.

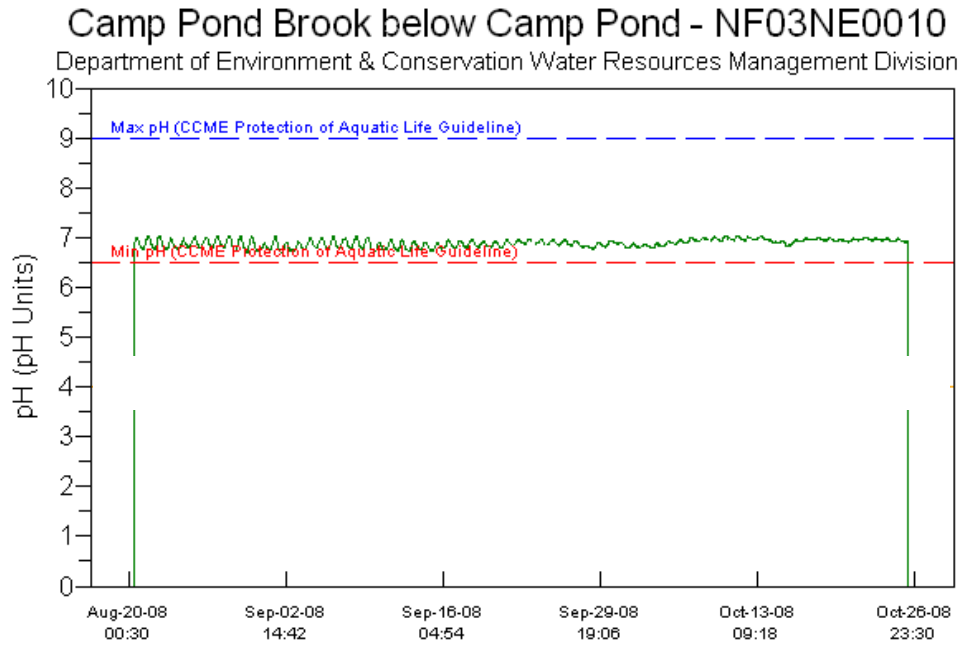
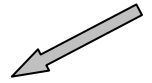


Figure 11



- Turbidity values (**Figure 12**) at the Camp Pond Brook station showed slightly fluctuating turbidity values over the deployment period. It is likely that the majority of spikes are a result of increased precipitation at those times. Around September 21st and 22nd the turbidity values were slightly increased so the Environmental staff on-site visually investigated and determined that the high winds were causing tremendous wave action along the shorelines in Camp Pond and was likely the cause of the slightly turbid water. As noted previously, there was a noticeable increase in the stage graph (**Figure 10**) in early October thus explaining the likely cause of the turbidity increase at that time. The cause of the last spike towards mid-October may also be due to increased precipitation.

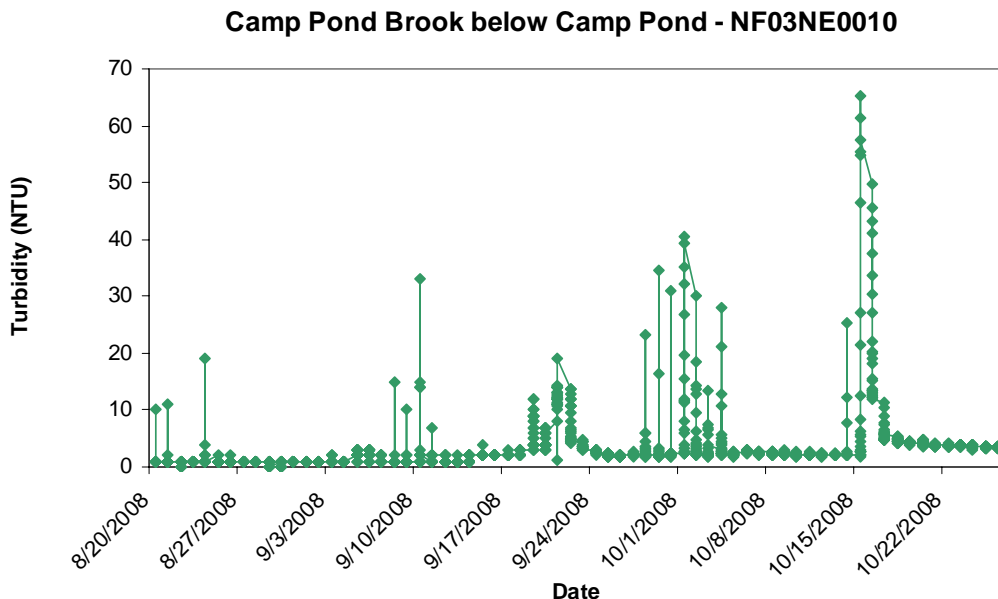
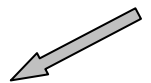


Figure 12



Note: Error measurements of 3000 NTU were removed from the graph to be able to view the results more easily

LOWER REID BROOK BELOW TRIBUTARY

- The water temperature and dissolved oxygen values (Figures 13 & 14 respectively) were somewhat variable throughout the deployment period with temperatures ranging from 18.82 to -0.2 °C. As the water temperatures decreased there was a corresponding increase in dissolved oxygen. The minimum dissolved oxygen value was 8.91mg/L over the deployment period.

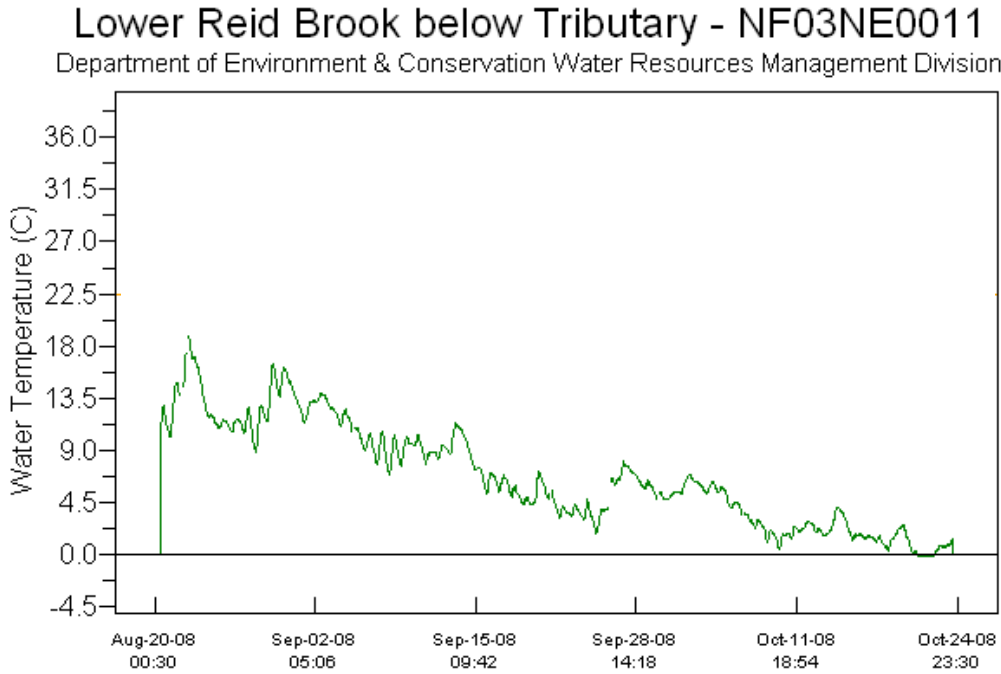


Figure 13

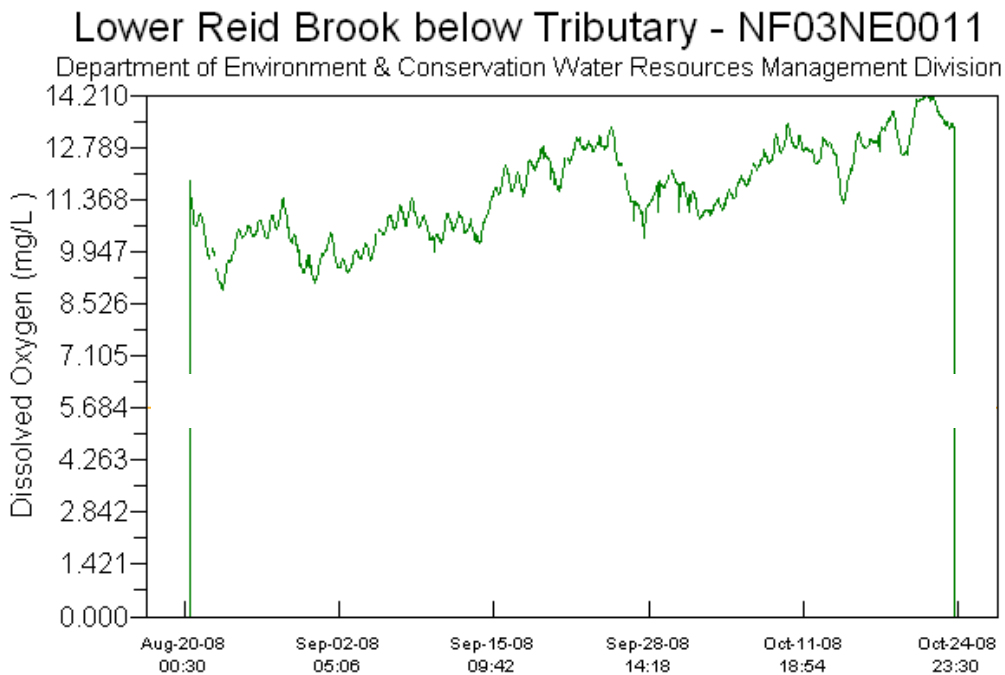
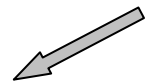
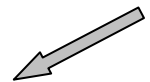


Figure 14



- The pH and specific conductivity (**Figures 15 & 16** respectively) remained at fairly constant background levels for this station over the deployment period. All pH values remained within CCME Water Quality Guidelines for Aquatic Life (6.5 – 9.0). The specific conductivity values ranged from 27 – 35 $\mu\text{S}/\text{cm}$.

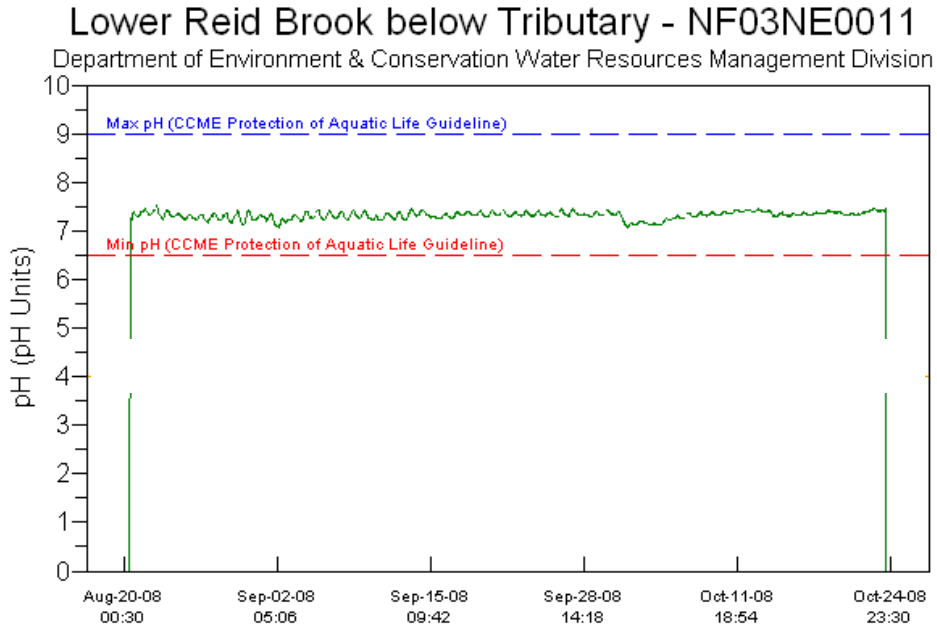


Figure 15

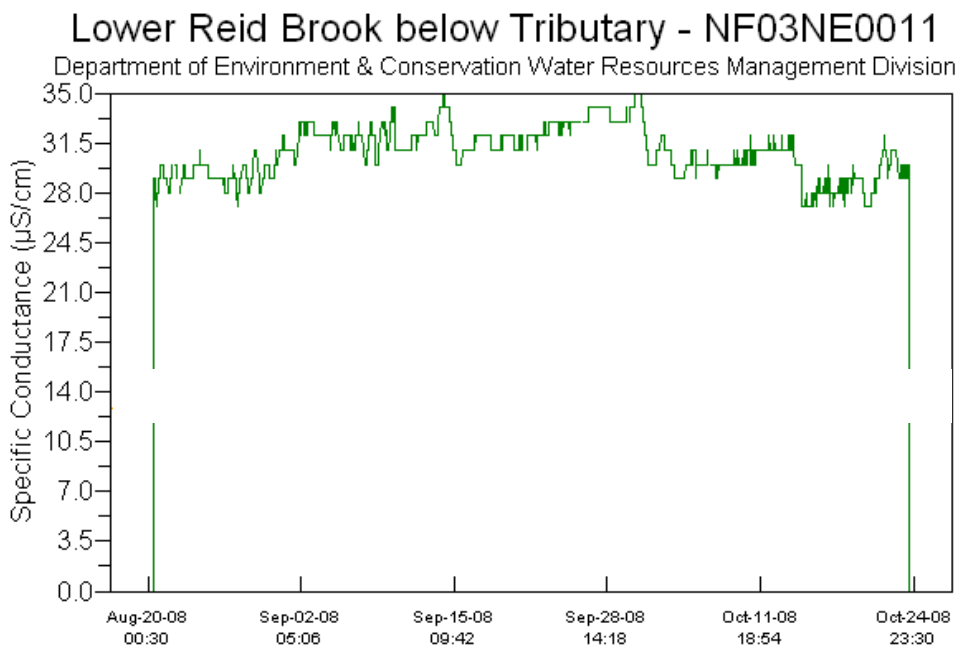
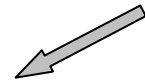
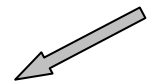


Figure 16



- Turbidity values (**Figure 17**) remained relatively consistent throughout the deployment period with larger spikes on two separate occasions. It is likely that these increases are due to precipitation events and high winds (see earlier section Camp Pond Brook –Turbidity **Figure 12**). There is a significant increase on the stage graph (**Figure 18**) in early October which is reflected in the turbidity graph.

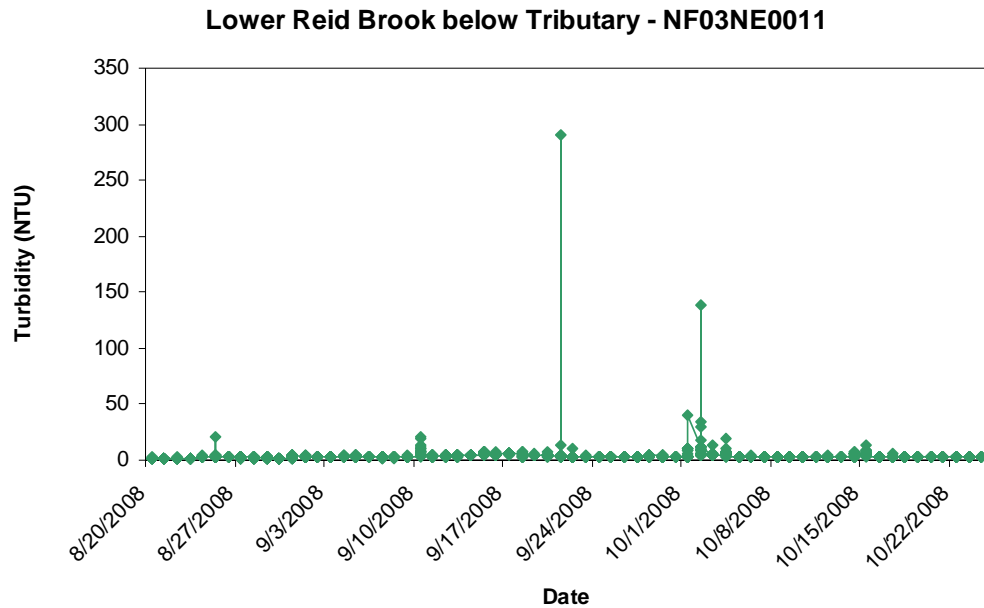


Figure 17

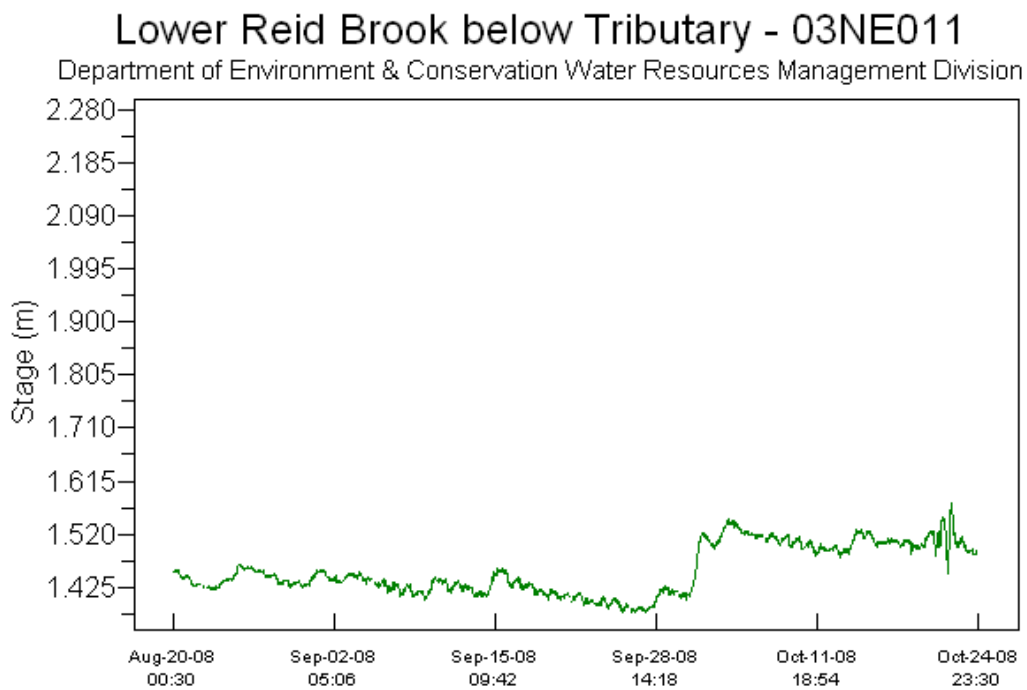
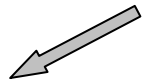
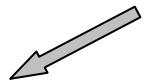


Figure 18



TRIBUTARY TO REID BROOK

- The water temperature and dissolved oxygen values (**Figures 19 & 20** respectively) were somewhat variable throughout the deployment period with temperatures ranging from 16.23 to -0.13 °C. As the water temperatures decreased there was a corresponding increase in dissolved oxygen. The minimum dissolved oxygen value was 9.69mg/L over the deployment period.

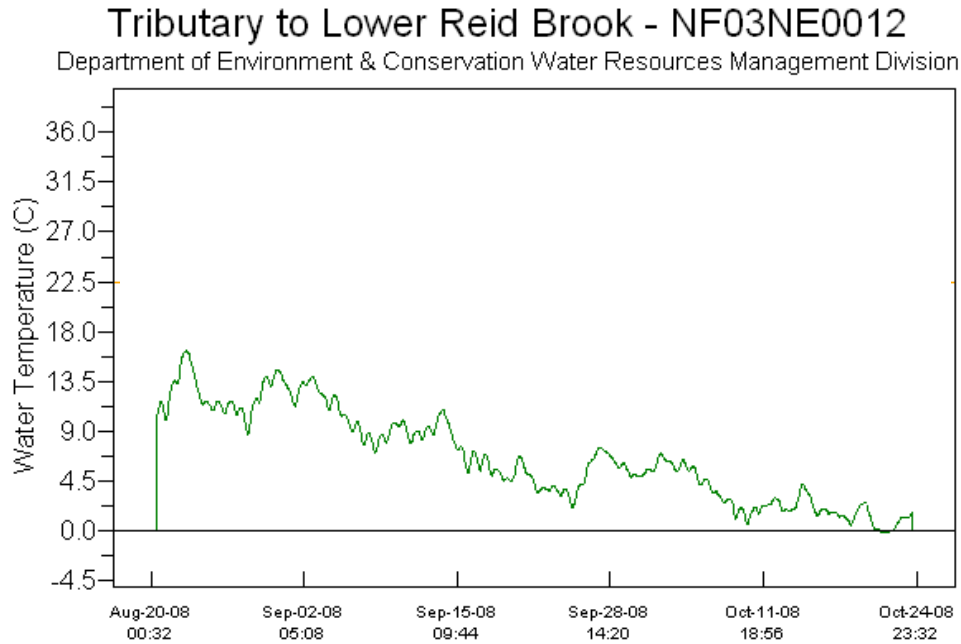


Figure 19

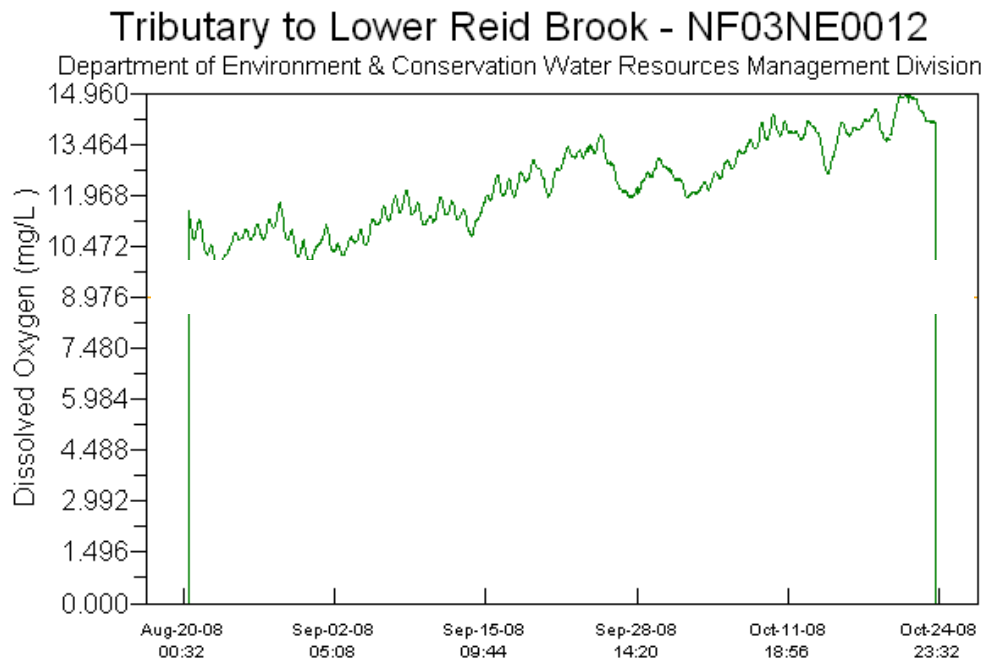
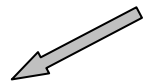
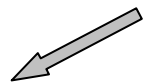


Figure 20



- The pH values (**Figure 21**) remained consistent and within CCME Water Quality Guidelines for Aquatic Life (6.5 – 9.0) over the deployment period. There was a decrease in pH values around the beginning of October when there were significant precipitation events occurring.

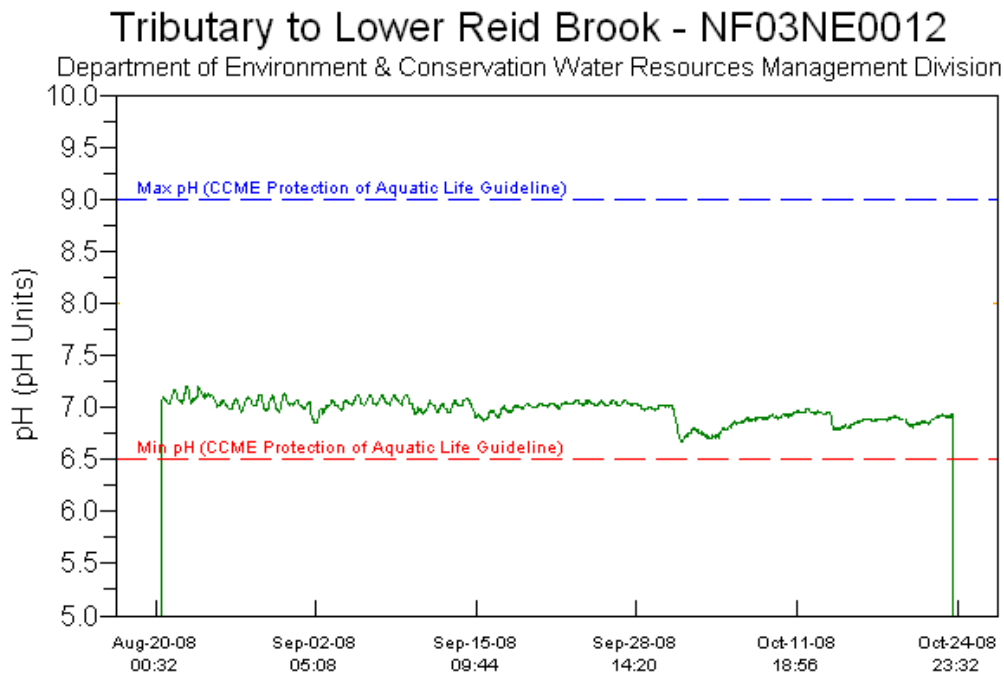
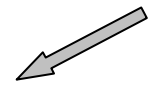


Figure 21



- The specific conductivity (**Figure 22**) fluctuated throughout the deployment period, however, the values only ranged from 27.8 – 39.1 $\mu\text{S}/\text{cm}$. It appears as though the precipitation in early October diluted the water and resulted in a decrease in conductivity values at this station.

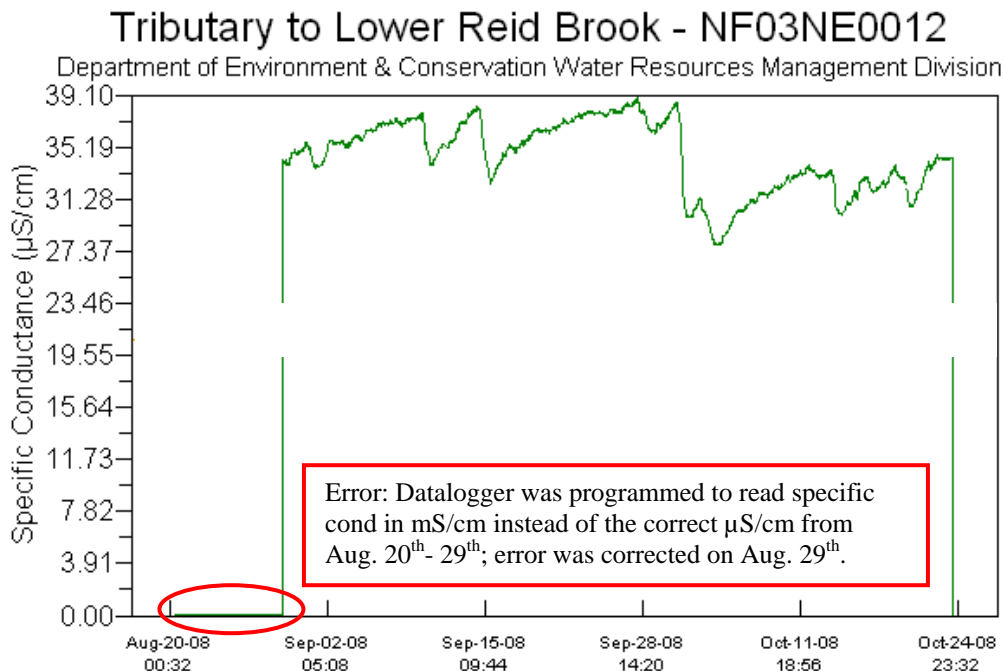
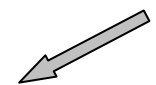


Figure 22



- The turbidity values obtained for the Tributary station do not appear to be accurate readings. All Datasondes will be sent to the manufacturer for performance testing and evaluation at which point it will be determined if the instrument for the Tributary station had a turbidity sensor problem. If so, the instrument will be repaired prior to the start of the next sampling season.

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December 15th, 2008