Real-Time Water Quality Deployment Report

Voisey's Bay Network

September 20, 2016 to October 26, 2016

Newfoundland Labrador

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

Contents

Prepared by:
Tara Clinton
Environmental Scientist
Water Resources Management Division
Department of Municipal Affairs & Environment
taraclinton@gov.nl.ca

Real Time Water Quality Monitoring

Department of Municipal Affairs and Environment staff monitors the real-time web pages regularly.

This deployment report discusses water quality related events occurring at four stations in the Voisey's Bay Network; Reid Brook at Outlet to Reid Pond, Camp Pond Brook, Reid Brook below Tributary, and Tributary to Reid Brook.

On September 20th, 2016, Vale Environment Staff redeployed real-time water quality monitoring instruments at the four real time stations in the Voisey's Bay network. The end of the deployment was October 26th, 2016. This was the fourth and final deployment for the 2016 season.

Quality Assurance and Quality Control

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.

At deployment and removal, a QAQC Instrument is temporarily deployed alongside the Field Instrument. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments**.** Based on the degree of difference between parameters recorded by the Field Instrument and QAQC Instrument at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

Table 1: Ranking classifications for deployment and removal

	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 µS/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

It should be noted that the temperature sensor on any instrument is the most important. All other parameters can be broken down into three groups: temperature dependant, temperature compensated and temperature independent. Because the temperature sensor is not isolated from the rest of the instrument the entire instrument must be at the same temperature before the sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

Deployment and removal comparison rankings for the Voisey's Bay Network stations are summarized below in Table 2.

Table 2: Comparison rankings for Voisey's Bay Network stations

Station Voisey's Bay	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Reid Brook at Outlet	September 20	Deployment	Excellent	Fair	Good	Excellent	Excellent
	October 26	Removal	Excellent	Good	Excellent	Good	Good
Camp Pond Brook	September 20	Department	Excellent	Fair	Marginal	Excellent	Excellent
	October 26	Removal	Excellent	Excellent	Excellent	Fair	**Poor**
Reid Brook below Tributary	September 20	Department	Good	Fair	Fair	Good	Excellent
	October 26	Removal	Excellent	Good	Good	Fair	**Poor**
Tributary to Reid Brook	September 20	Department	Excellent	Good	Good	Excellent	Excellent
	October 26	Removal	Excellent	Good	Excellent	Excellent	Good

During the deployment for **Reid Brook at Outlet of Reid Pond**, the water temperature, conductivity, dissolved oxygen and turbidity all ranked as 'Excellent' or 'Good'. pH data ranked as 'Fair' at deployment. The pH probe does require some time to acclimatize to the water environment, thus it is likely that the readings for the pH were taken earlier than necessary. Upon removal of the field instrument all the parameters ranked within the 'Excellent and 'Good' limits. This was acceptable rankings for data of an extended deployment.

At the station on **Camp Pond Brook below Camp Pond**, water temperature, dissolved oxygen and turbidity all ranked as 'Excellent'. pH data ranked as 'Fair' during the deployment comparison, with the specific conductivity data ranked as 'Marginal'. The lower ranking for the pH and conductivity data during deployment could have been a result of the two instruments not having enough time to acclimatize to the water before the data was recorded. During removal, water temperature, pH, specific conductivity all ranked as 'Excellent'. Dissolved oxygen ranked as 'Fair' at removal. The turbidity data when compared was ranked as 'Poor' during removal however it was determined that the QAQC instrument was reading inaccurate turbidity values.

During deployment of the field instrument at **Reid Brook below Tributary**, water temperature, dissolved oxygen and turbidity ranked as 'Excellent' and 'Good'. pH and conductivity data ranked as 'Fair'. During removal, water temperature, pH and specific conductivity ranked as 'Excellent' and 'Good'. Dissolved oxygen data ranked as 'Fair' and turbidity data ranked as 'Poor'.

Tributary to Reid Brook water temperature, pH, specific conductivity, dissolved oxygen and turbidity ranked as 'Excellent' and 'Good' during deployment. Upon removal, water temperature, pH, specific conductivity, dissolved oxygen and turbidity all ranked as 'Excellent' and 'Good'.

Data Interpretation

The following graphs and discussion illustrate significant water quality-related events from September 20th, to October 26th 2016 in the Voisey's Bay Real Time Water Quality Monitoring Network.

With the exception of water quantity data (stage), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QAQC protocol. Water Survey of Canada is responsible for QAQC of water quantity data. Corrected data can be obtained upon request.

During the data review it was identified that the turbidity data at Tributary to Reid Brook was not representing the brook from October 16th 2016 to October 25th, 2016. This data was removed and not used in this report.

Figure 1: Voisey's Bay Network Station Locations

Reid Brook at Outlet of Reid Pond

Water Temperature

Over the deployment period the water temperature ranged from 4.17 °C to 9.89 °C, with a median value of 6.79 °C (Figure 2). The median has dropped significantly from the previous deployment, as the water temperatures start to decline into the cooler season.

The water temperature at this station is decreasing; this is to be expected as the air temperatures also drop with the season changing into fall (Figure 3).

Please note the stage data, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC. Mean Air Temperature on Figure 3 was collected at the Nain Weather Station by Environment Canada.

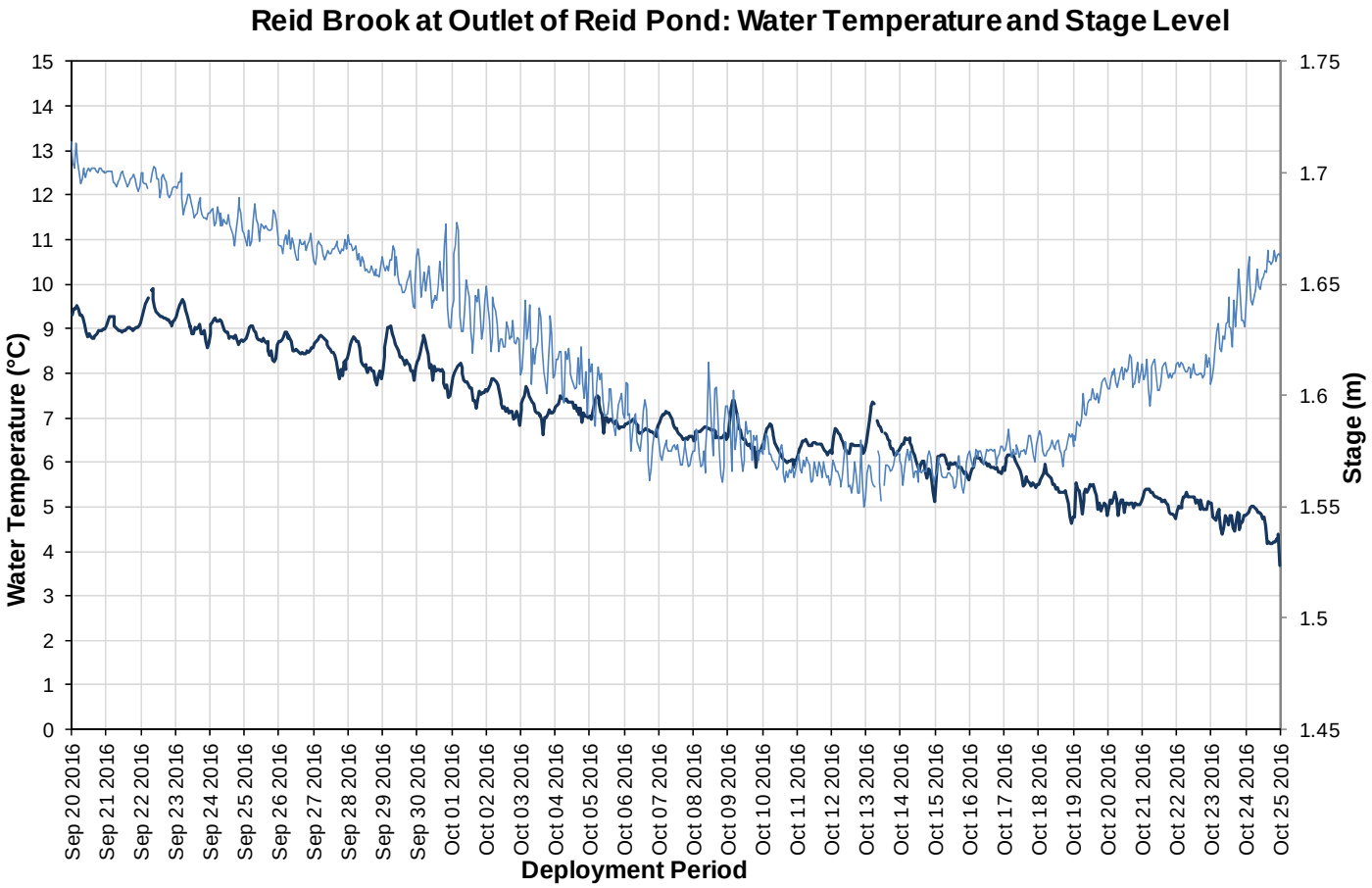

Figure 2: Water Temperature & Stage at Reid Brook at Outlet of Reid Pond

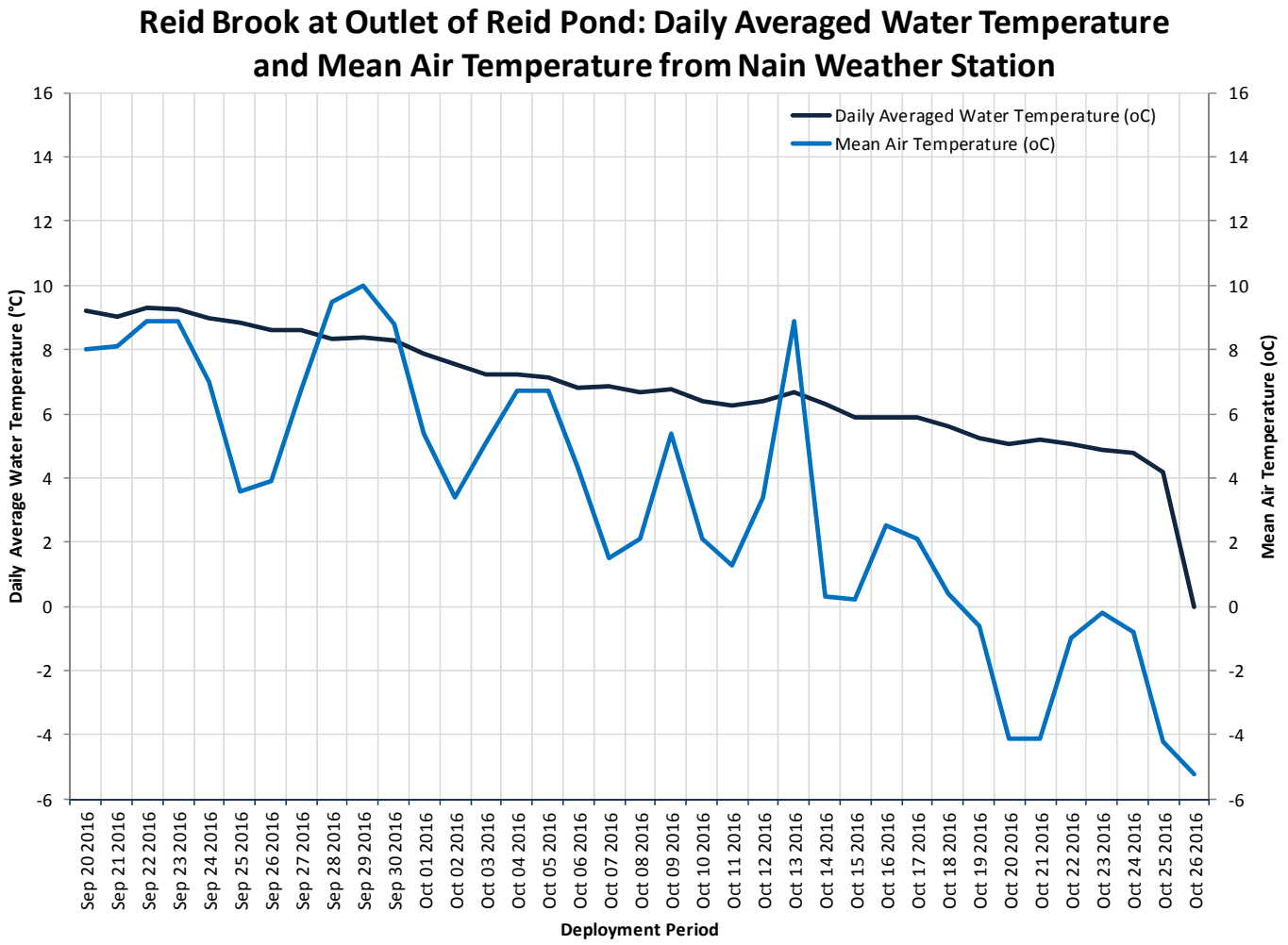

Figure 3: Daily Averaged Water Temperature at Reid Brook at Outlet of Reid Pond and Mean Air Temperatures from Nain Weather Station

pH

Throughout the deployment period, pH values ranged between 6.45 pH units and 7.51 pH units (Figure 4).

The pH data dips in several points along the deployment. The pH dips below the minimum Guideline for Protection of Aquatic Life on October 8th, 2016 and again on October 16 – 17th, 2016. This dip corresponds with a decrease in stage around the same time. Natural processes such as rainfall and runoff will alter the pH of a brook for a period of time.

The Canadian Council of Ministers of the Environment (CCME) guidelines are just a basis by which to compare any dramatic change in the pH data within a dataset. Every brook is different with its own 'normal' range.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

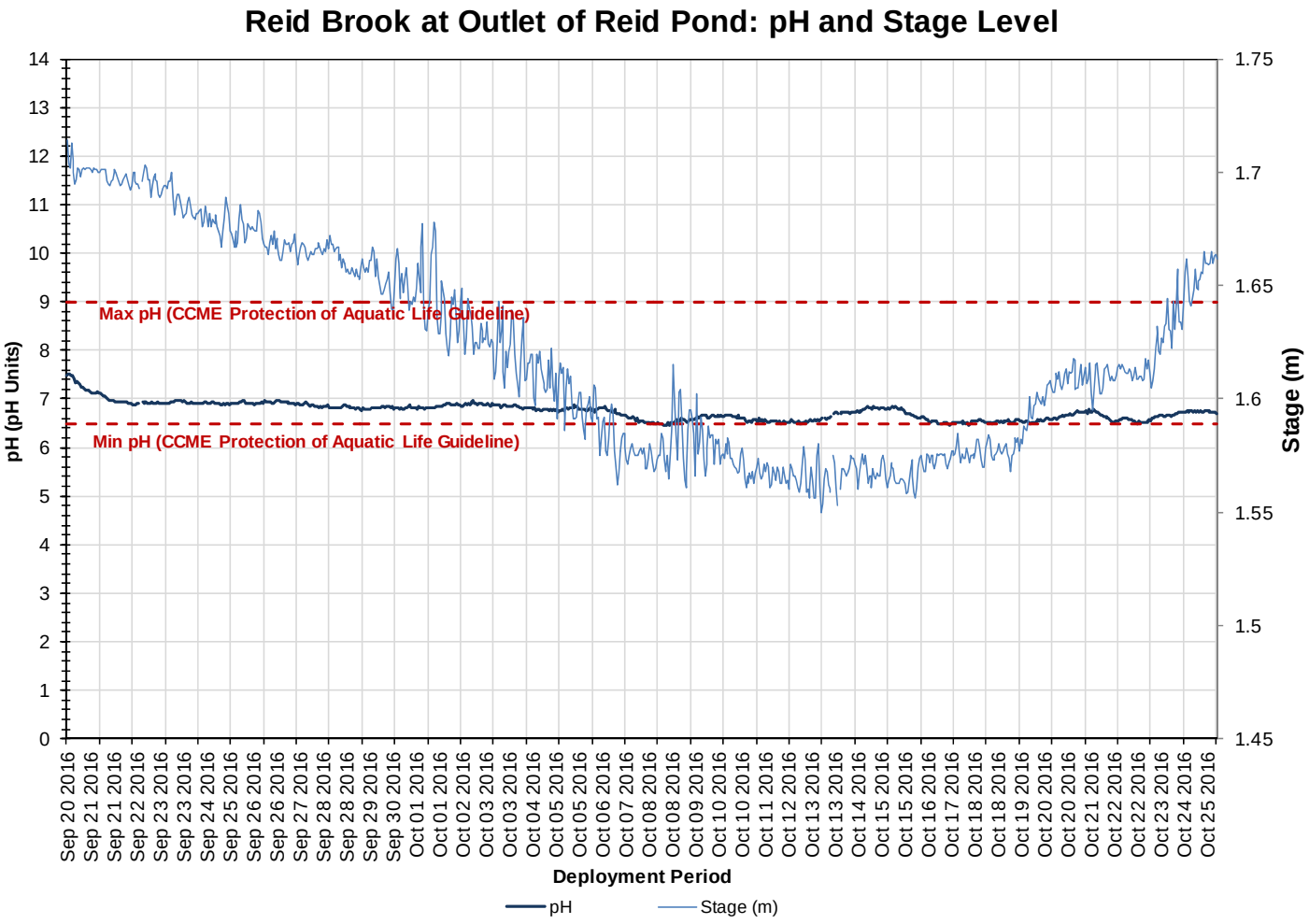

Figure 4: pH and Stage Level at Reid Brook at Outlet of Reid Pond

Specific Conductivity

The conductivity levels were within 11.4 µS/cm and 12.4 µS/cm during this deployment period. The conductivity at Reid Brook remains very stable. This is expected at this site as it is pristine in nature and a larger distance from any anthropogenic disturbances that could affect water parameters.

The common relationship between conductivity and stage level is generally inversed. However, due to this site being a pond environment and a significant distance from any anthropogenic influences, the conductivity at Reid Pond remains stable throughout this deployment (Figure 5).

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

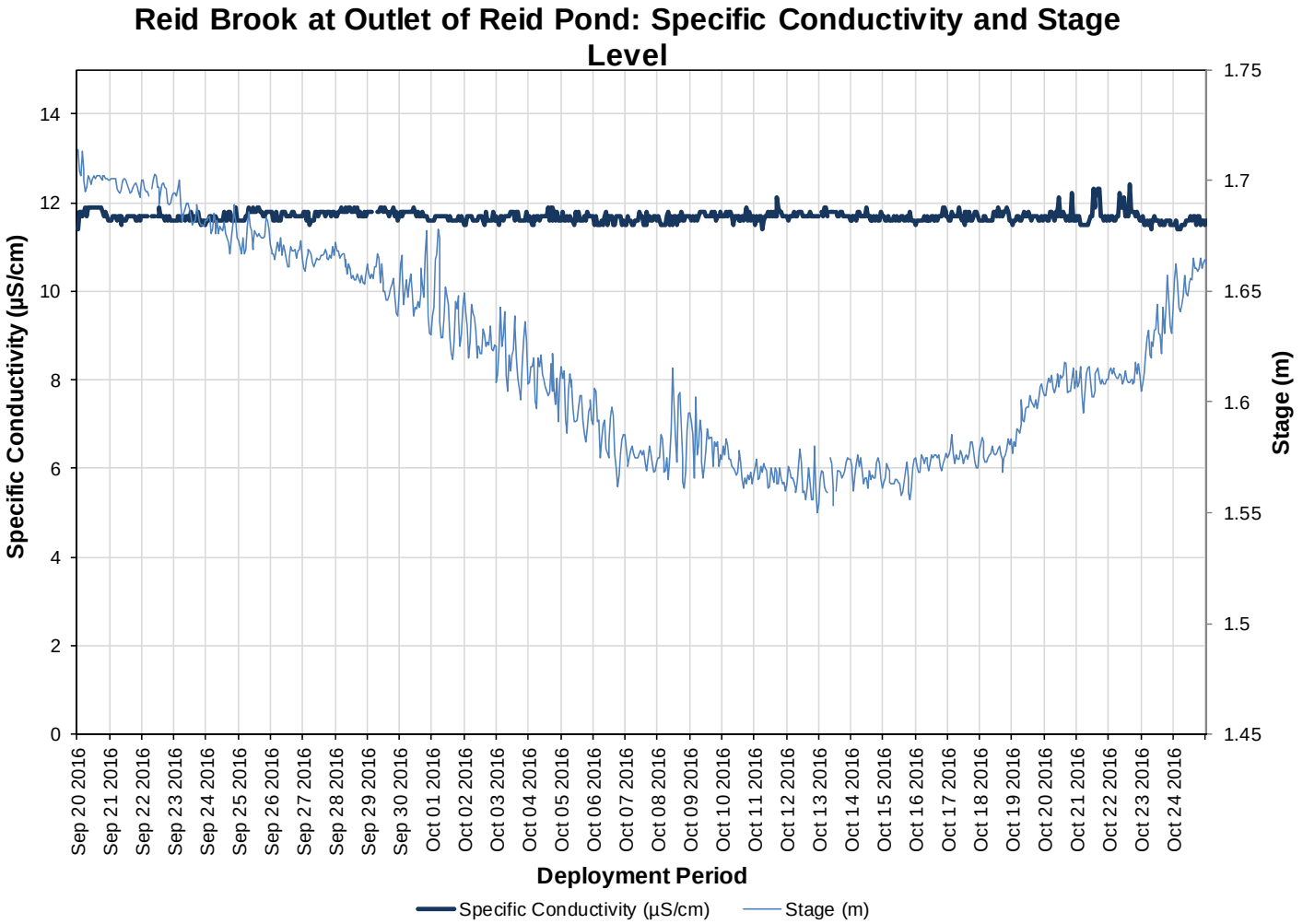

Figure 5: Specific Conductivity and Stage Level at Reid Brook at Outlet of Reid Pond

Dissolved Oxygen (mg/L & % Saturation)

The water quality instrument measures dissolved oxygen (mg/L) with the dissolved oxygen probe and then the instrument calculates percent saturation (% Sat) taking into account the water temperature.

During the deployment the dissolved oxygen concentration levels ranged within a minimum of 11.10 mg/L to a maximum of 12.16 mg/L. The percent saturation levels for dissolved oxygen ranged within 91.6% Saturation to 99.6% Saturation (Figure 6).

The dissolved oxygen concentration remained above the Guideline for the Protection of Early Life Stages (9.5mg/L). As the water temperatures start to decrease into the cooler temperatures there will be a natural increase in dissolved oxygen present in the brook. This is slightly evident toward the end of the deployment.

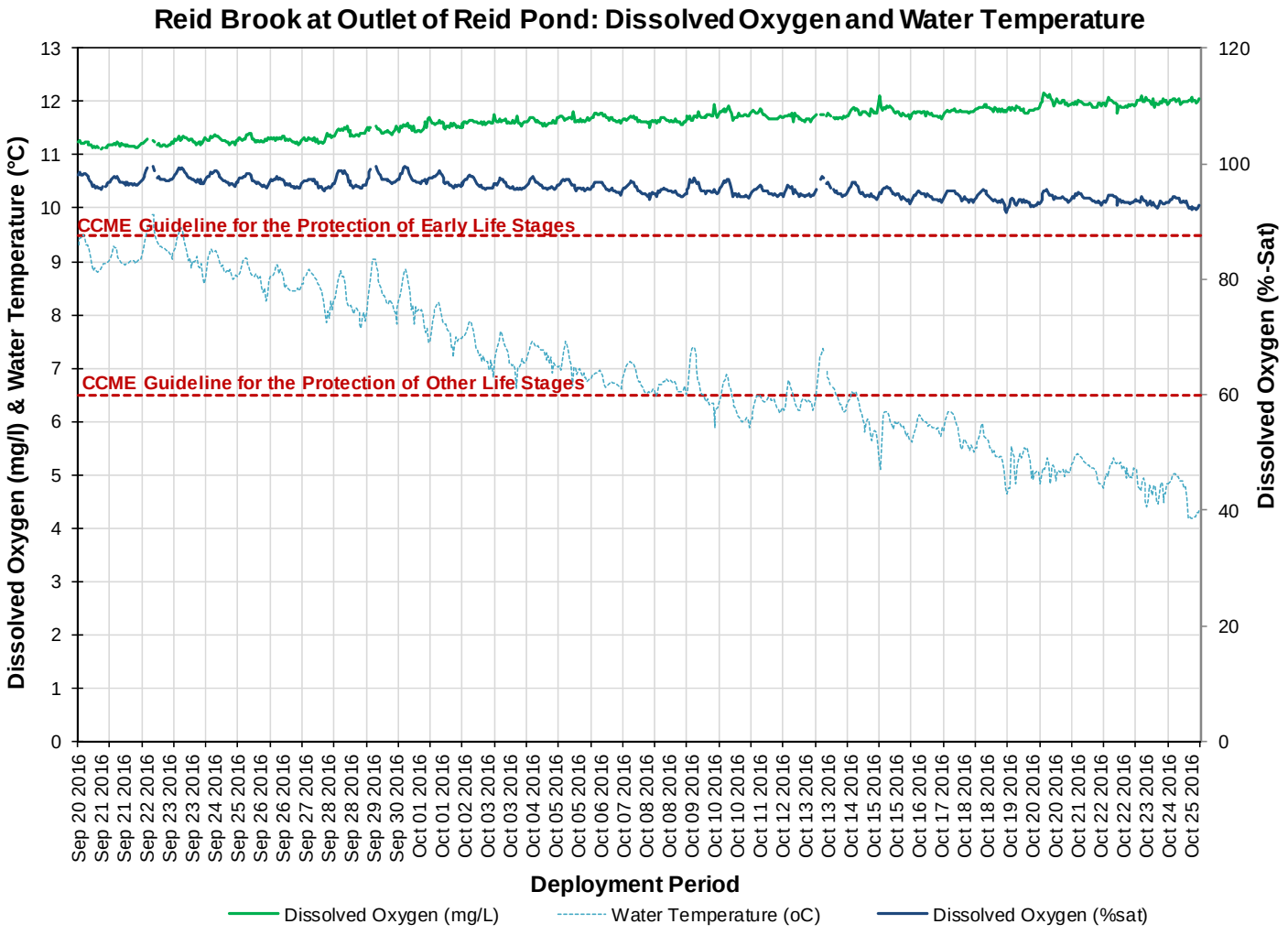

Figure 6: Dissolved Oxygen (mg/L & %Sat) at Reid Brook at Outlet of Reid Pond

Turbidity

Turbidity levels during the deployment ranged within 0.0 NTU and 2.7 NTU (Figure 7). The deployment data had a median of 0.0 NTU.

Waterbodies all have a level of turbidity to the water quality. A significant increase in turbidity that is of concern when monitoring brooks. During rainfall or runoff, higher turbidity readings would be expected. This site has naturally very low turbidity.

Generally the turbidity levels increase for a short period of time and then return to within the range of the baseline. At this station, the turbidity events correlate with slight increases in stage. Rainfall and subsequent runoff can increase the presence of suspended material in water. Turbidity values can also increase if there is a decrease in water level and the natural material in the waterbody becomes concentrated.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

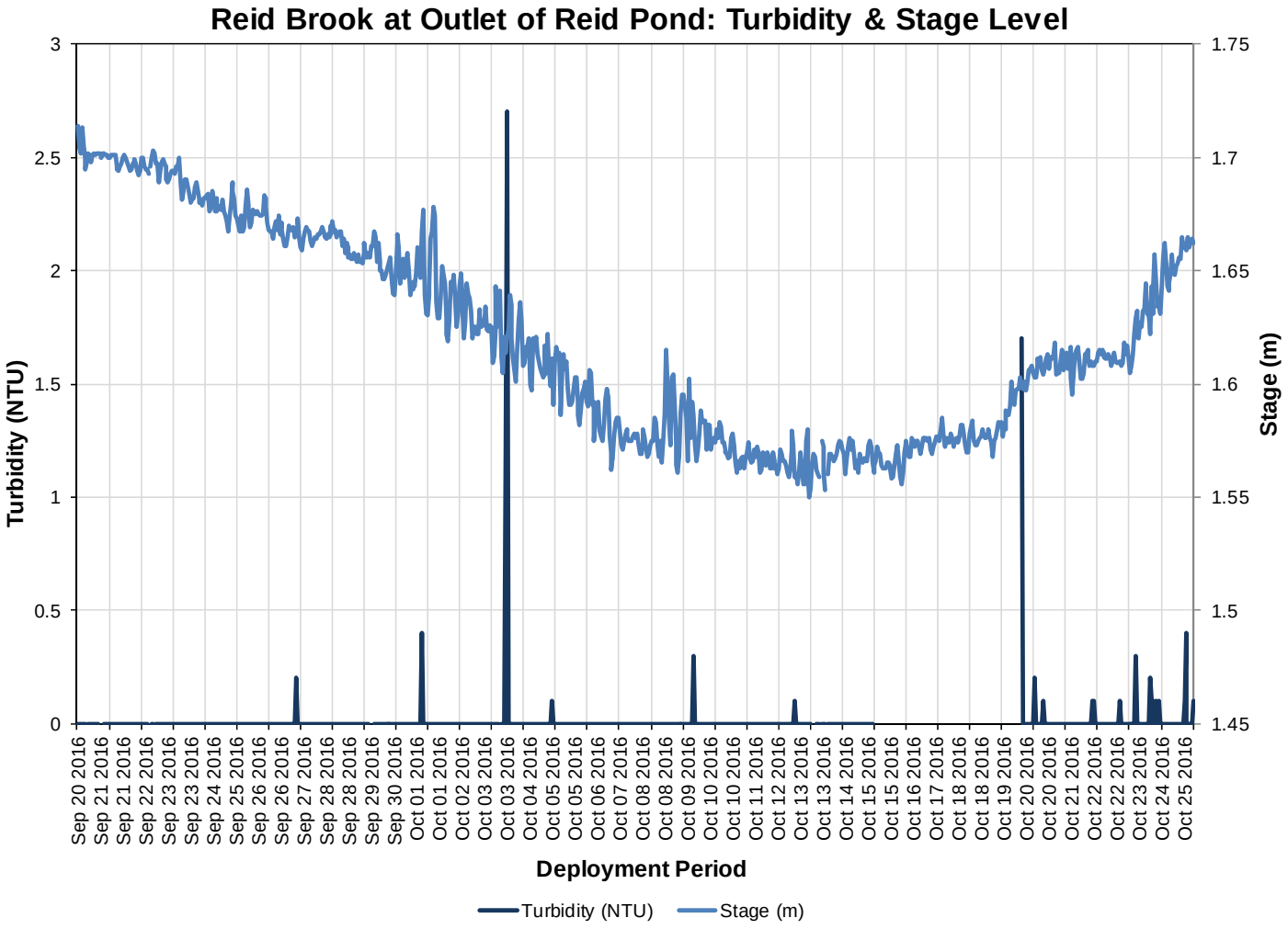

Figure 7: Turbidity at Reid Brook at Outlet of Reid Pond

Stage, Streamflow & Precipitation

Please note the stage and streamflow data graphed below is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Stage is important to display as it provides an estimation of water level at the station and can explain some of the events that are occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). Stage will increase during rainfall events (Figure 8) and during any surrounding snow or ice melt as runoff will collect in the brooks. However, direct snowfall will not cause them to rise significantly.

During the deployment period, the stage values ranged from 1.55m to 1.71m. The streamflow values ranged between 0.33 m^3/s to 0.94 m^3/s. The larger peaks in stage and streamflow do correspond with substantial rainfall events as noted on Figure 8. Precipitation data was obtained from Nain Weather Station. Precipitation ranges for the deployment period were a minimum of 0.0 mm and a maximum of 18.4 mm on October 16th, 2016.

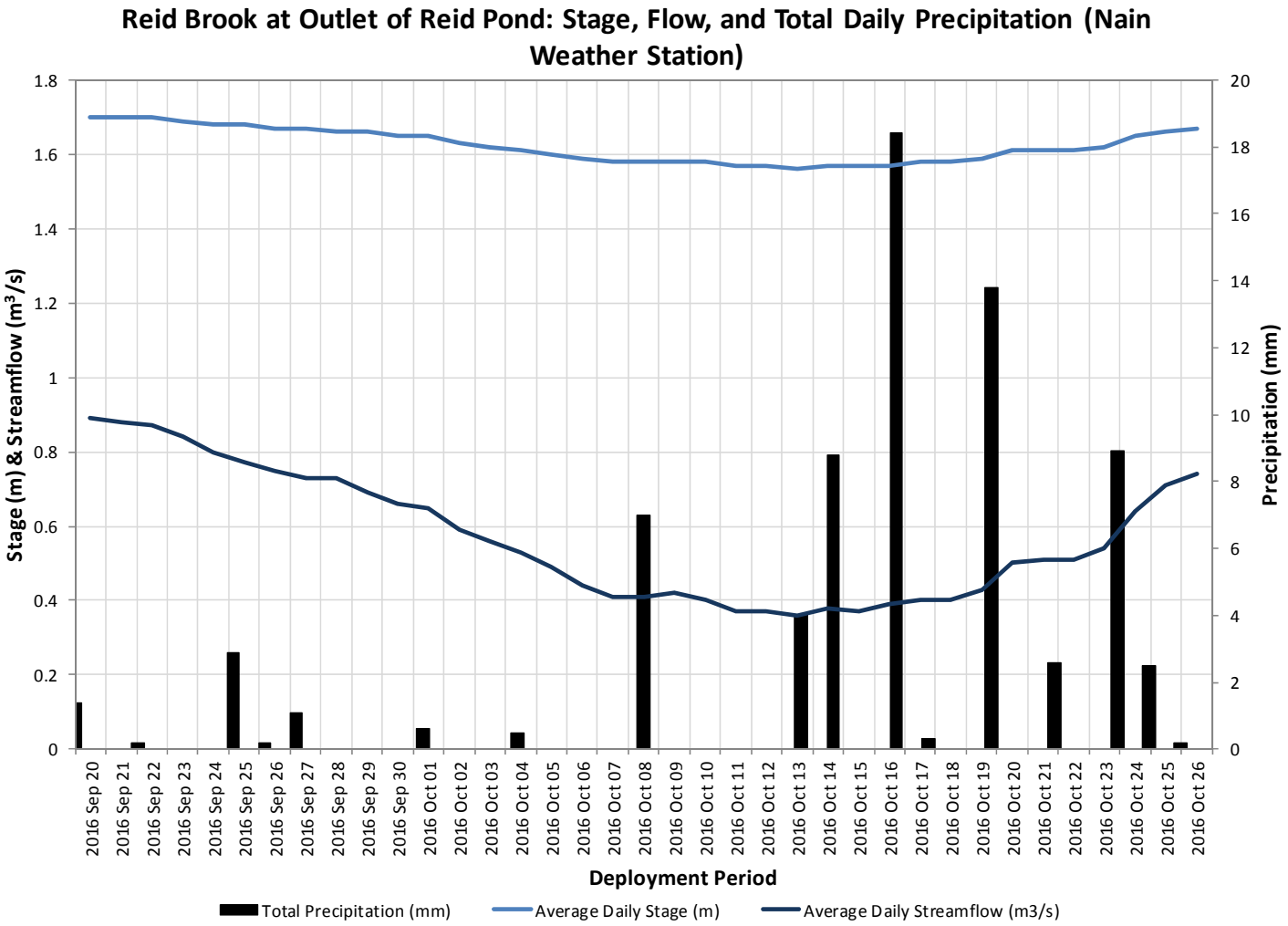

Figure 8: Daily Stage and Streamflow data from Reid Brook at Outlet of Reid Pond and Total Daily Precipitation from Nain, Labrador Weather Station

Camp Pond Brook below Camp Pond

Water Temperature

Water temperature ranged from 0.07°C to 11.82°C during this deployment period (Figure 9).

The water temperature at this station displays diurnal variations of the temperature. There are dips in water temperature on October 19 - 20th and October 23 – 25th, 2016; likely a result of rainfall during this time frame (Figure 10).

This stream is sensitive to changes in the ambient air temperature and fluctuates considerably depending on the weather and time of day. This station typically has the highest water temperatures and greatest fluctuations when compared to the other stations in the network.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

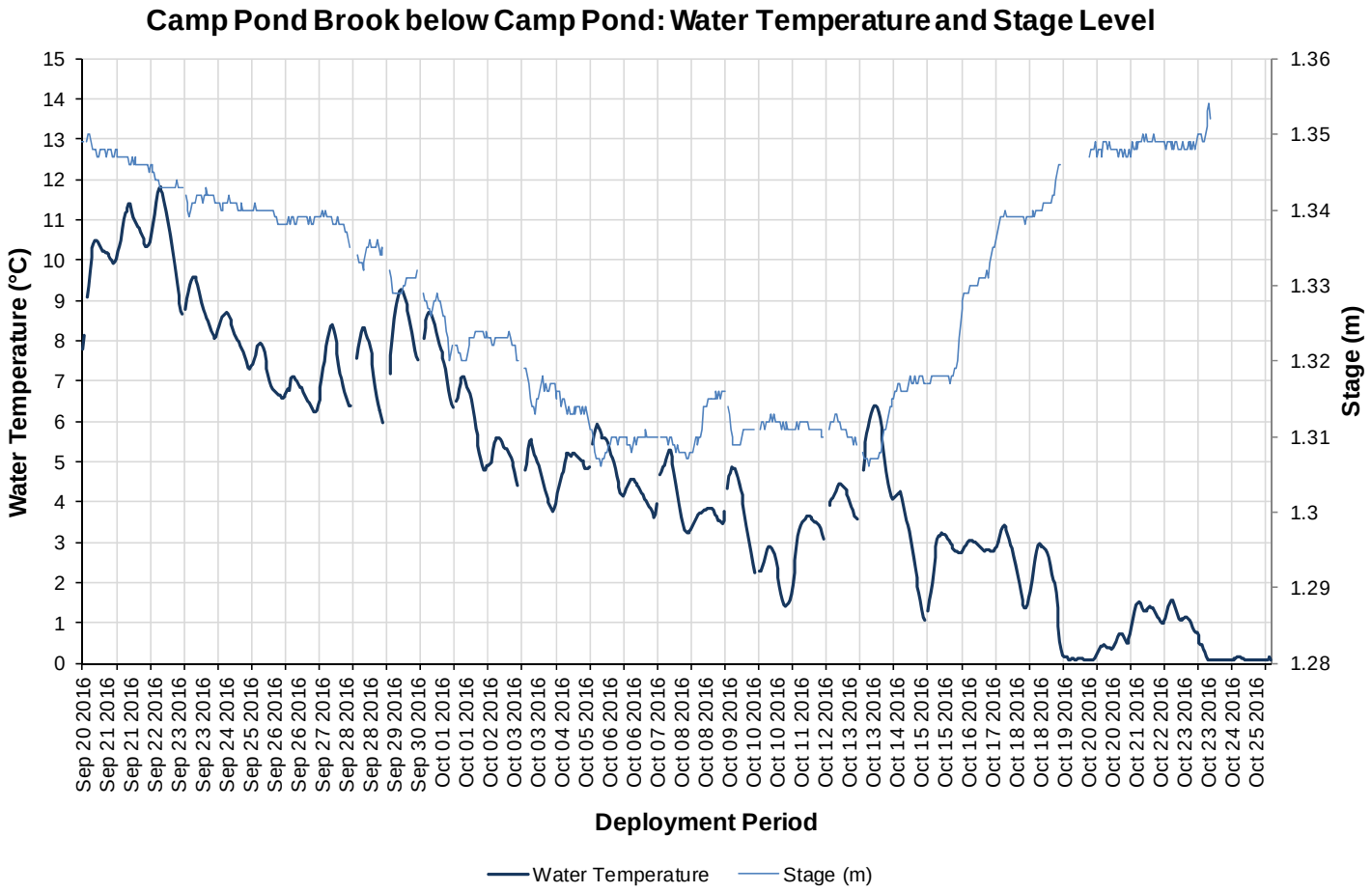

Figure 9: Water Temperature & Stage Level at Camp Pond Brook below Camp Pond

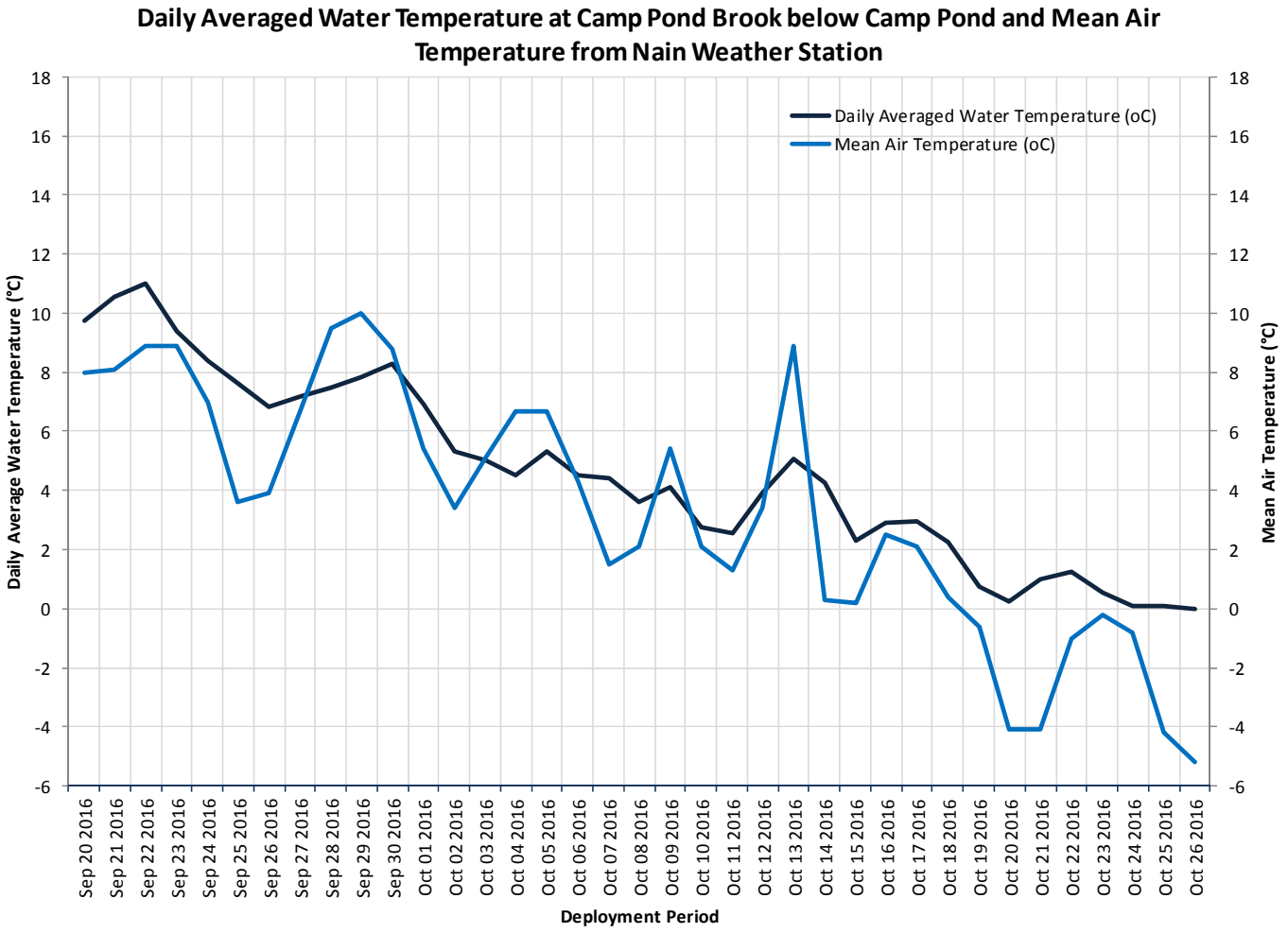

Figure 10: Daily Averaged Water Temperature at Camp Pond Brook below Camp Pond & Mean Air Temperature from Nain Weather Station.

pH

Throughout the deployment period, pH values ranged between 6.62 pH units and 7.09 pH units (Figure 11).

The pH levels are consistent during the deployment. The pH data remain within the Guidelines for Protection of Aquatic Life. The Canadian Council of Ministers of the Environment (CCME) guidelines are just a basis by which to compare any dramatic change in the pH data within a dataset. Every brook is different with its own natural baseline conditions.

Natural events such as rainfall and snow melt will alter the pH of a brook for a period of time. The pH levels will decrease slightly for a short period of time during and after high stage levels. This is a natural process.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

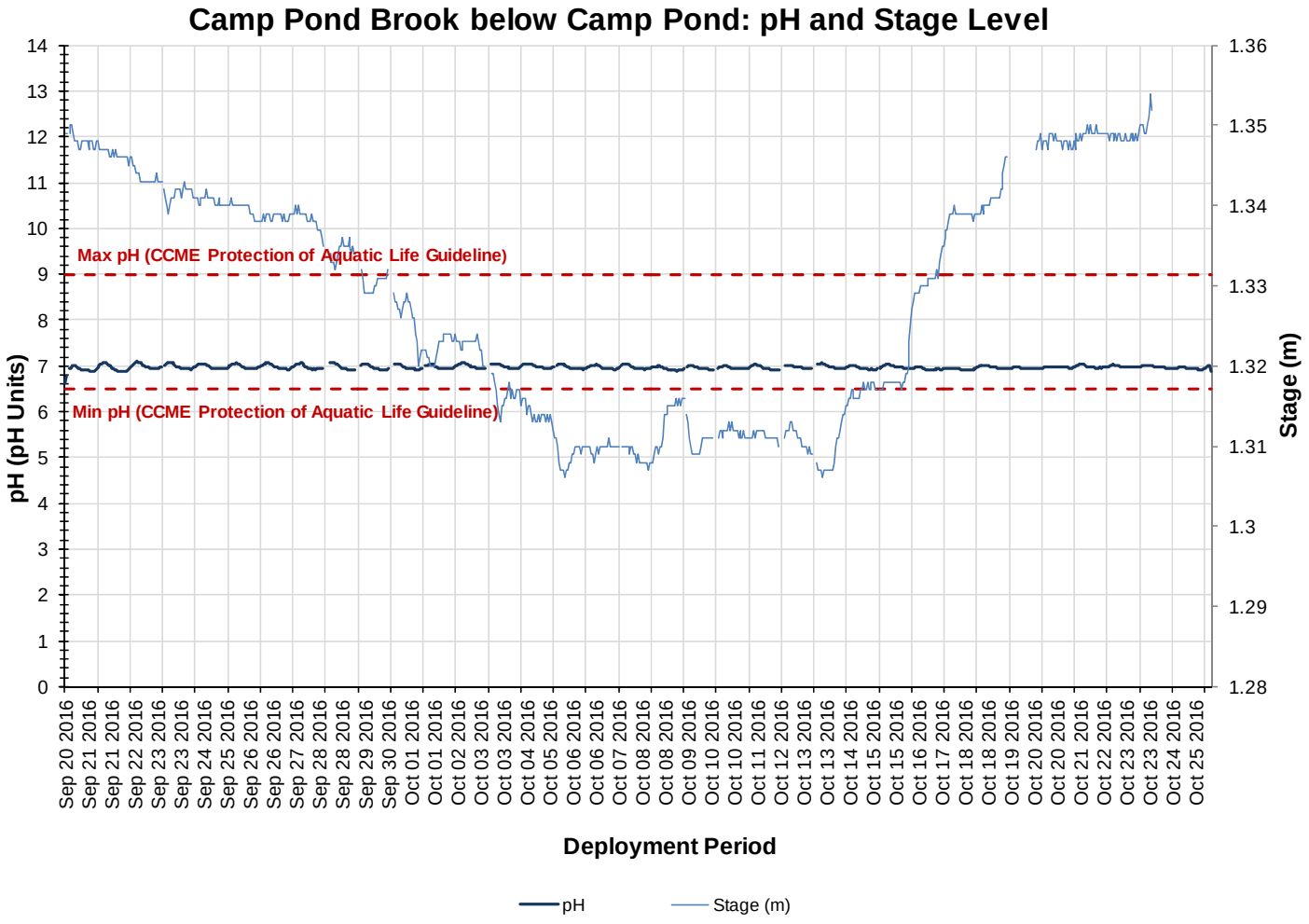

Figure 11: pH & Stage Level at Camp Pond Brook below Camp Pond

Specific Conductivity

Specific conductivity ranges from 38.5µS/cm to 62.5µS/cm with a median of 42.1µS/cm (Figure 12).

At this site the specific conductivity increases with stage level increases (Figure 12). The specific conductivity of the water increases as there is an increase in the concentration of dissolved solids present in the water column.

This is evident on Figure 12, on October 9th 2016, whereby the stage and conductivity values both increase for a short period of time. The larger spikes in conductivity on October 19th and October 24th, 2017 are likely a result of rainfall during that time. This site is located close to a frequently used main road and disturbed dust, particles and dissolved substances can be flushed into this brook.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

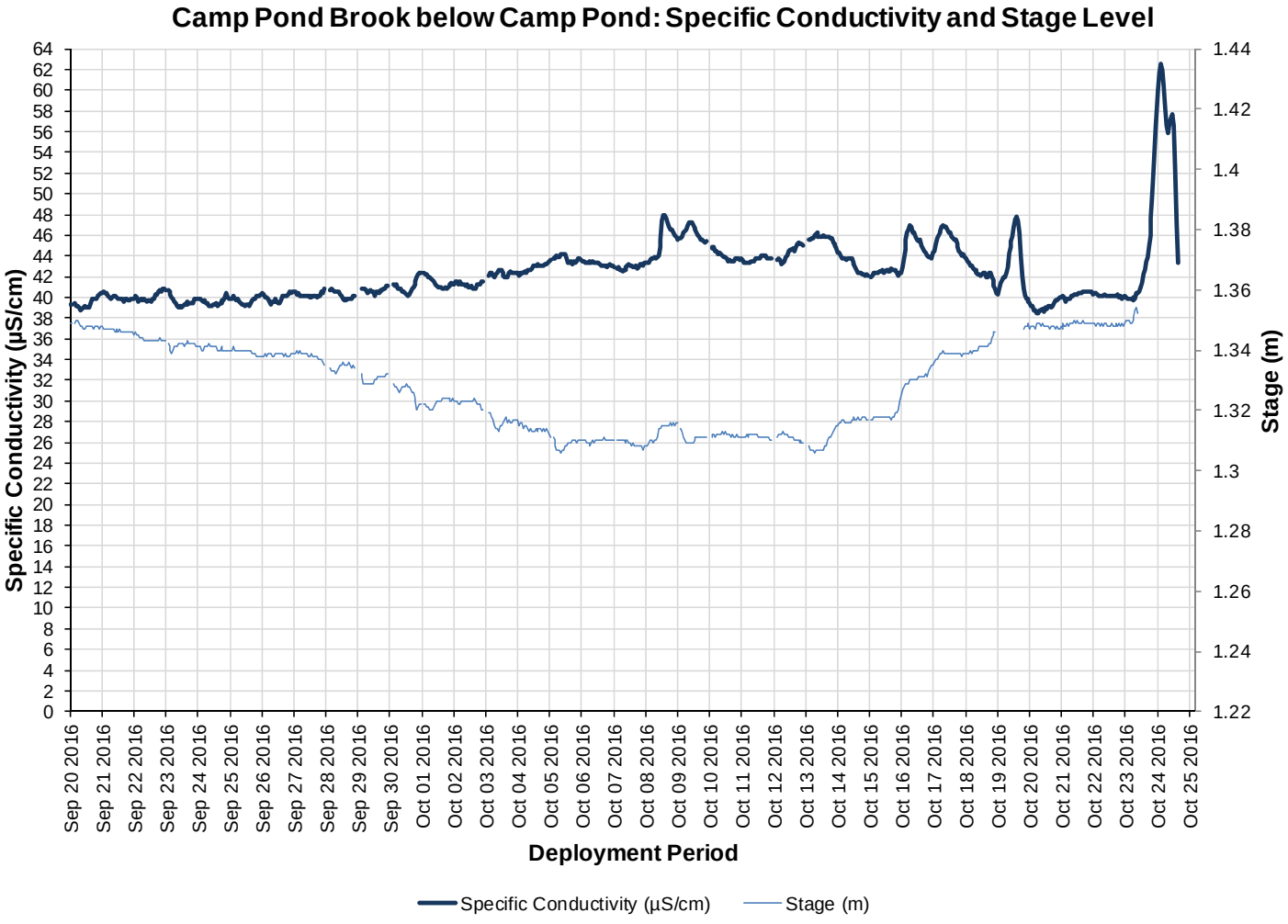

Figure 12: Specific Conductivity & Stage at Camp Pond Brook below Camp Pond

Dissolved Oxygen (mg/L & % Saturation)

Dissolved oxygen content ranges between 10.28mg/l and 14.03mg/l during the deployment period. The saturation of dissolved oxygen ranges from 88.4% to 99.4% (Figure 13). The water quality instrument measures dissolved oxygen (mg/L) with the dissolved oxygen probe and then the instrument calculates percent saturation (% Sat) with water temperature.

Dissolved oxygen concentration remained above the CCME guideline of 9.5mg/L for the duration of the deployment period. There were lower water temperatures during this deployment period (Figure 9) with a corresponding increase in dissolved oxygen. This is expected as water temperature directly influences the level of dissolved oxygen present in the water column.

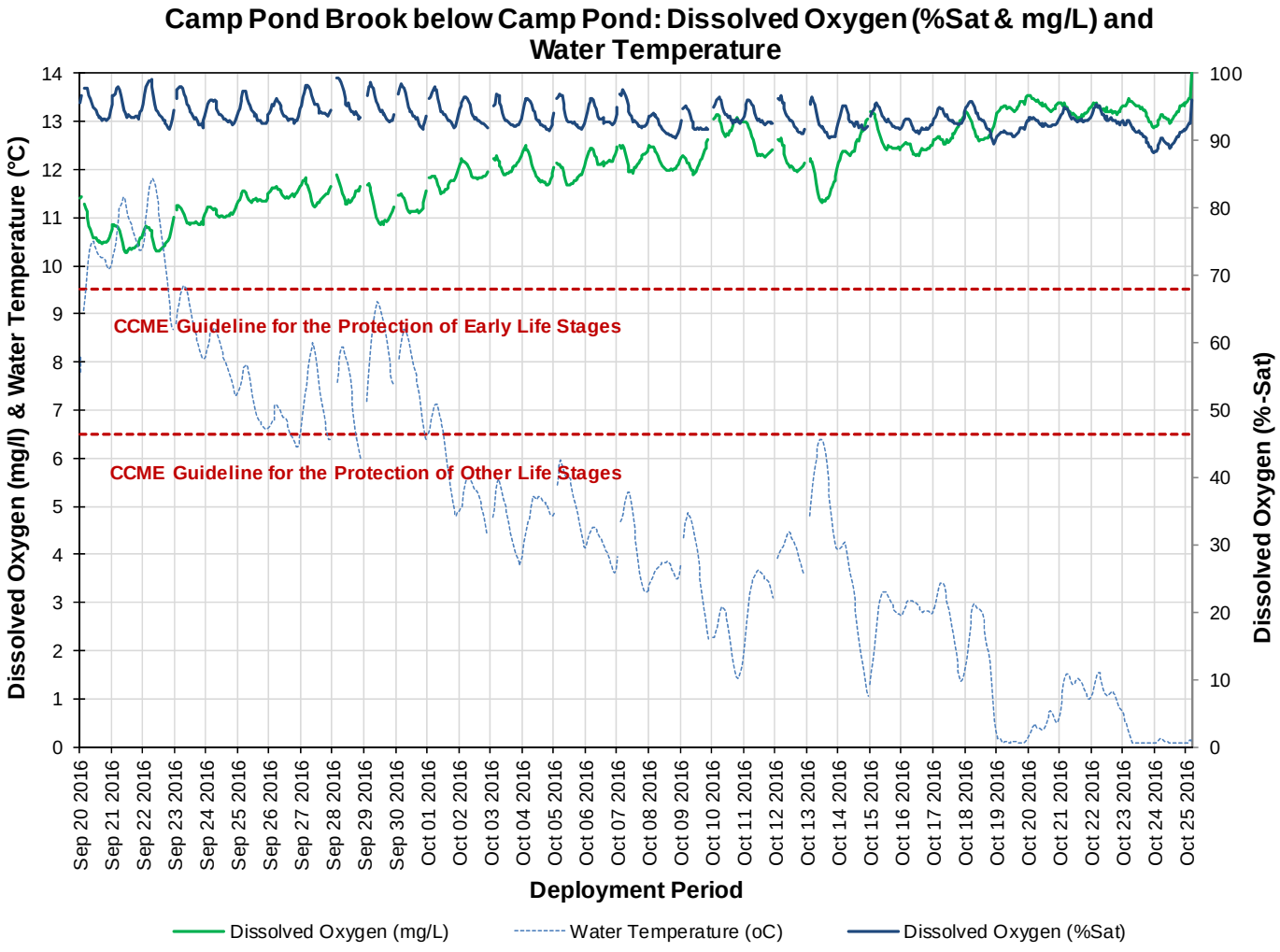

Figure 13: Dissolved Oxygen & Water Temperature at Camp Pond Brook below Camp Pond

Turbidity

Across the deployment period the turbidity ranges from 0.0NTU to 9.5NTU, with a median value of 0.0NTU (Figure 14). A median value of 0.0 NTU indicates there is very little natural background turbidity at this station during this deployment period.

The turbidity spikes during this deployment period are low. This type of turbidity change could be caused by anything in the water body (bubbles, drifting of algae or sunlight scattering). The graph below indicates the turbidity events were likely a result of a change in stage level.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

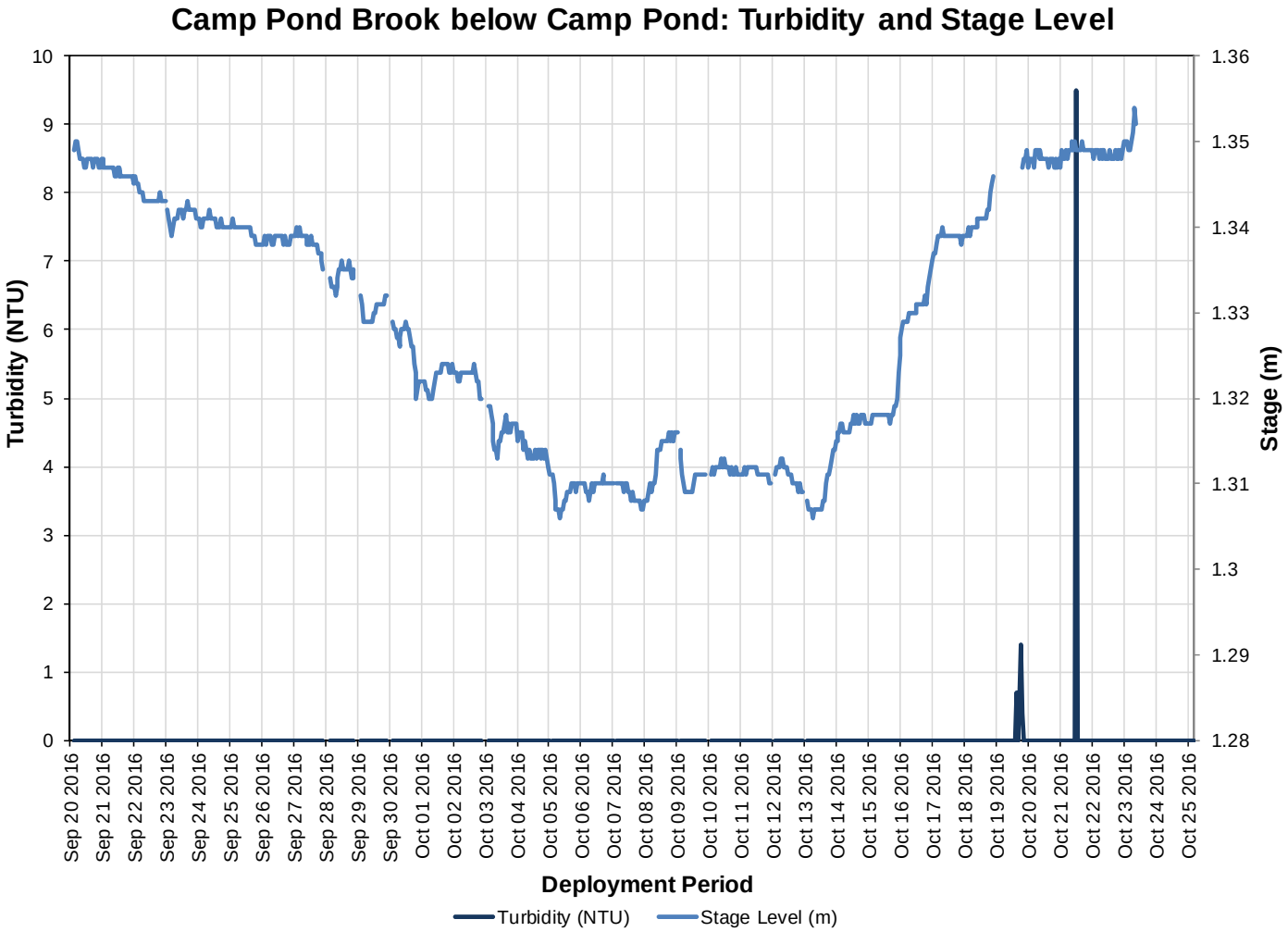

Figure 14: Turbidity & Stage Level at Camp Pond Brook below Camp Pond

Stage, Streamflow and Precipitation

WSC (Environment and Climate Change Canada) is responsible for QAQC of water quantity data (stage and flow). Corrected data can be obtained upon request. During the deployment period, the stage values ranged from 1.31m to 1.35m. Streamflow had a minimum amount of 0.07m^3/s and a maximum flow of 0.36m^3/s.

Precipitation data was obtained from the Environment Canada weather station at Nain. The weather station is 30 km northeast of Voisey's Bay (Figure 15). Precipitation occurs on 17 days during the deployment period and amounts are small in magnitude, with the largest on October 16th, 2016 accumulating 18.4 mm of precipitation.

Daily averaged stage, daily averaged streamflow and total precipitation are graphed below to show the relationship between rainfall and water level (Figure 15). These factors can influence changes in water quality parameters.

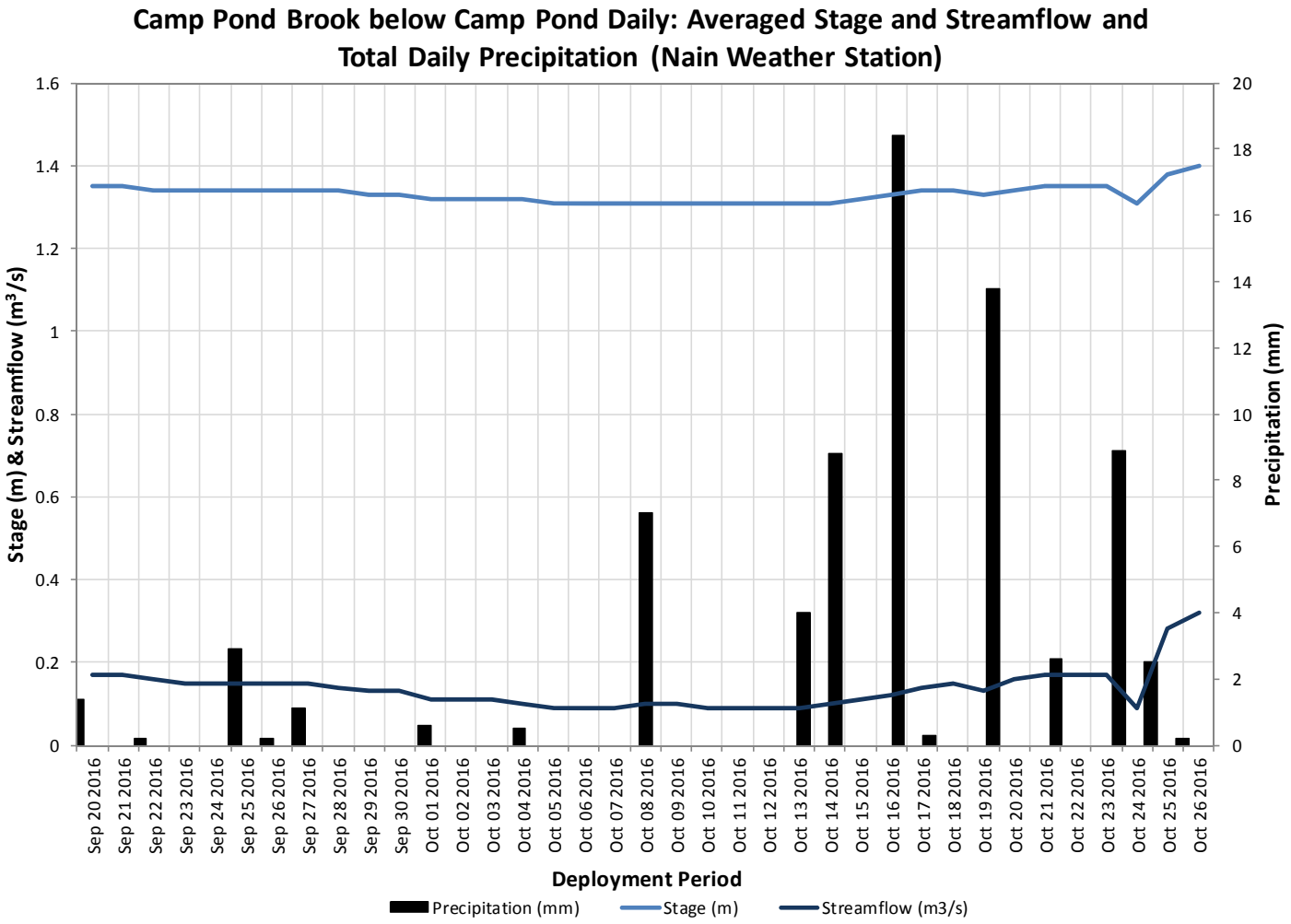

Figure 15: Daily averaged stage, daily averaged streamflow at Camp Pond Brook below Camp Pond and Total Daily Precipitation (Nain, Labrador Weather Station)

Reid Brook below Tributary

Water Temperature

Water temperature ranges from 0.19 °C to 9.31 °C, with a median value of 4.02 °C which is considerably lower than last deployments median of 9.93 °C (Figure 16).

The water temperature at this station displays diurnal variations of the temperature. There is a spike in water temperatures on October 9th and again on October 17th, 2016 which corresponds with an increase in the stage level. The increase in water temperature was likely a result of precipitation (Figure 17).

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

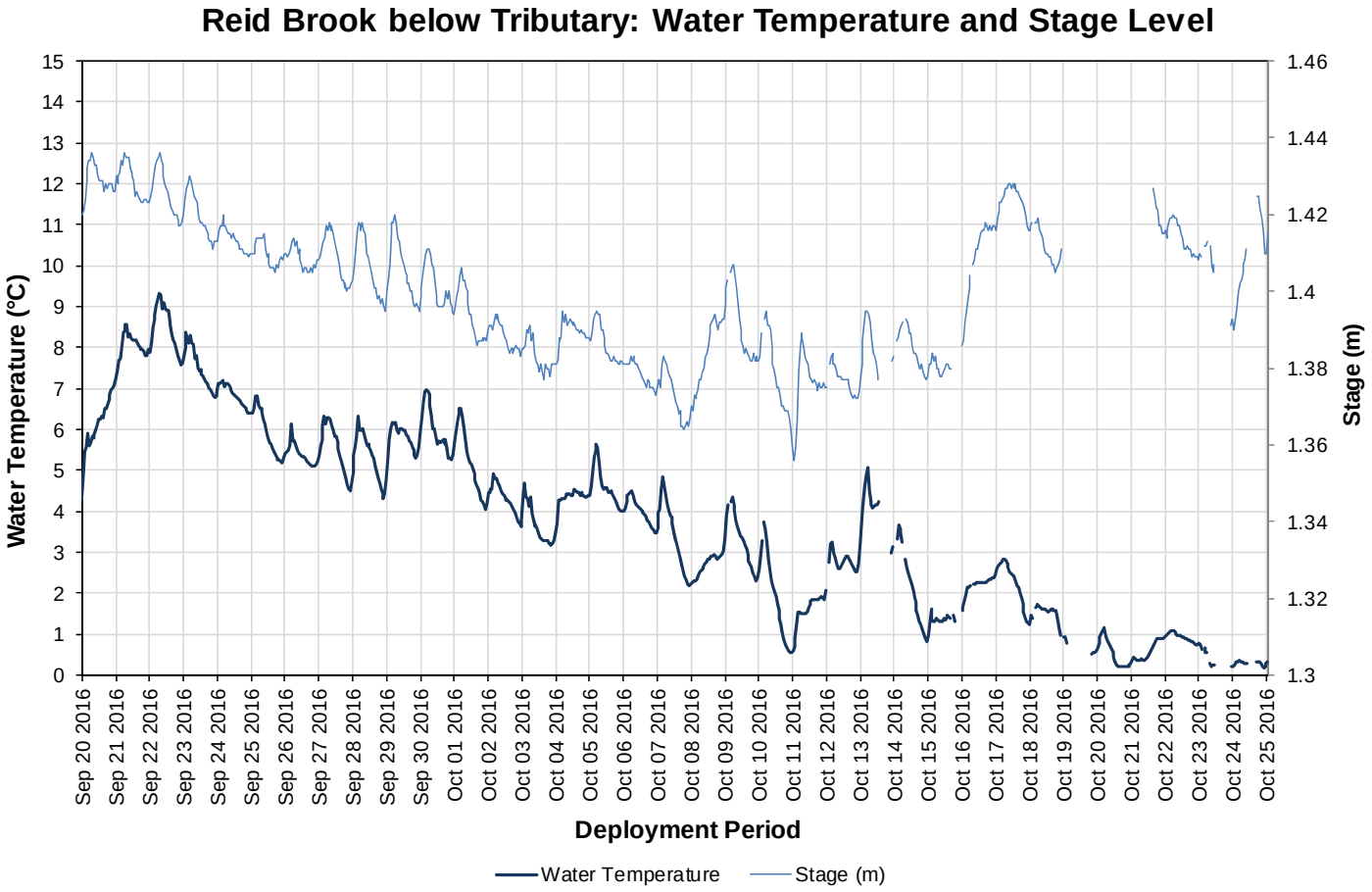

Figure 16: Water Temperature & Stage Level at Reid Brook below Tributary

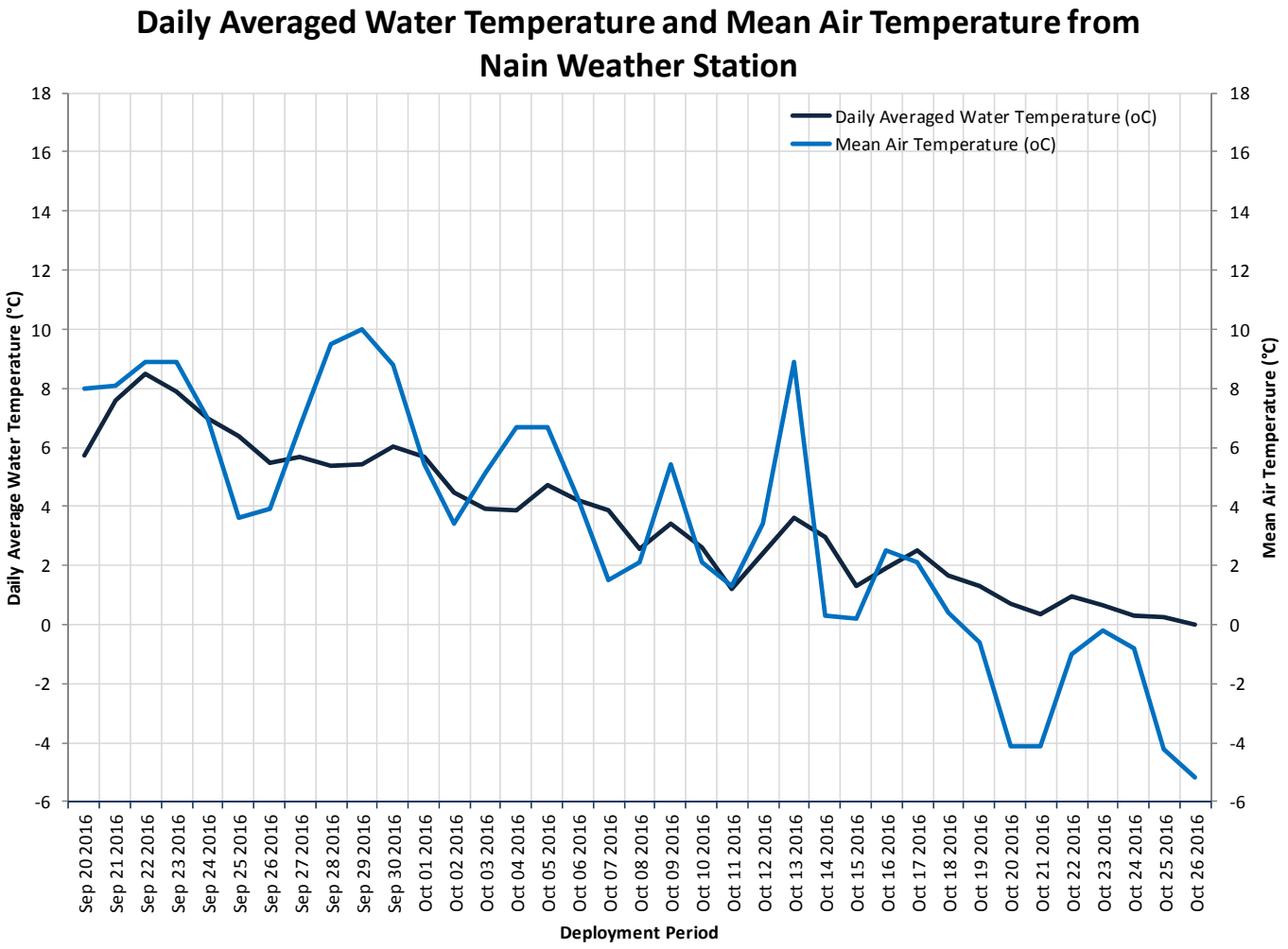

Figure 17: Daily Averaged Water Temperature at Reid Brook below Tributary and Mean Air Temperature from Nain Weather Station

pH

During this deployment this station had a pH ranges from 6.35 to 6.96 pH units, with a median value of 6.69 (Figure 18).

For the majority of the deployment period, the pH data remains within the CCME guidelines for aquatic life. Toward the end of the deployment the pH values dips below the minimum pH for CCME guideline of Protection of Aquatic Life Guidelines. During large stage increases pH levels will dip slightly. The stage increases are likely a result of precipitation and the addition of rain water cause the water to become slightly more acidic therefore the pH drops. Overall the pH levels at this station are consistent.

The Canadian Council of Ministers of the Environment (CCME) guidelines are just a basis by which to compare any dramatic change in the pH data within a dataset. Every brook is different with its own natural baseline conditions.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

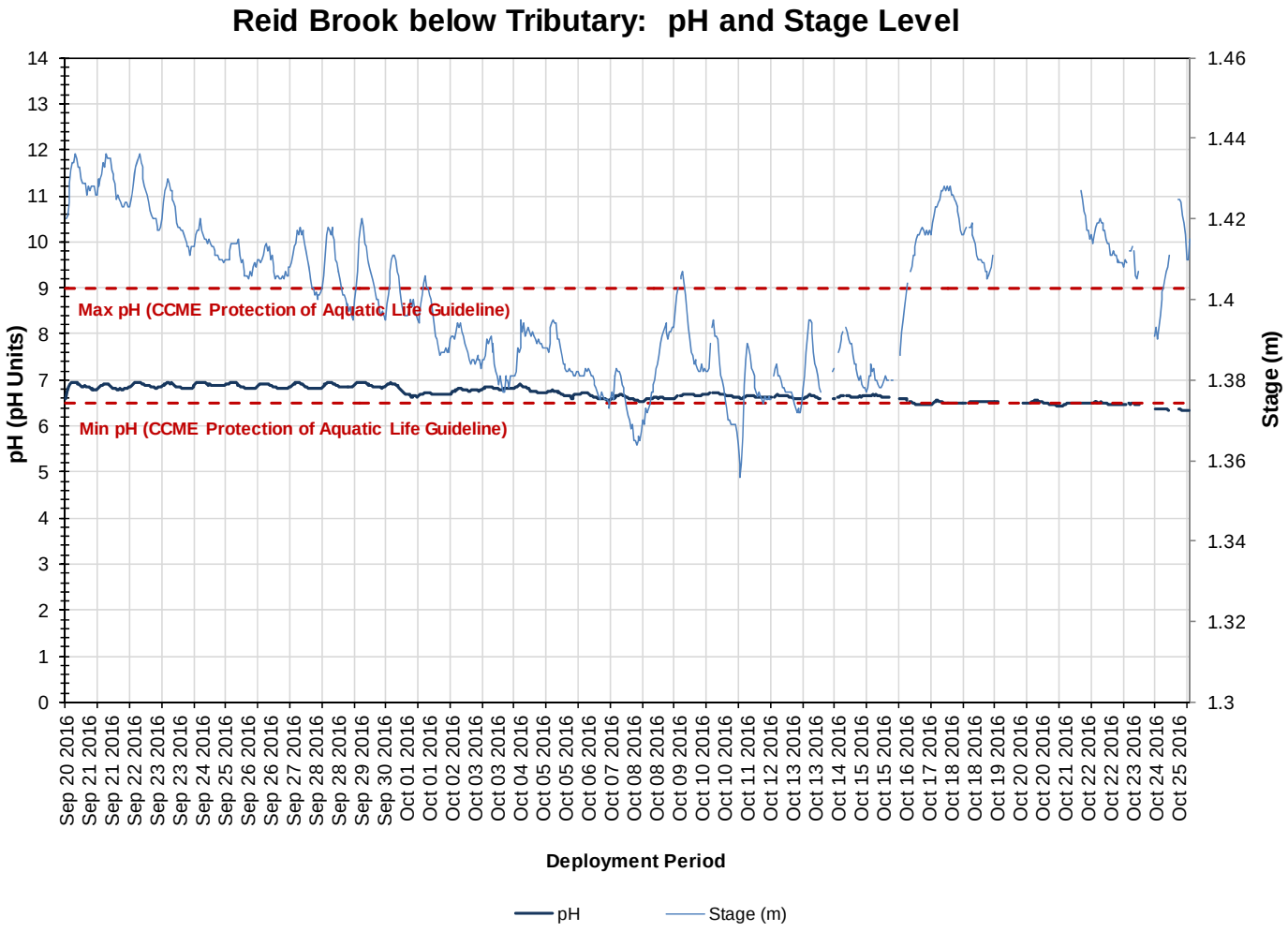

Figure 18: pH & Stage at Reid Brook below Tributary

Specific Conductivity

Specific conductivity ranges from 35.5µS/cm to 44.9µS/cm with a median of 40.2µS/cm. (Figure 19).

As stage level increases, the specific conductivity of the water decreases likely a result of the higher volume of water flushing the dissolved solids through the brook. The relationship is evident on Figure 19, on October 17th 2016 as the conductivity values dip.

Over the deployment period the conductivity levels are reasonably consistent. Toward the end of the deployment conductivity data does drop off slightly, this is to be expected as the water level increases slightly likely an increase from precipitation (Figure 19).

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

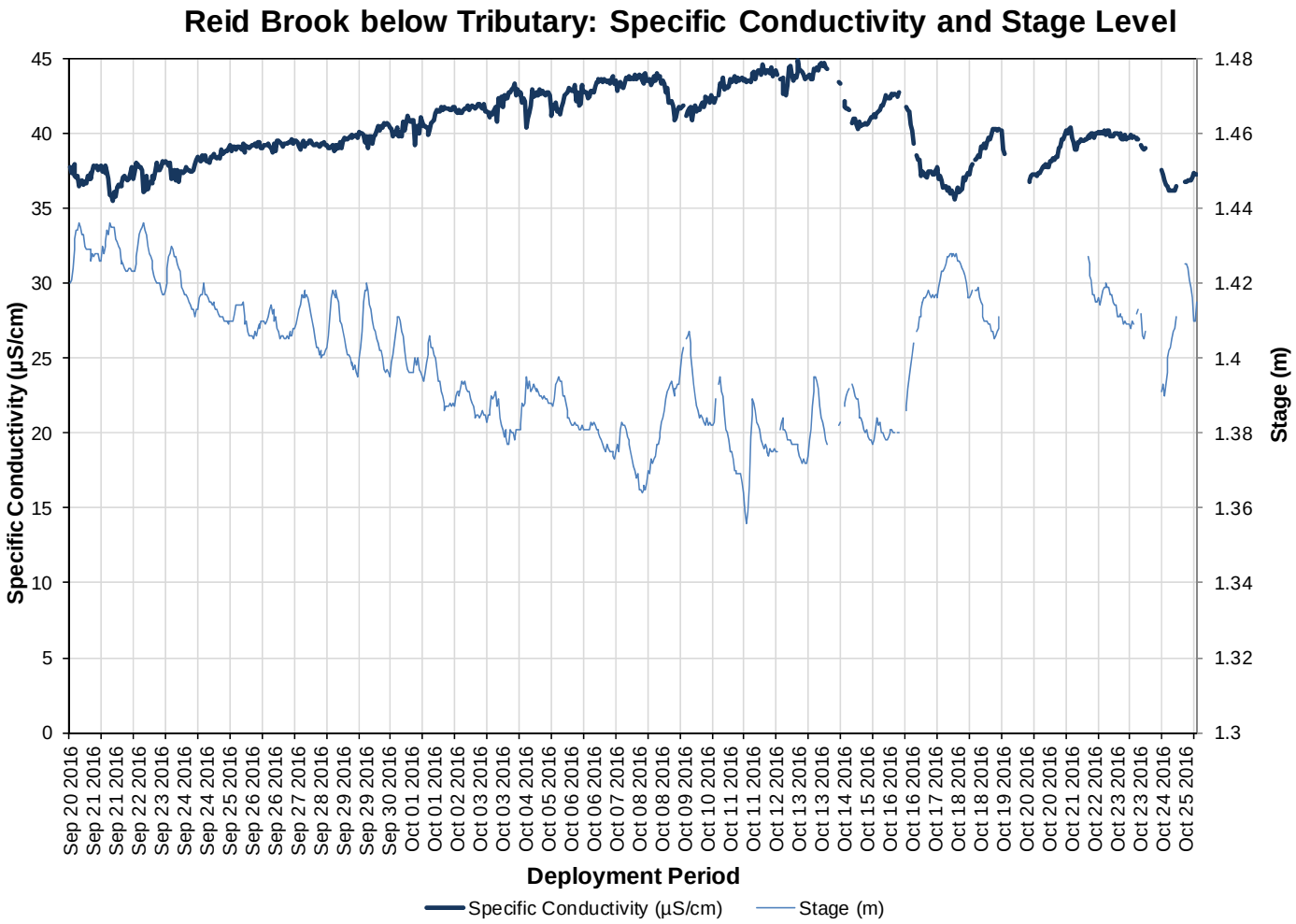

Figure 19: Specific Conductivity & Stage at Reid Brook below Tributary

Dissolved Oxygen

Dissolved oxygen content ranges between 10.96mg/l and 13.88mg/l during the deployment period. The saturation of dissolved oxygen ranges from 91.6% to 100.7% (Figure 20). The water quality instrument measures dissolved oxygen (mg/L) with the dissolved oxygen probe and then the instrument calculates percent saturation (% Sat) with water temperature (Figure 20).

During this deployment the dissolved oxygen concentration remained above the CCME guideline of 9.5mg/L. The dissolved oxygen levels were reasonably consistent; there were small dips in dissolved oxygen that correspond with changes in water temperature at the same time.

Toward the end of the deployment the dissolved oxygen concentration (mg/L) increases, this change is reflected in the drop in water temperature for the same time frame. The lower temperature allows for more dissolved oxygen to be present in the water body.

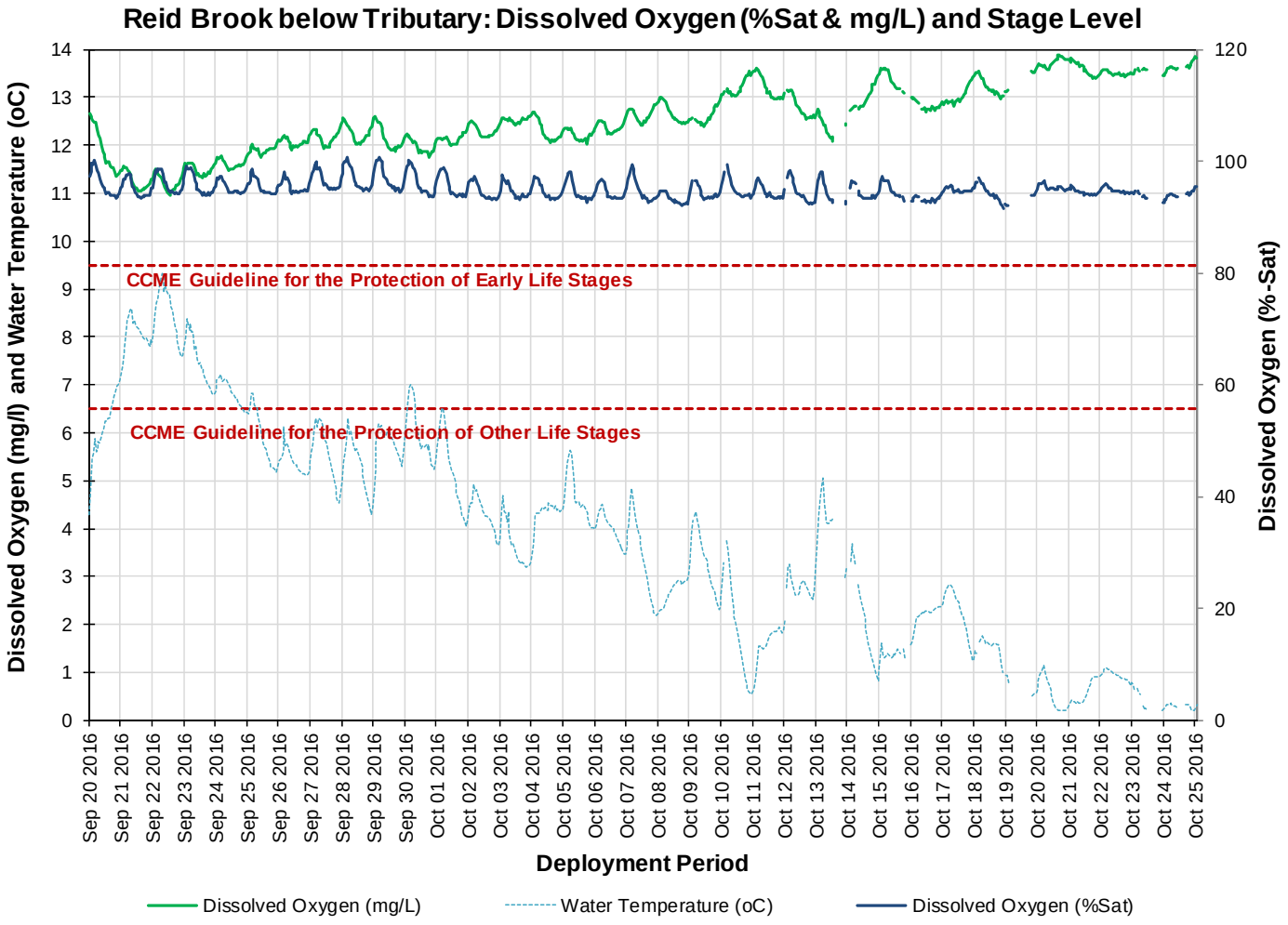

Figure 20: Dissolved Oxygen and Water Temperature at Reid Brook below Tributary

Turbidity

Turbidity ranges from 0.0 NTU to 3.6 NTU during the deployment period, with a median value of 0.0NTU (Figure 21).

A median value of 0.0 NTU indicates there is very little natural background turbidity. There were a few low - medium turbidity events at this station throughout the deployment. The turbidity spikes correlate with an increase in stage level and likely a result of precipitation causing the mixing of solids in the water column (Figure 21).

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

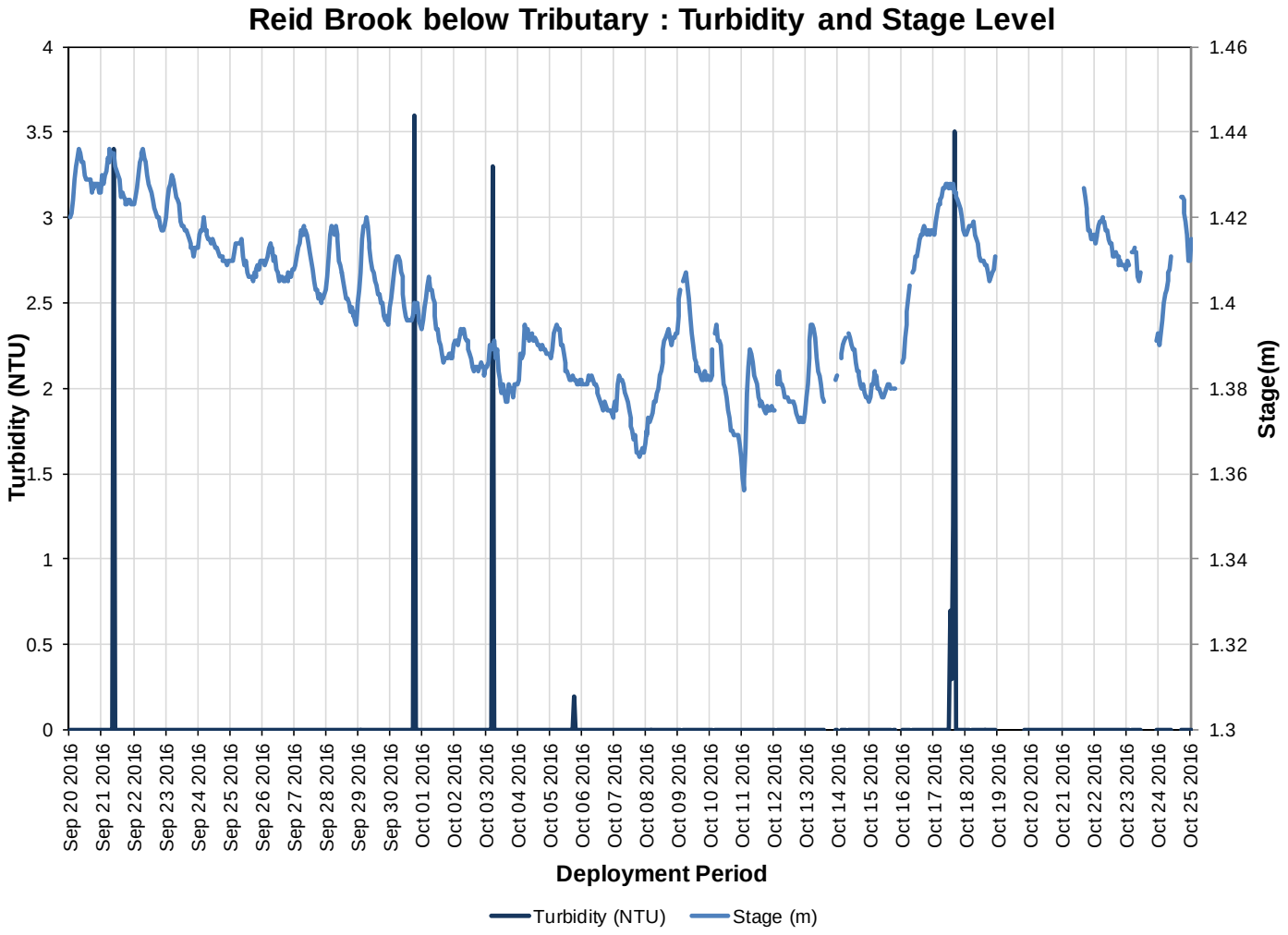

Figure 21: Turbidity and Stage Level at Reid Brook below Tributary

Stage, Streamflow and Precipitation

Stage, streamflow and precipitation are graphed below to show the relationship between rainfall and water level (Figure 22). It is evident that the peaks in stage (m) and streamflow (m^3/s) data are a result of precipitation.

Precipitation data was obtained from the Environment Canada weather station at Nain. The weather station is 30 km northeast of Voisey's Bay. Precipitation occurs on 17 days during the deployment period and amounts are small in magnitude, with the exception of the largest on October 16th, 2016 with 18.4 mm of rain.

During the deployment period, the stage values ranged from 1.36m to 1.44m. Streamflow had a minimum amount of 0.57m^3/s and a maximum flow of 1.67m^3/s.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

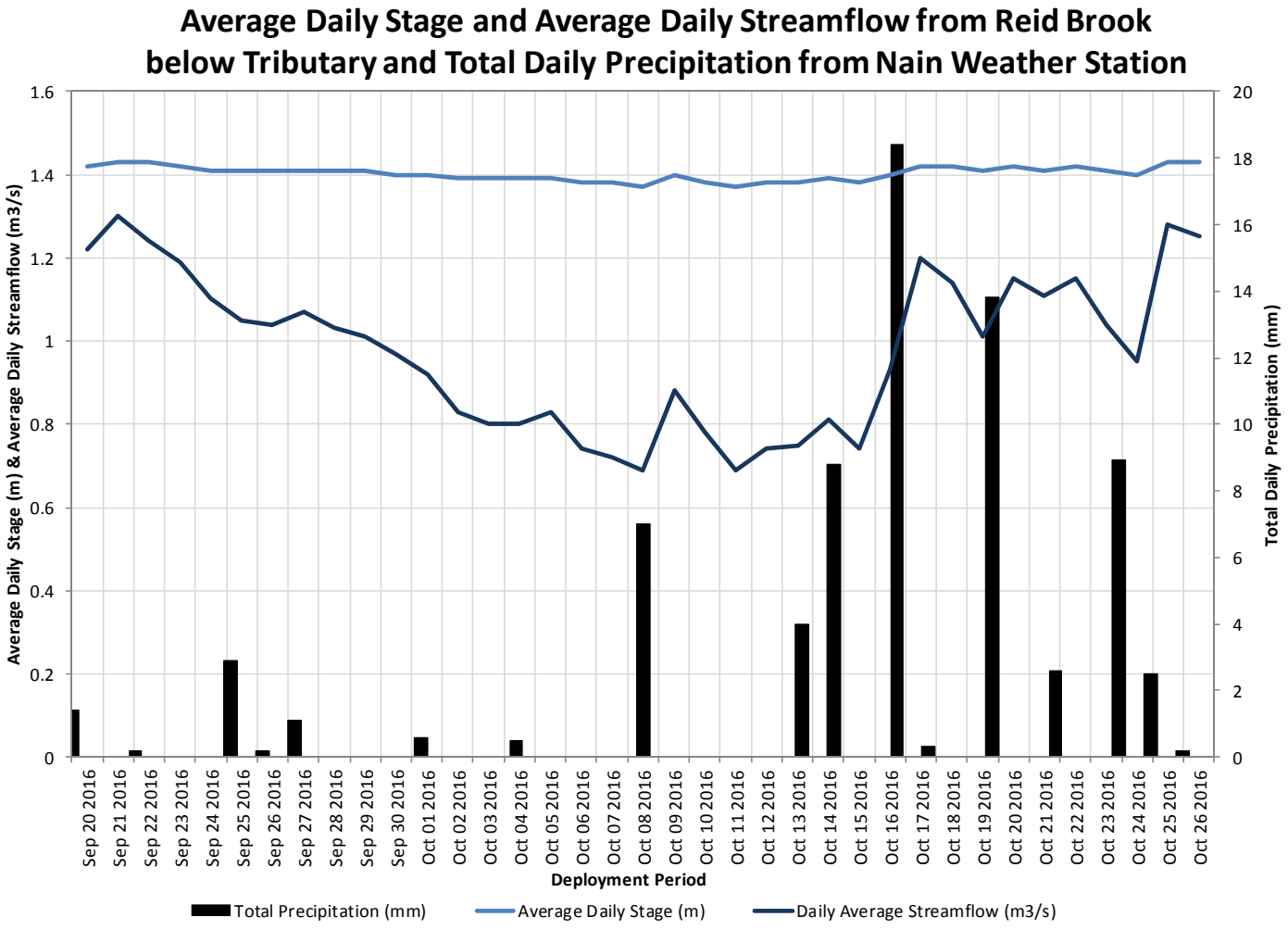

Figure 22: Daily averaged stage and Daily averaged streamflow at Reid Brook below Tributary and Total Daily Precipitation from Nain, Labrador Weather Station

Tributary to Reid Brook

Water Temperature

Water temperature ranges from 0.00 °C to 8.60 °C, with a median value of 3.60 °C which is considerably lower than the previous month median of 9.50°C (Figure 23). This would be expected as the air temperatures start to cool with the change in the seasons.

Streams and brooks are sensitive to changes in the ambient air temperature thus water temperature will fluctuate considerably depending on the weather and the time of day (Figure 24). This is evident at this station with the low dips in water temperature during the higher stage increases. It is likely that there was a rainfall event at this time.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

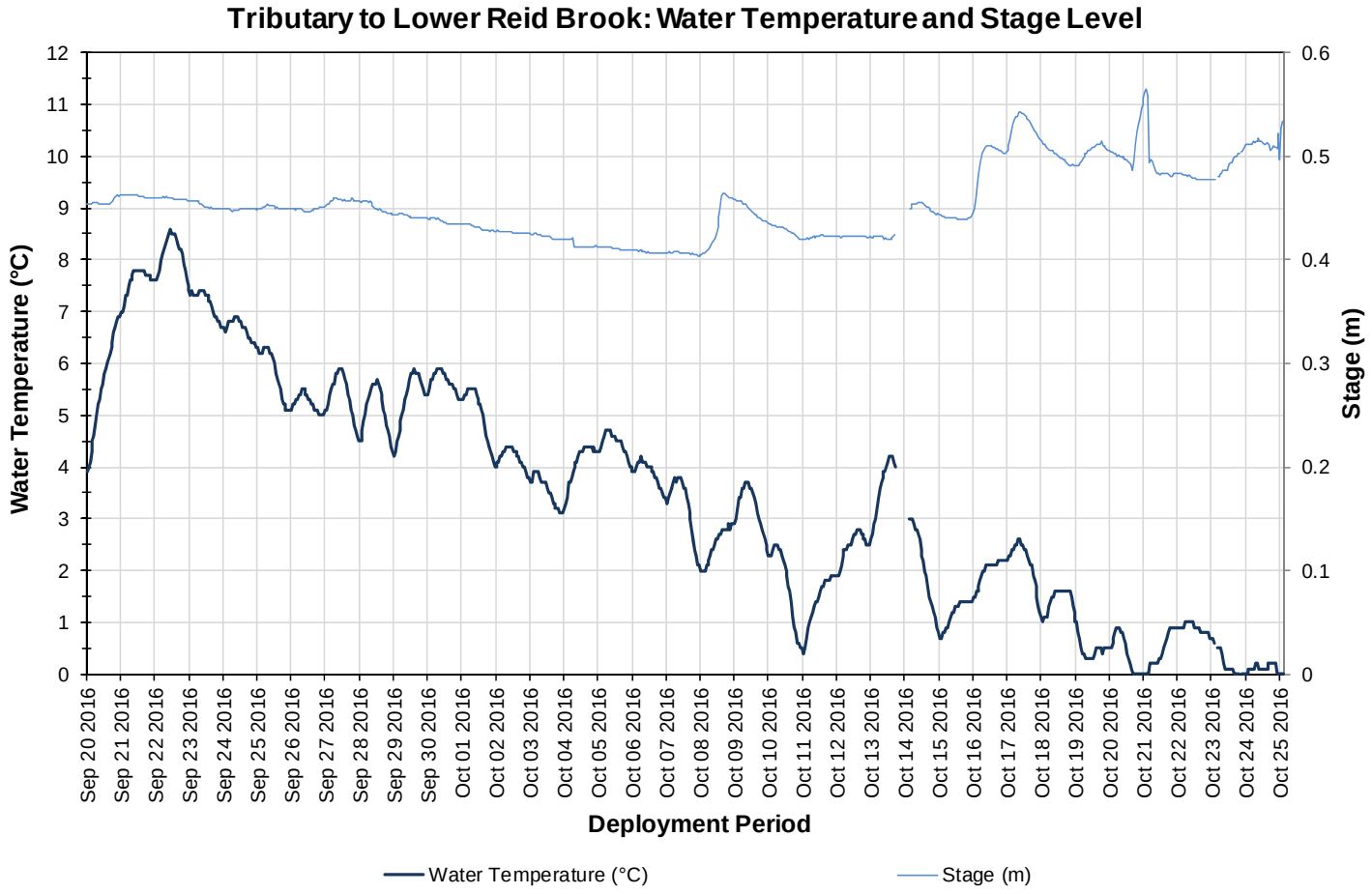

Figure 23: Water Temperature and Stage at Tributary to Reid Brook

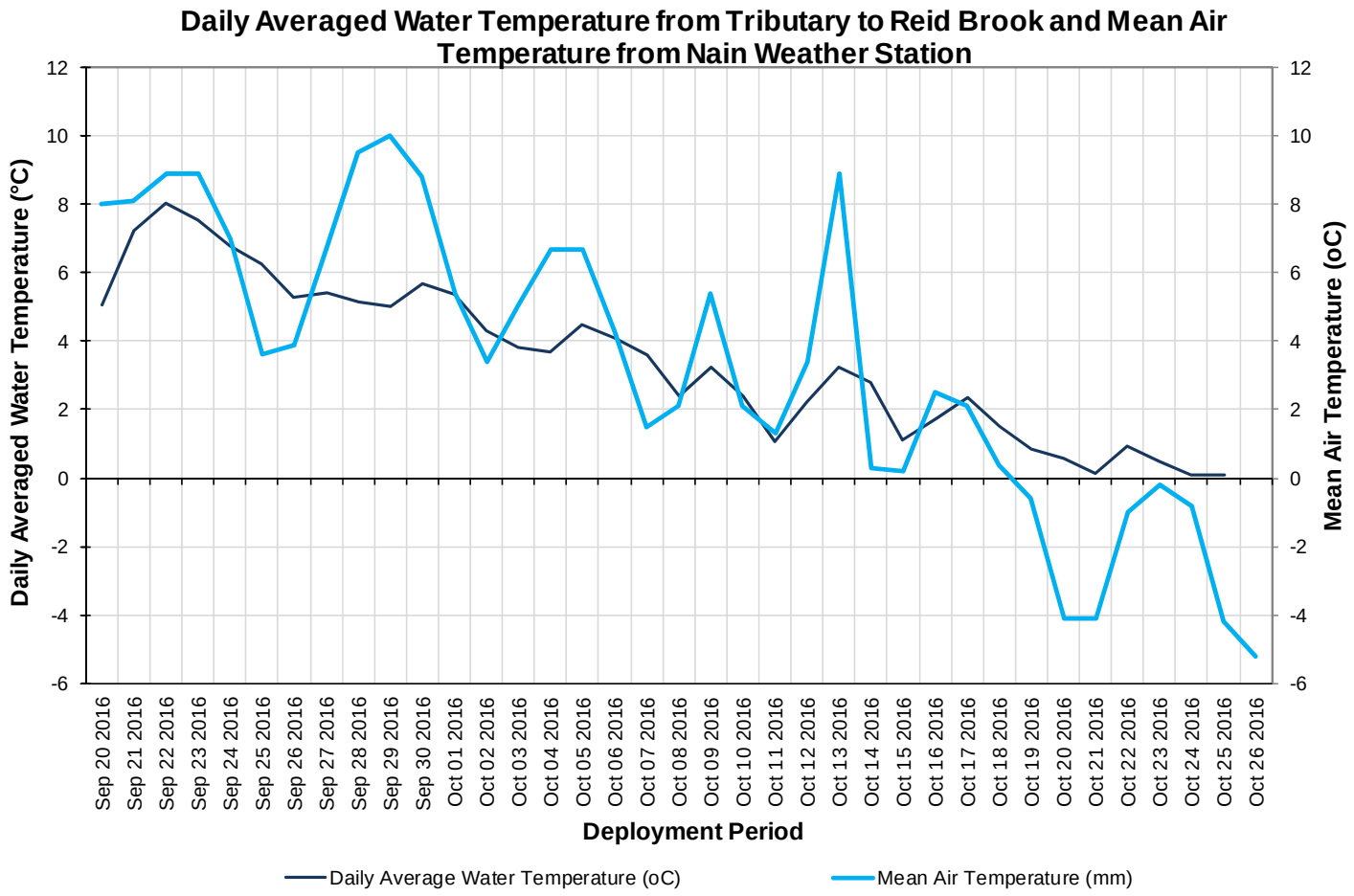

Figure 24: Daily Average Water Temperature at Tributary to Reid Brook and Mean Air Temperature from Nain Weather Station.

pH

Over the deployment period the pH values ranged from 6.76 to 7.13 pH units, with a median value of 7.02 (Figure 25).

For the entire deployment period, the pH values stayed within the CCME guidelines. Toward the end of the deployment the pH dips slightly while still remaining within the CCME guidelines. The stage level does peak on several occasions at the end of the deployment as well. The increase in stage level can indicate a rainfall event, and rainfall will influence the pH values to decrease for a short period of time (Figure 25).

The CCME guideline provides a basis by which to judge the overall health of the brook. Naturally, all streams are different and have natural baseline conditions.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

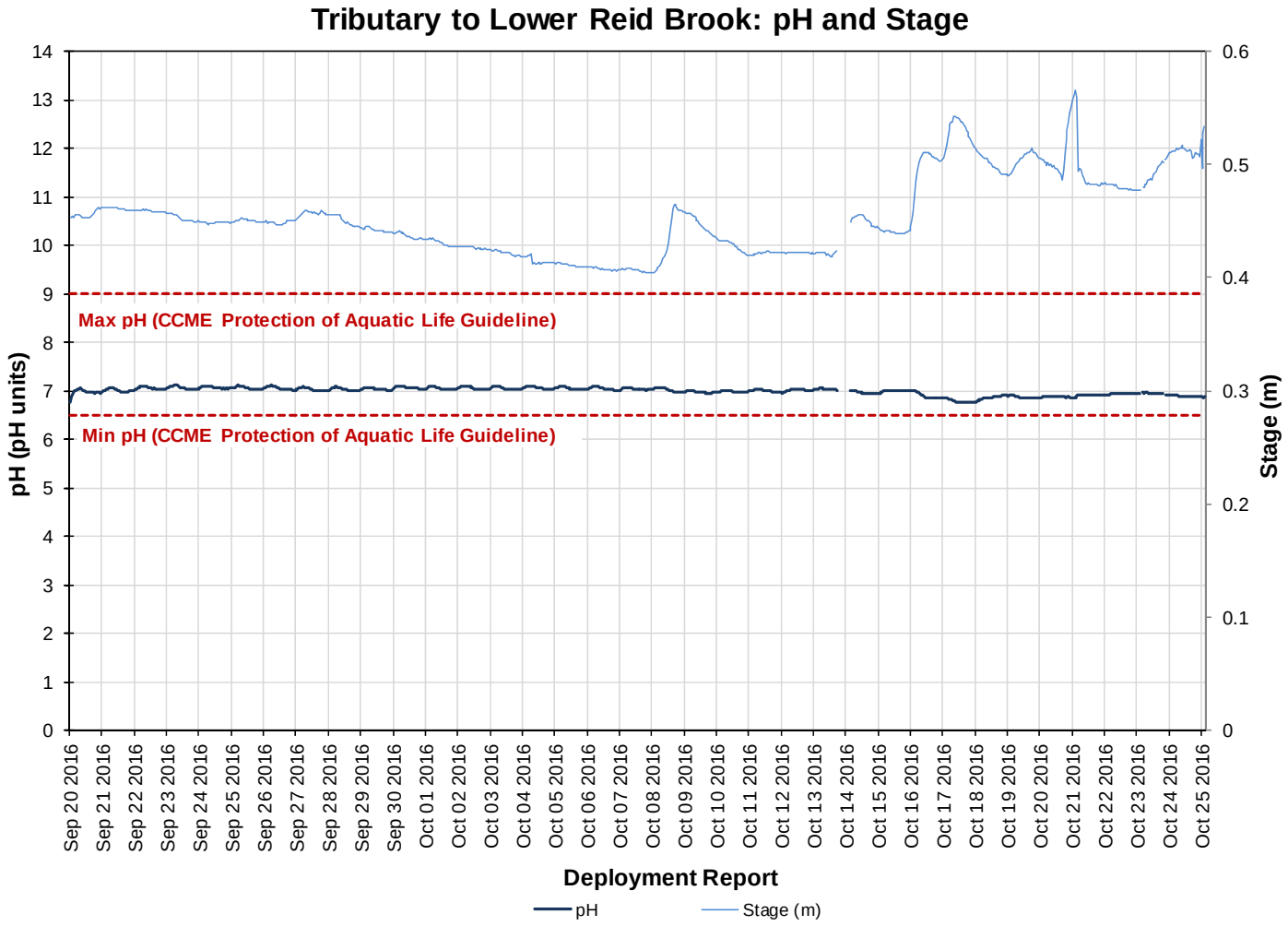

Figure 25: pH & Stage Level at Tributary to Reid Brook

Specific Conductivity

Specific conductivity ranges from 33.9µS/cm to 44.0µS/cm with a median of 39.5µS/cm. (Figure 26).

The relationship between specific conductance and stage is inversed. When stage level rises, the specific conductance level drops in response as the increased amount of water in the river system dilutes the solids that are present (Figure 26).

The specific conductivity data on Figure 26 displays the changes that occur during stage increases and decreases.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

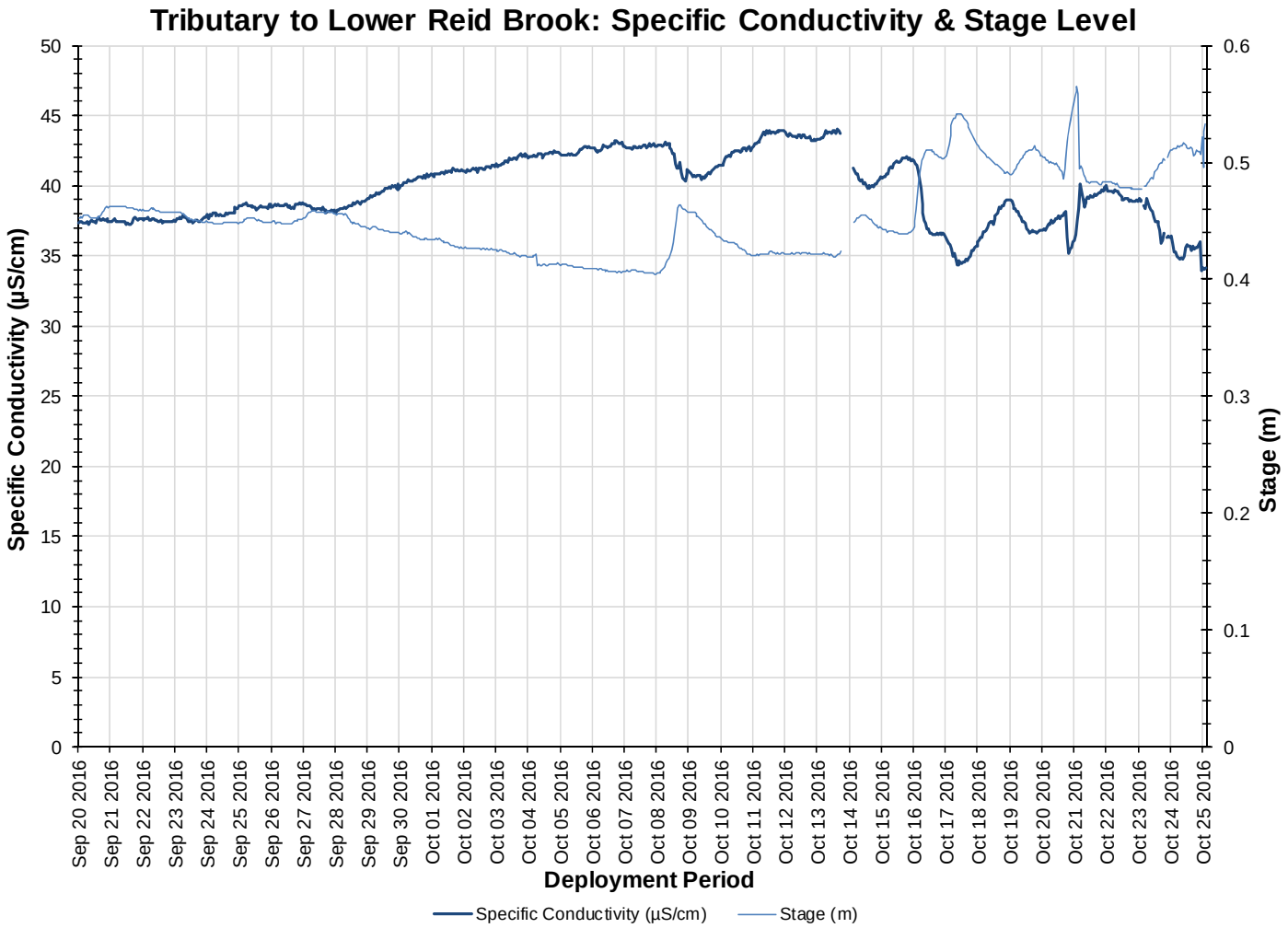

Figure 26: Specific Conductivity & Stage at Tributary to Reid Brook

Dissolved Oxygen

Dissolved oxygen content ranges between 11.31mg/l and 14.21mg/l during the deployment period. The saturation of dissolved oxygen ranges from 94.5% to 100.4% (Figure 27). The water quality instrument measures dissolved oxygen (mg/L) with the dissolved oxygen probe and then the instrument calculates percent saturation (% Sat) with water temperature.

The dissolved oxygen data levels remained above the CCME guidelines for the protection of early/other life stages (Figure 27).

Dissolved oxygen data displays a diurnal pattern. During nightfall the dissolved oxygen levels are higher, the cooler temperatures allow for more DO to be stored in the water column. During the day time the water temperatures are higher so there is less DO in the water column. During the day time aquatic organisms will also be using the dissolved oxygen present.

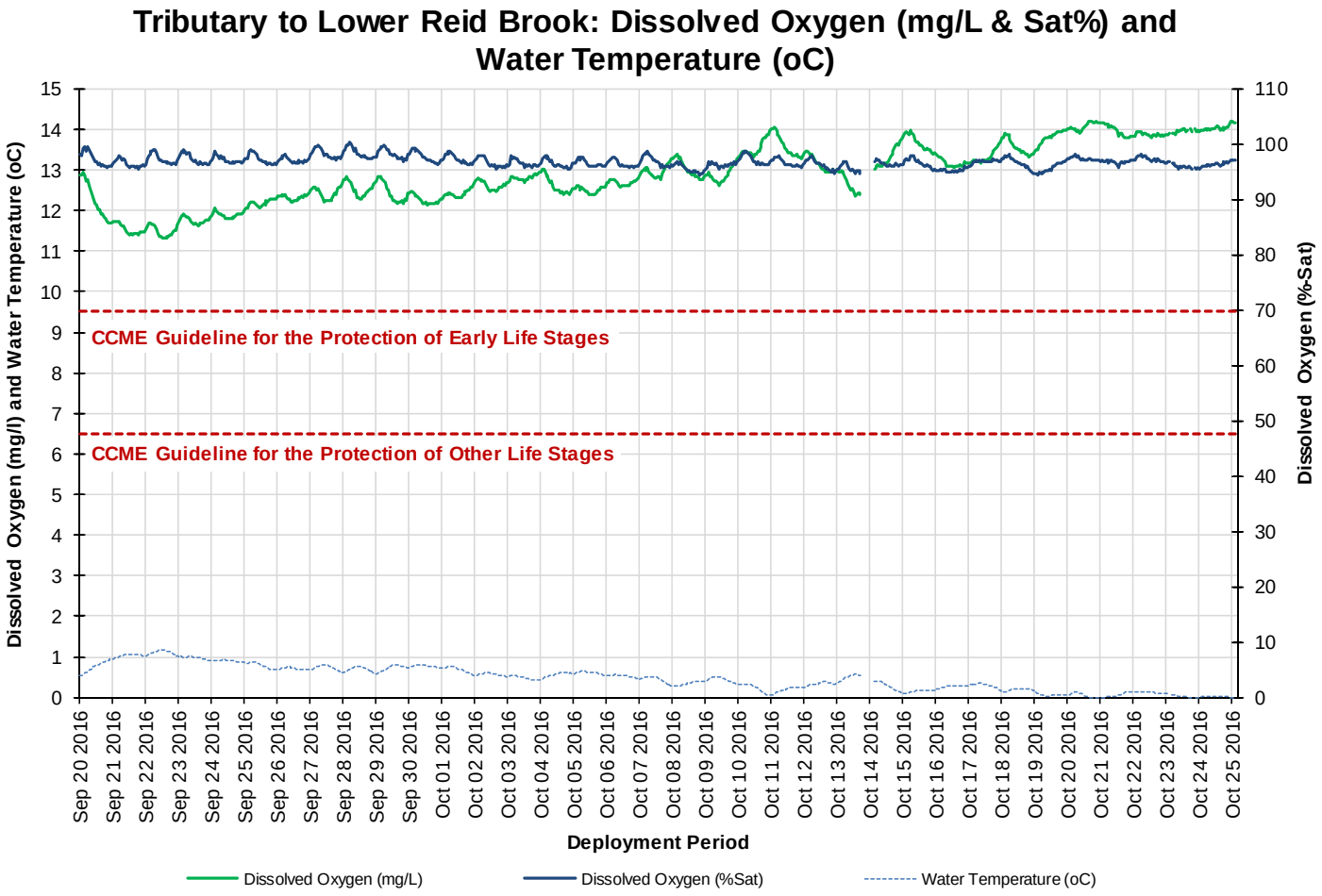

Figure 27: Dissolved Oxygen & Water Temperature at Tributary to Reid Brook

Turbidity

Turbidity ranges from 0.0 NTU to 5.7 NTU during the deployment period, with a median value of 0.0NTU (Figure 28). A median value of 0.0 NTU indicates there is very little natural background turbidity at this station during this deployment period.

There are several low turbidity events at this station. Some of the turbidity events correlate with an increase in stage level, likely a result of rainfall. The increase in water volume can stir up solids and materials in the water column (Figure 28). This particular site has sandy-clay like bottom to the brook. This material is easily disturbed during rainfall events or large increases in stage.

During the data review it was identified that the data from October 16th 2016 to the end of deployment was not representing the brook at that time, therefore it was removed.

Please note the stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

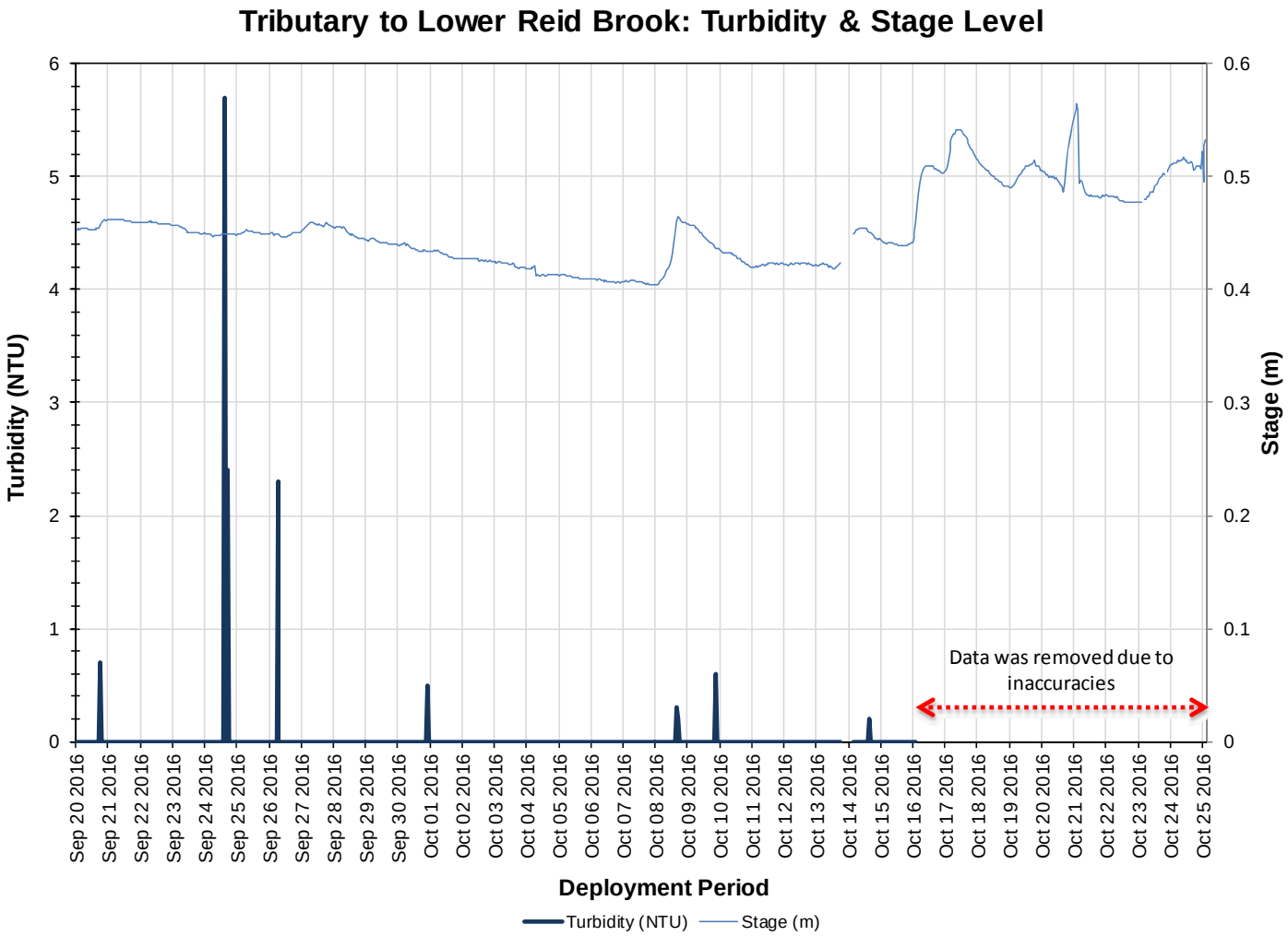

Figure 28: Turbidity & Stage at Tributary to Reid Brook

Stage, Streamflow, and Precipitation

Please note the stage and streamflow data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC. Precipitation data was obtained from the Environment Canada weather station at Nain. The weather station is 30 km northeast of Voisey's Bay (Figure 29).

Precipitation data was obtained from the Environment Canada weather station at Nain. The weather station is 30 km northeast of Voisey's Bay. Precipitation occurs on 17 days during the deployment period and amounts are small in magnitude, with the exception of the largest on October 16th, 2016 with 18.4 mm of rain. During the deployment period, the stage values ranged from 0.40m to 0.57m. Streamflow had a minimum amount of 0.08m^3/s and a maximum flow of 0.36m^3/s.

Daily averaged Stage, Streamflow and total precipitation are graphed below to show the relationship between rainfall and water level (Figure 29). It is evident that the peaks in stage (m) and streamflow data are a result of precipitation.

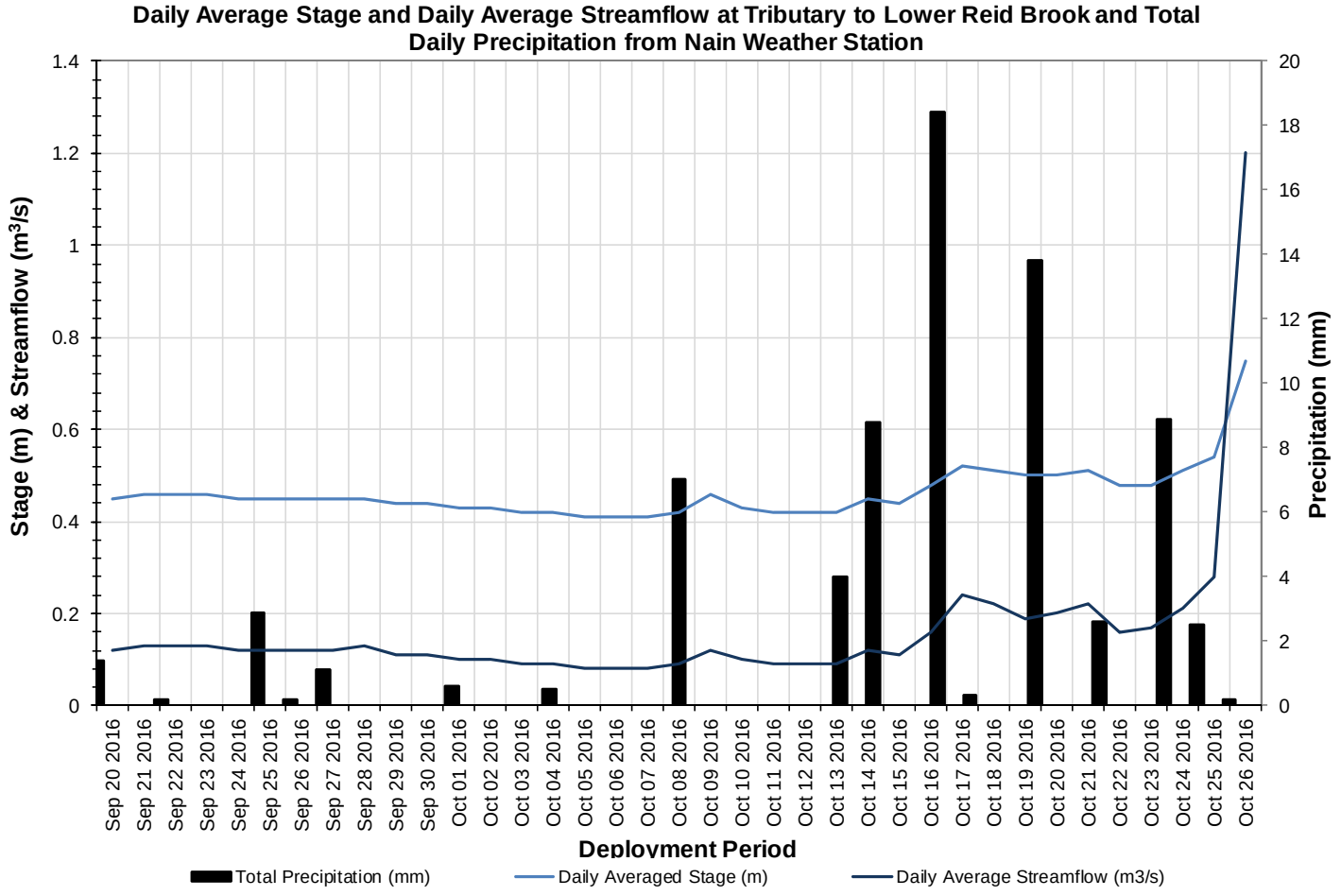

Figure 29: Daily Averaged Stage and Streamflow at Tributary to Reid Brook and Total Daily Precipitation (Nain, Labrador Weather Station)

Conclusions

The overall water temperatures across all stations were within a minimum of 0.0°C found at Tributary to Reid Brook and a maximum of 11.82°C recorded at Camp Pond Brook below Camp Pond. Tributary to Reid Brook and Camp Pond Brook had the lowest and highest water temperatures in the previous deployment as well. Overall the water temperature was decreasing across the network of stations as the air temperatures start to cool. The stations on Camp Pond Brook, Tributary to Lower Reid Brook and Lower Reid Brook are more sensitive to changes in the ambient air temperatures as these sites are brooks with continuously moving water. Reid Brook at Outlet of Reid Pond is a pond that has a larger surface area and is deeper. Ponds and lakes take a longer time to adjust to the ambient air temperature.

The pH values for this deployment ranged between a minimum of 6.35 pH units at Reid Brook below Tributary and Reid Brook below Reid Pond had the highest pH at 7.51 pH units Throughout this season the pH at all of the stations was reasonably consistent. There were dips below the CCME guideline for the protection of aquatic life cycles; however the CCME guideline provides a basis by which to judge the overall health of the brook. Naturally, all streams are different and have varying ranges of normal. When there were changes in the pH values it was during high stage events, likely from rainfall.

The overall specific conductivity across all stations were within a minimum of 11.4 µS/cm at Reid Brook at Outlet of Reid Pond and a maximum value of 62.5 µS/cm at Camp Pond Brook below Camp Pond. These two stations also had the lowest conductivity minimum and highest conductivity maximum during the previous August to September 2016 deployment. Conductivity values at Reid Brook at Outlet of Reid Pond were the lowest across deployment when compared to the other stations. Camp Pond Brook below Camp Pond maintains the highest median at 42.1µS/cm, this is to be expected with Camp Pond Brook being closer to the mine site and has an increased potential for roadway runoff and other anthropogenic influences.

Dissolved oxygen levels for the deployment period ranged between a minimum of 10.28 mg/l at Camp Pond Brook below Camp Pond and a maximum of 14.21 mg/l found at Tributary to Reid Pond. Camp Pond Brook below Camp Pond and Tributary to Reid Pond also had the lowest and highest DO mg/L during the previous August to September 2016 deployment season. Dissolved oxygen is lower at this time of year and varies diurnally as water temperature is greatly affected by ambient air temperature.

Turbidity levels for the four real-time stations ranged within a minimum of 0.0 NTU from all stations and a maximum of 9.5 NTU at Camp Pond Brook below Camp Pond. Camp Pond Brook below Camp Pond site is the closest in proximity to the mine site and would be most likely affected by any disturbances that may occur. The turbidity values recorded at Camp Pond Brook below Camp Pond are very low in significance and in frequency, the turbidity spikes that are recorded return to background values within good time.

Overall the changes in the water quality for this deployment can be explained by natural events. Camp Pond Brook below Camp Pond does have the potential for anthropogenic influences as the site is the closest to the inhabited area. It is important to note that during a change (a decrease or increase) in the water quality the change only occurs for a short period of time and the water quality parameters do return to the original state.

APPENDIX A: Comparison Graphs

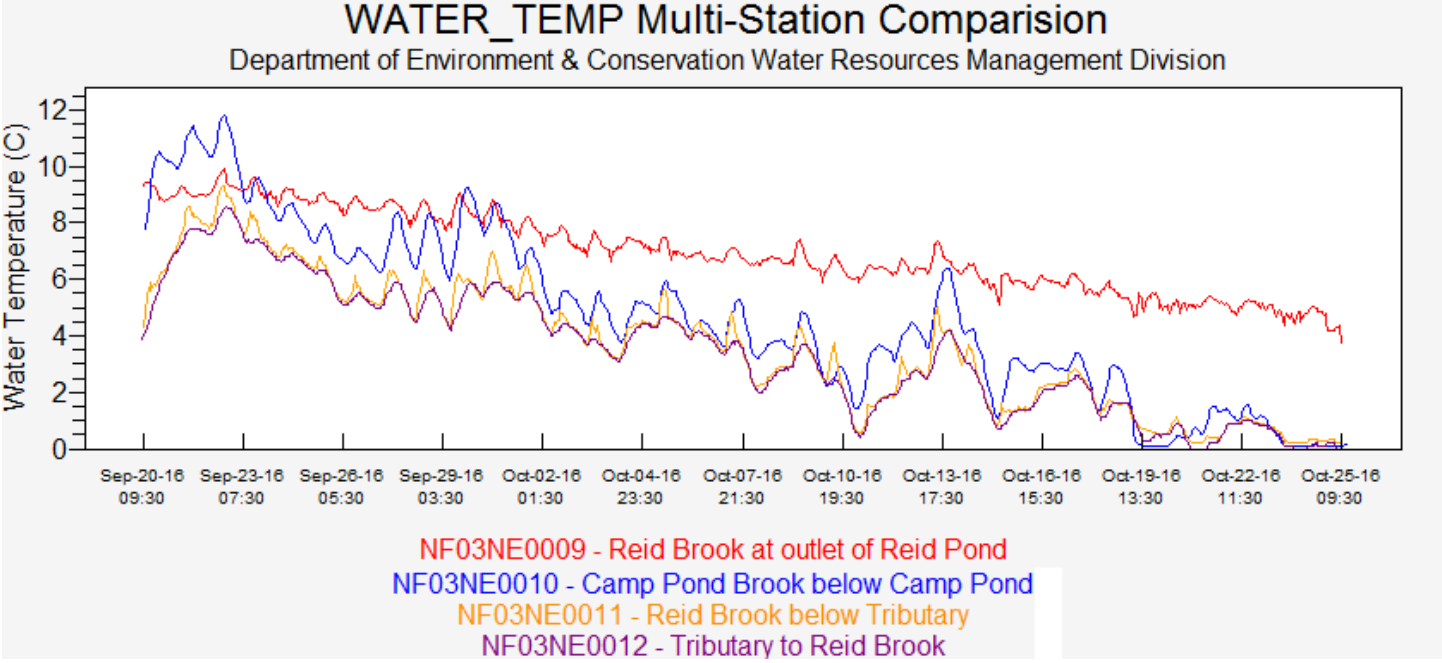

Figure A1: Comparison of Water Temperature at the Real-Time Stations in Voisey's Bay

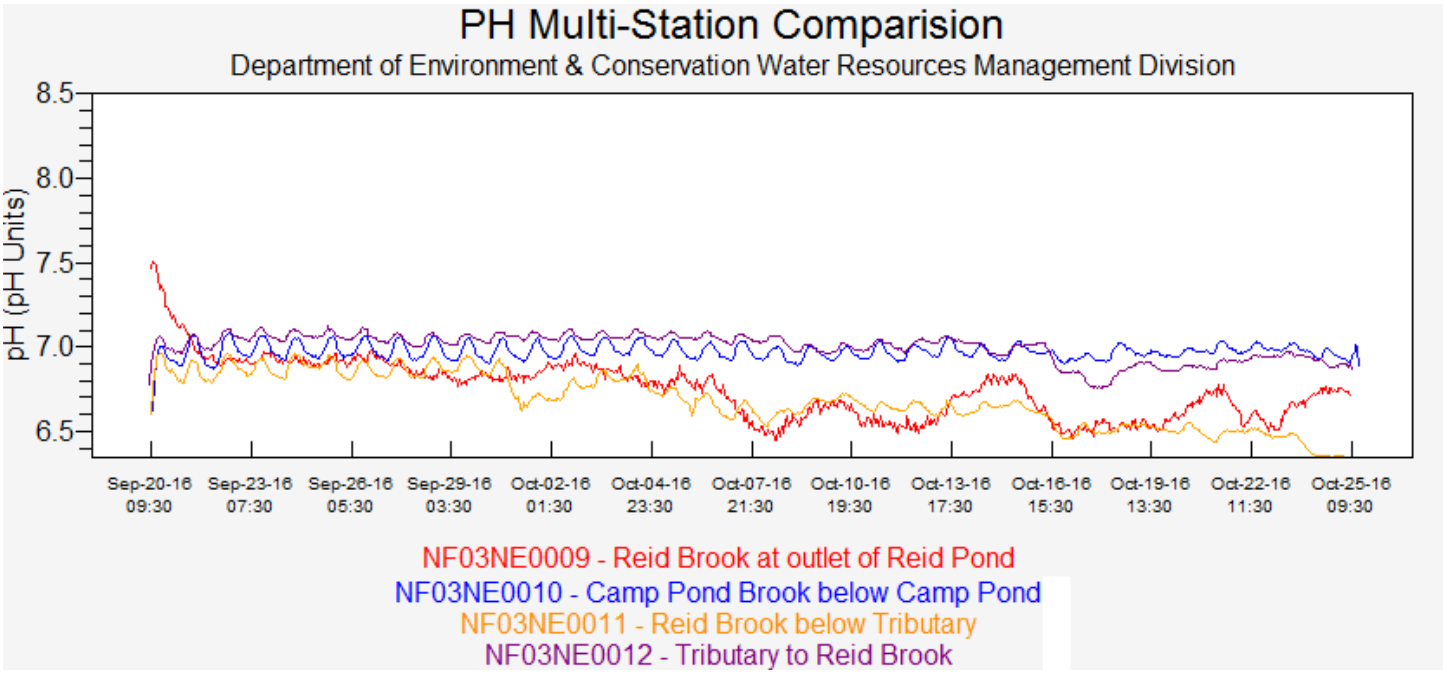

Figure A2: Comparison of pH at the Real-Time Stations in Voisey's Bay

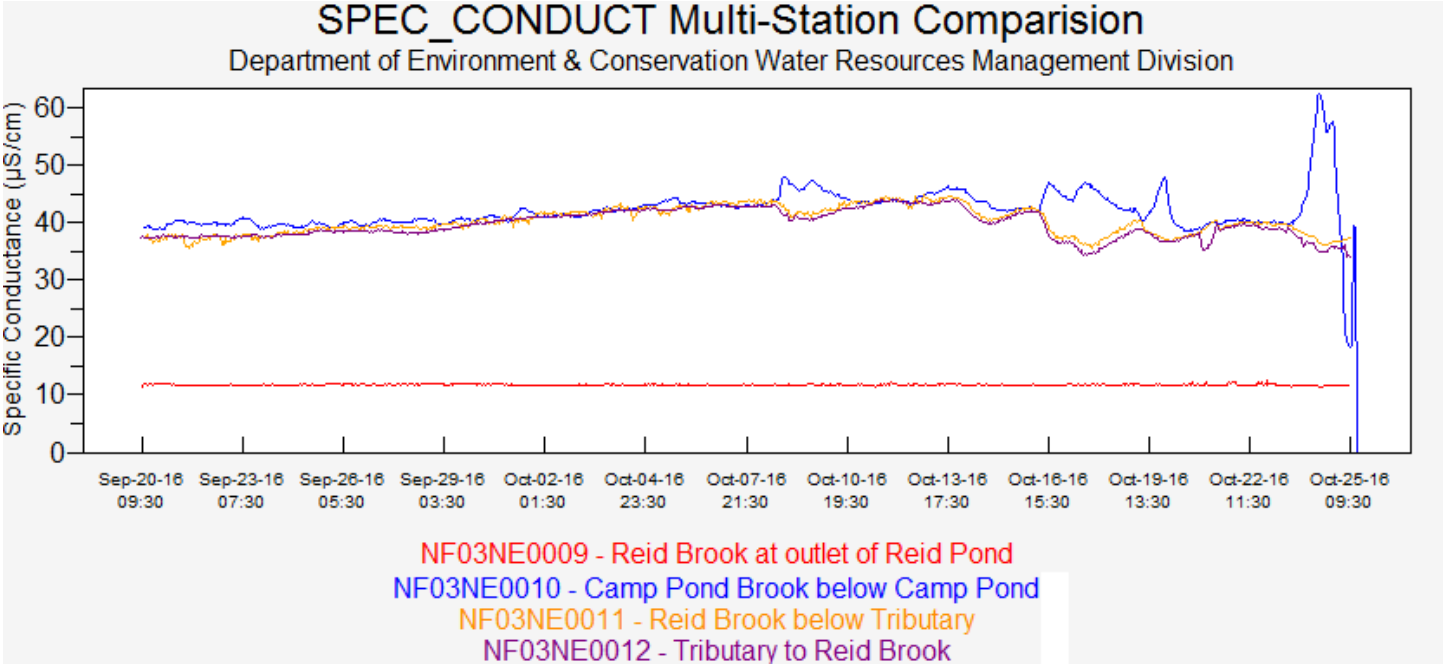

Figure A3: Comparison of Conductivity at the Real-Time Stations in Voisey's Bay

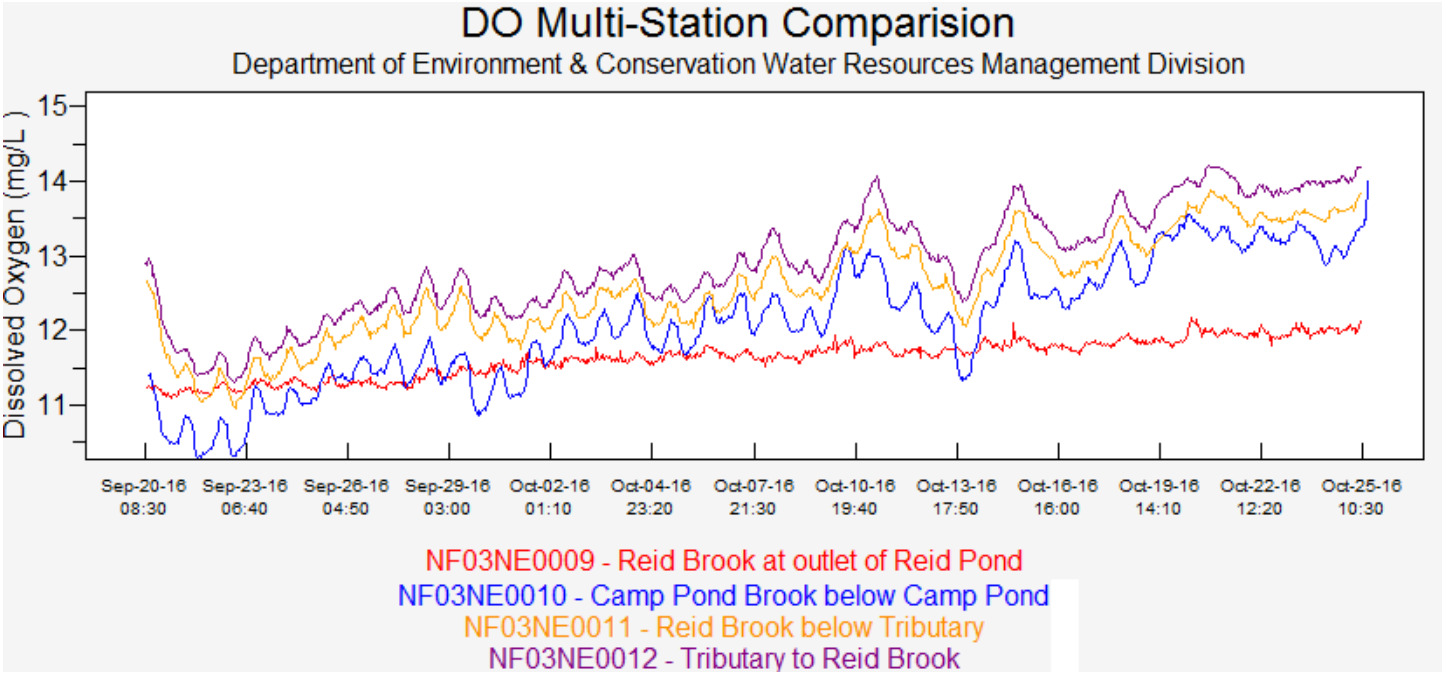

Figure A4: Comparison of Dissolved Oxygen (mg/L) at the Real-Time Stations in Voisey's Bay

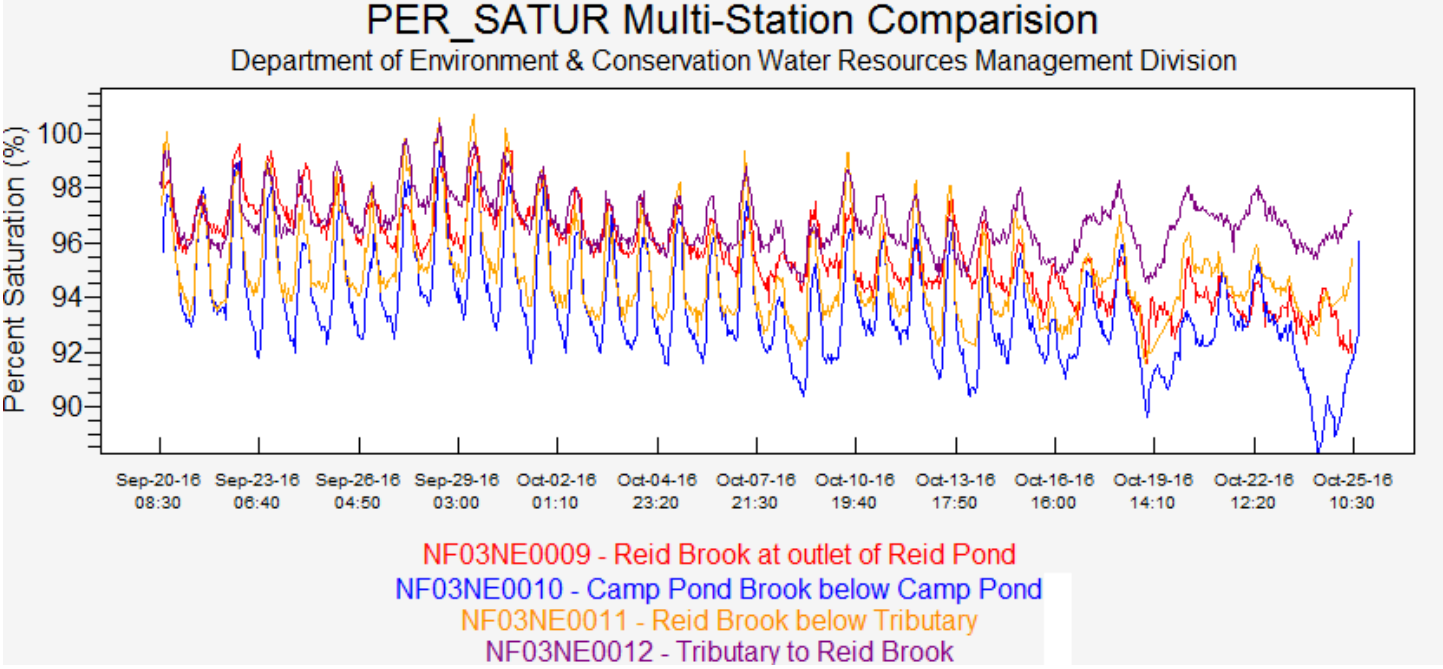

Figure A5: Comparison of Dissolved Oxygen (%Sat) at the Real-Time Stations in Voisey's Bay

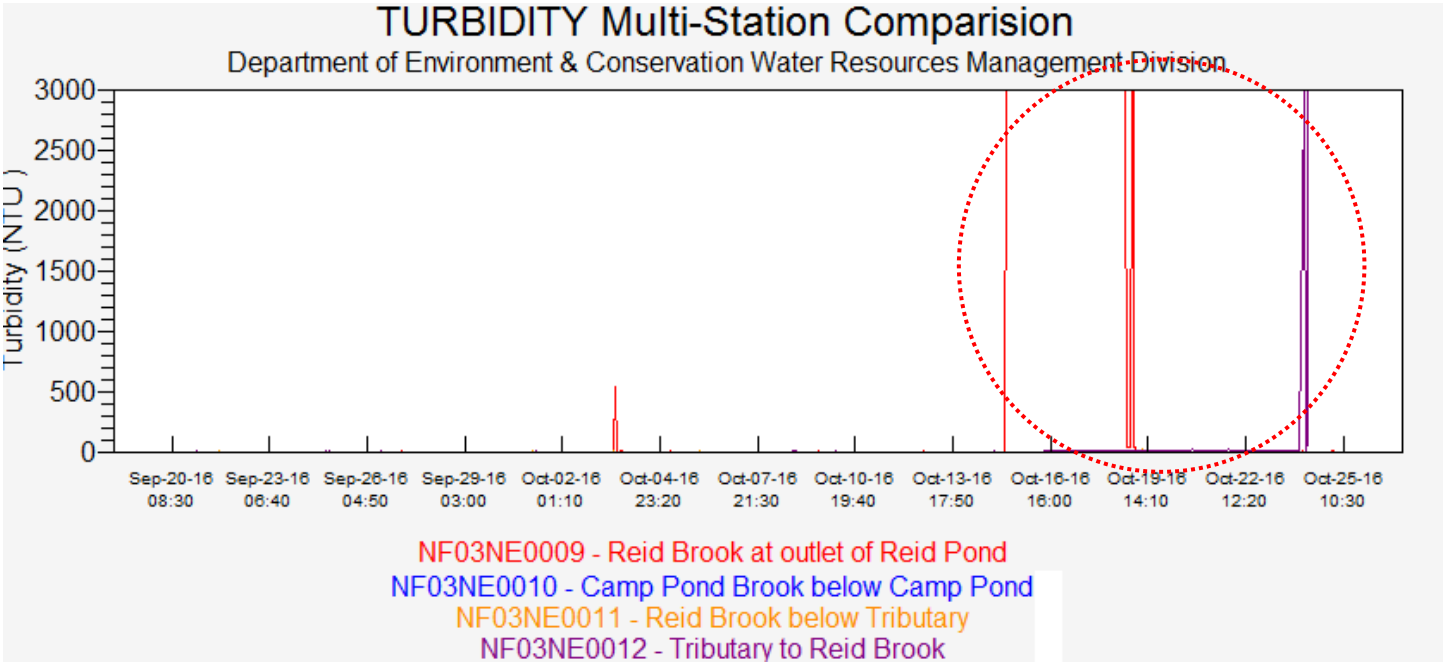

Figure A6: Comparison of Turbidity at the Real-Time Stations in Voisey's Bay. (The circled turbidity data was removed for the report).

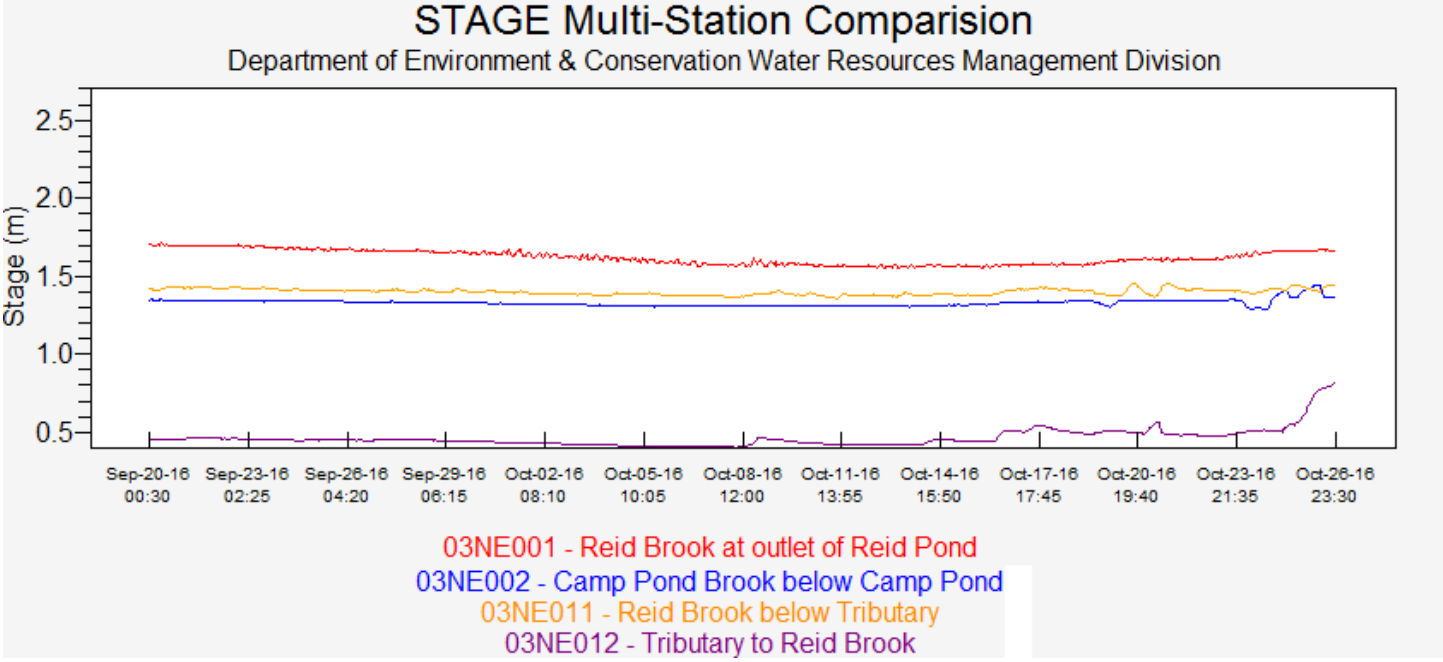

Figure A7: Comparison of Stage (m) at the Real-Time Stations in Voisey's Bay. Please note the stage and streamflow data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data.

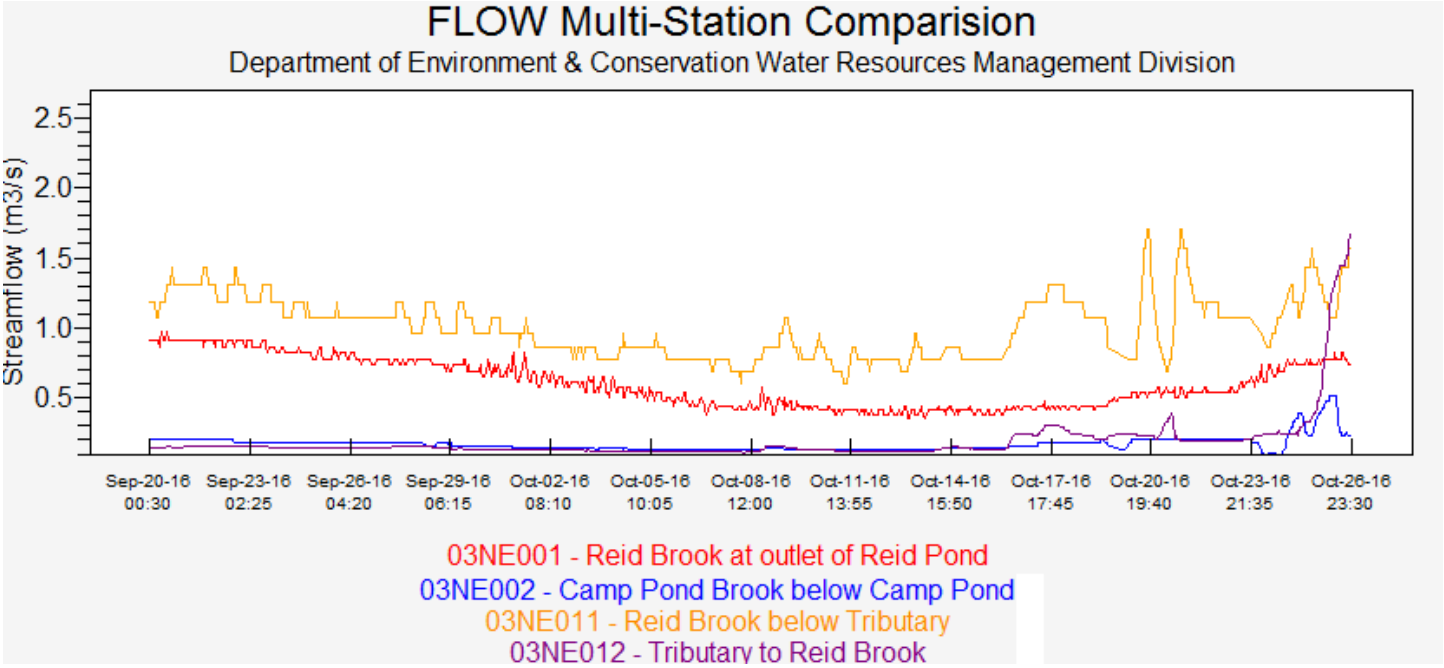

Figure A8: Comparison Flow (m^3/s) at the Real-Time Stations in Voisey's Bay. Please note the stage and streamflow data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data.

APPENDIX B: Water Parameter Description

Dissolved Oxygen: The amount of Dissolved Oxygen (DO) (mg/l or % saturation) in the water is vital to aquatic organisms for their survival. The concentration of DO is affected by such things as water temperature, water depth and flow (e.g., aeration by rapids, riffles etc.), consumption by aerobic organisms, consumption by inorganic chemical reactions, consumption by plants during darkness, and production by plants during the daylight (CCME 2014).

Flow: Flow (m3/s) is a measure of how quickly a volume of water is displaced in streams, rivers, and other channels.

pH: pH is the measure of hydrogen ion activity and affects: (i) the availability of nutrients to aquatic life; (ii) the concentration of biochemical substances dissolved in water; (iii) the efficiency of hemoglobin in the blood of vertebrates; and (iv) the toxicity of pollutants. Changes in pH can be attributed to industrial effluence, saline inflows or aquatic organisms involved in the photosynthetic cycling of CO_2 (CCME 2014).

Specific conductivity: Specific conductivity (µS/cm) is a measure of water's ability to conduct electricity, with values normalized to a water temperature of 25°C. Specific conductance indicates the concentration of dissolved solids (such as salts) in the water, which can affect the growth and reproduction of aquatic life. Specific conductivity is affected by rainfall events, the composition of inflowing tributaries and their associated geology, saline inflow (e.g., road salt), agricultural run-off and industrial inputs (Swanson and Baldwin 1965).

Stage: Stage (m) is the elevation of the water surface and is often used as a surrogate for the more difficult to measure flow.

Temperature: Essential to the measurement of most water quality parameters, temperature (°C) controls most processes and dynamics of limnology. Water temperature is influenced by such things as ambient air temperature, solar radiation, meteorological events, industrial effluence, wastewater, inflowing tributaries, as well as water body size and depth (OTT Hydromet 2017).

Total Dissolved Solids: Total Dissolved Solids (TDS) (g/l) is a measure of alkaline salts dissolved in water or in fine suspension and can affect the growth and reproduction of aquatic life. It is affected by rainfall events, the composition of inflowing tributaries and their associated geology, saline inflow (e.g., road salt), agricultural run-off and industrial inputs (CCME 2014; Swanson and Baldwin 1965).

Turbidity: Turbidity (NTU) is a measure of the translucence of water and indicates the amount of suspended material in the water. Turbidity is caused by any substance that makes water cloudy (e.g., soil erosion, micro-organisms, vegetation, chemicals, etc.) and can correspond to precipitation events, high stage, and floating debris near the sensor (Sadar, 2017).

APPENDIX C: Grab Sample Data

Maxxam Job #: B6K6028
Report Date: 2016/10/05

Department of Environment & Conservation
Your P.O. #: 215062145-2

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
DDB473 Reid Brook at Outlet to Reid Pond								
Sampling Date 2016/09/20 09:35								
Matrix W								
Sample # 2016-6412-00-SI-SP								
Registration # WS-S-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Calculated TDS	7.0	1.0	mg/L	N/A	2016/10/04	2016/10/04		4675802
Hardness (CaCO3)	4.6	1.0	mg/L	N/A	2016/09/28	2016/09/28		4675795
Nitrate (N)	0.063	0.050	mg/L	N/A	2016/10/04	2016/10/04		4675798
Inorganics								
Conductivity	12	1.0	uS/cm	N/A	2016/09/28	2016/09/28	JMV	4679094
Bromide (Br-)	<1.0	1.0	mg/L	N/A	2016/09/29	2016/09/29	FD	4680428
Total Alkalinity (Total as CaCO3)	<5.0	5.0	mg/L	N/A	2016/10/04	2016/10/04	NRG	4685431
Dissolved Chloride (Cl)	1.4	1.0	mg/L	N/A	2016/10/04	2016/10/04	KBT	4685433
Colour	7.8	5.0	TCU	N/A	2016/10/04	2016/10/04	MCN	4685436
Dissolved Fluoride (F-)	<0.10	0.10	mg/L	N/A	2016/09/28	2016/09/28	JMV	4679095
Total Kjeldahl Nitrogen (TKN)	0.11	0.10	mg/L	+/- <RDL	2016/09/28	2016/09/29	AAY	4679730
Nitrite (N)	<0.010	0.010	mg/L	N/A	2016/10/03	2016/10/03	KBT	4685442
Nitrogen (Ammonia Nitrogen)	<0.050	0.050	mg/L	N/A	2016/10/03	2016/10/03	MCN	4685665
Dissolved Organic Carbon (C)	1.7	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687304
Total Organic Carbon (C)	1.6	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687159
pH	6.87	N/A	pH	N/A	2016/09/28	2016/09/28	JMV	4679093
Total Phosphorus	0.010	0.004	mg/L	+/- 0.004	2016/09/28	2016/09/28	SNR	4679569
Dissolved Sulphate (SO4)	<2.0	2.0	mg/L	N/A	2016/10/04	2016/10/04	MCN	4685434
Turbidity	0.18	0.10	NTU	N/A	2016/09/28	2016/09/28	JMV	4679143
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	<0.000013	0.000013	mg/L	N/A	2016/09/30	2016/10/03	ARS	4683235
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	0.051	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Antimony (Sb)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Arsenic (As)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Barium (Ba)	0.0024	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Boron (B)	<0.050	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Cadmium (Cd)	0.000011	0.000010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Calcium (Ca)	1.4	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Chromium (Cr)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Copper (Cu)	<0.0020	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Iron (Fe)	<0.050	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Lead (Pb)	<0.00050	0.00050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Magnesium (Mg)	0.27	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Manganese (Mn)	<0.0020	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Nickel (Ni)	<0.0020	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Potassium (K)	0.15	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Selenium (Se)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Sodium (Na)	0.79	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Strontium (Sr)	0.0050	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Uranium (U)	<0.00010	0.00010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Zinc (Zn)	<0.0050	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B6K6028
Report Date: 2016/10/05

Department of Environment & Conservation
Your P.O. #: 215062145-2

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
DDB474 Camp Pond Brook								
Sampling Date 2016/09/20 10:20								
Matrix W								
Sample # 2016-6413-00-SI-SP								
Registration # WS-S-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Calculated TDS	27	1.0	mg/L	N/A	2016/10/04	2016/10/04		4675802
Hardness (CaCO3)	14	1.0	mg/L	N/A	2016/09/28	2016/09/28		4675795
Nitrate (N)	0.054	0.050	mg/L	N/A	2016/10/04	2016/10/04		4675798
Inorganics								
Conductivity	38	1.0	uS/cm	N/A	2016/09/28	2016/09/28	JMV	4679094
Bromide (Br-)	<1.0	1.0	mg/L	N/A	2016/09/29	2016/09/29	FD	4680428
Total Alkalinity (Total as CaCO3)	11	5.0	mg/L	N/A	2016/10/04	2016/10/04	NRG	4685431
Dissolved Chloride (Cl)	3.0	1.0	mg/L	N/A	2016/10/04	2016/10/04	KBT	4685433
Colour	15	5.0	TCU	N/A	2016/10/04	2016/10/04	MCN	4685436
Dissolved Fluoride (F-)	<0.10	0.10	mg/L	N/A	2016/09/28	2016/09/28	JMV	4679095
Total Kjeldahl Nitrogen (TKN)	0.13	0.10	mg/L	+/- <RDL	2016/09/28	2016/09/29	AAY	4679730
Nitrite (N)	<0.010	0.010	mg/L	N/A	2016/10/03	2016/10/03	KBT	4685442
Nitrogen (Ammonia Nitrogen)	<0.050	0.050	mg/L	N/A	2016/10/03	2016/10/03	MCN	4685665
Dissolved Organic Carbon (C)	3.0	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687304
Total Organic Carbon (C)	3.2	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687159
pH	7.19	N/A	pH	N/A	2016/09/28	2016/09/28	JMV	4679093
Total Phosphorus	0.008	0.004	mg/L	+/- 0.004	2016/09/28	2016/09/28	SNR	4679569
Dissolved Sulphate (SO4)	5.9	2.0	mg/L	N/A	2016/10/04	2016/10/04	MCN	4685434
Turbidity	1.4	0.10	NTU	N/A	2016/09/28	2016/09/28	JMV	4679143
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	<0.000013	0.000013	mg/L	N/A	2016/09/30	2016/10/03	ARS	4683235
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	0.13	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Antimony (Sb)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Arsenic (As)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Barium (Ba)	0.0067	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Boron (B)	<0.050	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Cadmium (Cd)	<0.000010	0.000010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Calcium (Ca)	3.7	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Chromium (Cr)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Copper (Cu)	0.0034	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Iron (Fe)	0.40	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Lead (Pb)	<0.00050	0.00050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Magnesium (Mg)	1.1	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Manganese (Mn)	0.013	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Nickel (Ni)	0.025	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Potassium (K)	0.64	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Selenium (Se)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Sodium (Na)	2.1	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Strontium (Sr)	0.021	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Uranium (U)	<0.00010	0.00010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349
Total Zinc (Zn)	<0.0050	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677349

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Maxxam Job #: B6K6028
Report Date: 2016/10/05

Department of Environment & Conservation
Your P.O. #: 215062145-2

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
DDB475 Tributary to Lower Reid								
Sampling Date 2016/09/20 08:30								
Matrix W								
Sample # 2016-6414-00-SI-SP								
Registration # WS-S-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Calculated TDS	30	1.0	mg/L	N/A	2016/10/04	2016/10/04		4675802
Hardness (CaCO3)	13	1.0	mg/L	N/A	2016/09/28	2016/09/28		4675795
Nitrate (N)	<0.050	0.050	mg/L	N/A	2016/10/04	2016/10/04		4675798
Inorganics								
Conductivity	37	1.0	uS/cm	N/A	2016/09/28	2016/09/28	JMV	4679094
Bromide (Br-)	<1.0	1.0	mg/L	N/A	2016/09/29	2016/09/29	FD	4680428
Total Alkalinity (Total as CaCO3)	12	5.0	mg/L	N/A	2016/10/04	2016/10/04	NRG	4685431
Dissolved Chloride (Cl)	3.0	1.0	mg/L	N/A	2016/10/04	2016/10/04	KBT	4685433
Colour	29	5.0	TCU	N/A	2016/10/04	2016/10/04	MCN	4685436
Dissolved Fluoride (F-)	0.12	0.10	mg/L	N/A	2016/09/28	2016/09/28	JMV	4679095
Total Kjeldahl Nitrogen (TKN)	0.12	0.10	mg/L	+/- <RDL	2016/09/28	2016/09/29	AAY	4679730
Nitrite (N)	<0.010	0.010	mg/L	N/A	2016/10/03	2016/10/03	KBT	4685442
Nitrogen (Ammonia Nitrogen)	<0.050	0.050	mg/L	N/A	2016/10/03	2016/10/03	MCN	4685665
Dissolved Organic Carbon (C)	3.7	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687304
Total Organic Carbon (C)	4.0	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687159
pH	7.17	N/A	pH	N/A	2016/09/28	2016/09/28	JMV	4679093
Total Phosphorus	0.016	0.004	mg/L	+/- 0.005	2016/09/28	2016/09/28	SNR	4679569
Dissolved Sulphate (SO4)	4.0	2.0	mg/L	N/A	2016/10/04	2016/10/04	MCN	4685434
Turbidity	1.1	0.10	NTU	N/A	2016/09/28	2016/09/28	JMV	4679142
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	<0.000013	0.000013	mg/L	N/A	2016/09/30	2016/10/03	ARS	4683235
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	0.12	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Antimony (Sb)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Arsenic (As)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Barium (Ba)	0.0052	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Boron (B)	<0.050	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Cadmium (Cd)	<0.000010	0.000010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Calcium (Ca)	3.3	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Chromium (Cr)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Copper (Cu)	<0.0020	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Iron (Fe)	0.60	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Lead (Pb)	<0.00050	0.00050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Magnesium (Mg)	1.1	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Manganese (Mn)	0.012	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Nickel (Ni)	0.0058	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Potassium (K)	0.49	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Selenium (Se)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Sodium (Na)	2.7	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Strontium (Sr)	0.019	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Uranium (U)	<0.00010	0.00010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Zinc (Zn)	<0.0050	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528

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Maxxam Job #: B6K6028
Report Date: 2016/10/05

Department of Environment & Conservation
Your P.O. #: 215062145-2

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
DDB476 Lower Reid Brook below Tributary								
Sampling Date 2016/09/20 08:55								
Matrix W								
Sample # 2016-6415-00-SI-SP								
Registration # WS-S-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Calculated TDS	30	1.0	mg/L	N/A	2016/10/04	2016/10/04		4675802
Hardness (CaCO3)	13	1.0	mg/L	N/A	2016/09/28	2016/09/28		4675795
Nitrate (N)	<0.050	0.050	mg/L	N/A	2016/10/04	2016/10/04		4675798
Inorganics								
Conductivity	36	1.0	uS/cm	N/A	2016/09/28	2016/09/28	JMV	4679094
Bromide (Br-)	<1.0	1.0	mg/L	N/A	2016/09/29	2016/09/29	FD	4680428
Total Alkalinity (Total as CaCO3)	12	5.0	mg/L	N/A	2016/10/04	2016/10/04	NRG	4685431
Dissolved Chloride (Cl)	3.0	1.0	mg/L	N/A	2016/10/04	2016/10/04	KBT	4685433
Colour	28	5.0	TCU	N/A	2016/10/04	2016/10/04	MCN	4685436
Dissolved Fluoride (F-)	0.13	0.10	mg/L	N/A	2016/09/28	2016/09/28	JMV	4679095
Total Kjeldahl Nitrogen (TKN)	0.12	0.10	mg/L	+/- <RDL	2016/09/28	2016/09/29	AAY	4679730
Nitrite (N)	<0.010	0.010	mg/L	N/A	2016/10/03	2016/10/03	KBT	4685442
Nitrogen (Ammonia Nitrogen)	<0.050	0.050	mg/L	N/A	2016/10/03	2016/10/03	MCN	4685665
Dissolved Organic Carbon (C)	3.5	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687304
Total Organic Carbon (C)	3.8	0.50	mg/L	N/A	2016/10/04	2016/10/04	SMT	4687159
pH	6.97	N/A	pH	N/A	2016/09/28	2016/09/28	JMV	4679093
Total Phosphorus	0.008	0.004	mg/L	+/- 0.004	2016/09/28	2016/09/28	SNR	4679569
Dissolved Sulphate (SO4)	3.9	2.0	mg/L	N/A	2016/10/04	2016/10/04	MCN	4685434
Turbidity	1.7	0.10	NTU	N/A	2016/09/28	2016/09/28	JMV	4679142
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	<0.000013	0.000013	mg/L	N/A	2016/10/03	2016/10/04	ARS	4685869
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	0.11	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Antimony (Sb)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Arsenic (As)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Barium (Ba)	0.0055	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Boron (B)	<0.050	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Cadmium (Cd)	<0.000010	0.000010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Calcium (Ca)	3.4	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Chromium (Cr)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Copper (Cu)	<0.0020	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Iron (Fe)	0.62	0.050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Lead (Pb)	<0.00050	0.00050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Magnesium (Mg)	1.1	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Manganese (Mn)	0.013	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Nickel (Ni)	0.0060	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Potassium (K)	0.51	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Selenium (Se)	<0.0010	0.0010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Sodium (Na)	2.7	0.10	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Strontium (Sr)	0.018	0.0020	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Uranium (U)	<0.00010	0.00010	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528
Total Zinc (Zn)	<0.0050	0.0050	mg/L	N/A	2016/09/27	2016/09/27	BAN	4677528

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