Real-Time Water Quality Deployment Report

Marathon Gold Corp Network

September 6 to November 23, 2023

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment & Climate Change
Water Resources Management Division

General

This report will review the water quality data for the following real-time water quality monitoring stations at Marathon Gold network: Victoria River Outlet, Valentine River Outlet, and Roebucks Brook, for the duration of September 6th to November 23rd, 2023.

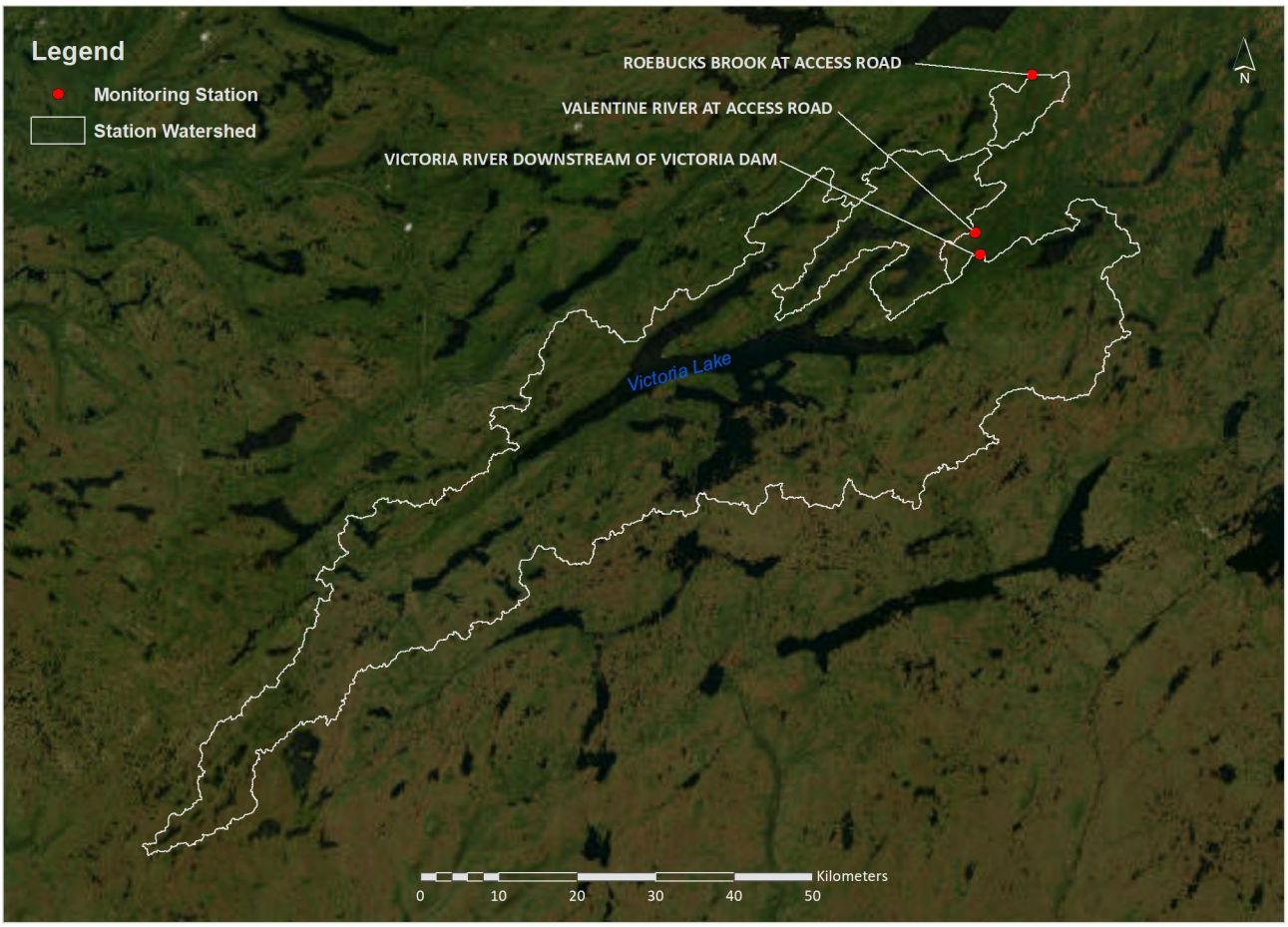


Figure 1: Location of the Marathon Gold Corp. Real Time Surface Water Quality Network (November 2023)

Quality Assurance and Quality Control

- As part of the Quality Assurance and Quality Control protocol (QA/QC), 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 QA/QC Sonde is temporarily deployed adjacent to the Field Sonde. 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 Sonde and QA/QC Sonde 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 (°C)	<=+/-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 sonde 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 sonde the entire sonde 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 Marathon Gold Corp Surface Water Monitoring Network between September 6th and November 23rd, 2023, are summarized in Table 1.

Table 2: Comparison rankings for Marathon Gold Corp. Surface Water Monitoring Network September 6 - November 23, 2023

Station	Date	Action	Comparison Ranking				
			Temperature	**pH**	**Conductivity**	**Dissolved Oxygen**	**Turbidity**
Victoria River	September 6	Deployment	Excellent	Poor	Excellent	Fair	Excellent
	November 23	Removal	Excellent	Fair	Excellent	Good	Excellent
Valentine	September 6	Deployment	Excellent	Good	Excellent	Marginal	Excellent

River	November 23	Removal	Excellent	Fair	Excellent	Good	Excellent
Roebucks Brook	September 6	Deployment	Excellent	Poor	Good	Excellent	Excellent
	November 23	Removal	Excellent	Poor	Fair	Excellent	Excellent

- There are a few circumstances which may cause less than ideal QA/QC rankings to be obtained. These include: the placement of the QA/QC sonde in relation to the field sonde, the amount of time each sonde was given to stabilize before readings were recorded; and deteriorating performance of one of the sensors.
- At deployment, rankings were varied from Excellent to Poor at each station. This may be due to the sondes not having acclimated before values were read.
- At removal, the rankings again ranged from Excellent to Poor. This may be due to the sensors not having fully acclimated to the environment before readings were recorded, or an error with the QAQC sonde.

Data Interpretation

- The following graphs and discussion illustrate water quality related events from September 6 to November 23, 2023 at the three surface water quality/quantity real time monitoring stations in the Marathon Gold Corp Network.

Victoria River

- Water temperature ranged from 1.2 to 22.19°C during this deployment period (Figure 2).
- Water temperature showed a decreasing trend throughout deployment, corresponding to ambient air temperatures as the season progressed into late fall/early winter.

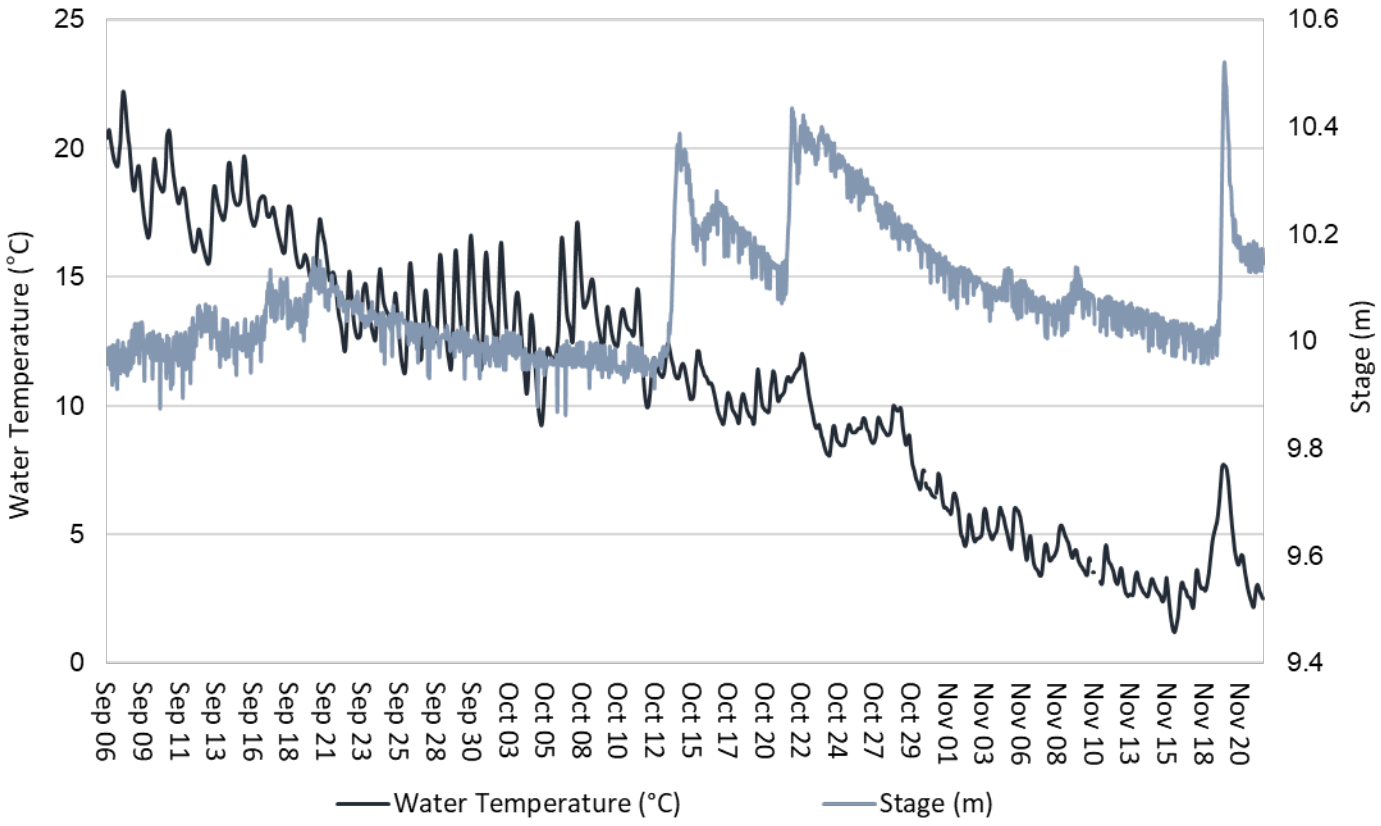


Figure 2: Water Temperature and Stage

- pH ranged between 6.60 and 7.36 pH units throughout the deployment period, with a median value of 6.86 units (Figure 3).
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). pH fluctuates slightly during the day and night.
- There are occasional small increases and decreases in pH associated with increased stage.
- Overall, pH showed a slight decreasing trend and was likely influenced by the addition of acidic precipitation on October 13th as pH levels did not return to background levels after this event.

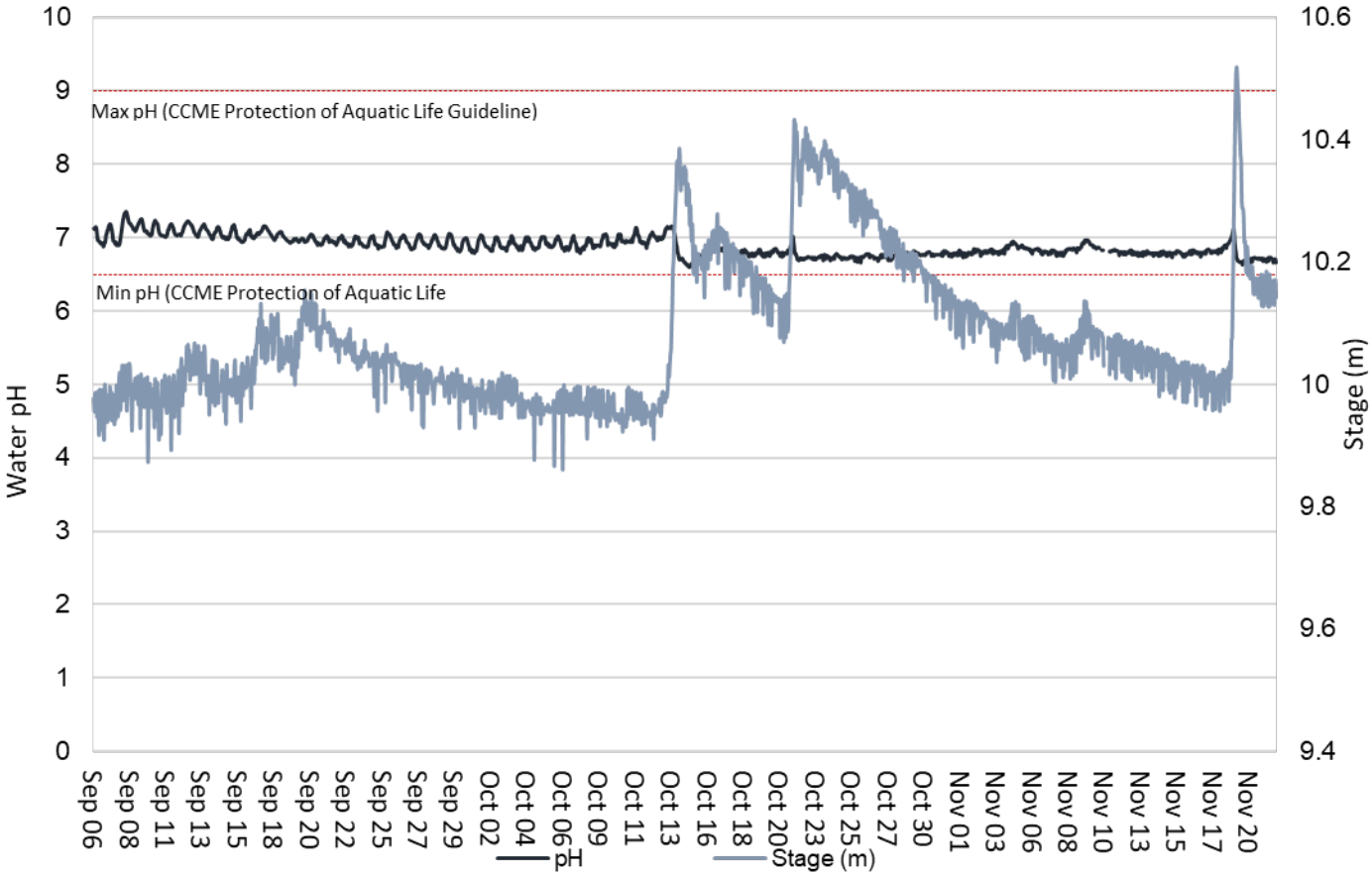


Figure 3: Water pH and Stage

- Specific conductivity ranged from 21.8 to 56.4 µs/cm (Figure 4) with a median of 24.9 µs/cm.
- Specific conductivity showed regular fluctuation over the course of this deployment period, spiking during periods of high precipitation which caused stage increases and corresponding increases in conductivity for a short time. This indicates the precipitation may cause particulates in the river sediment to re-suspend into the water column or new material to be washed into the river, increasing the conductivity for a short period of time before it settles out again.

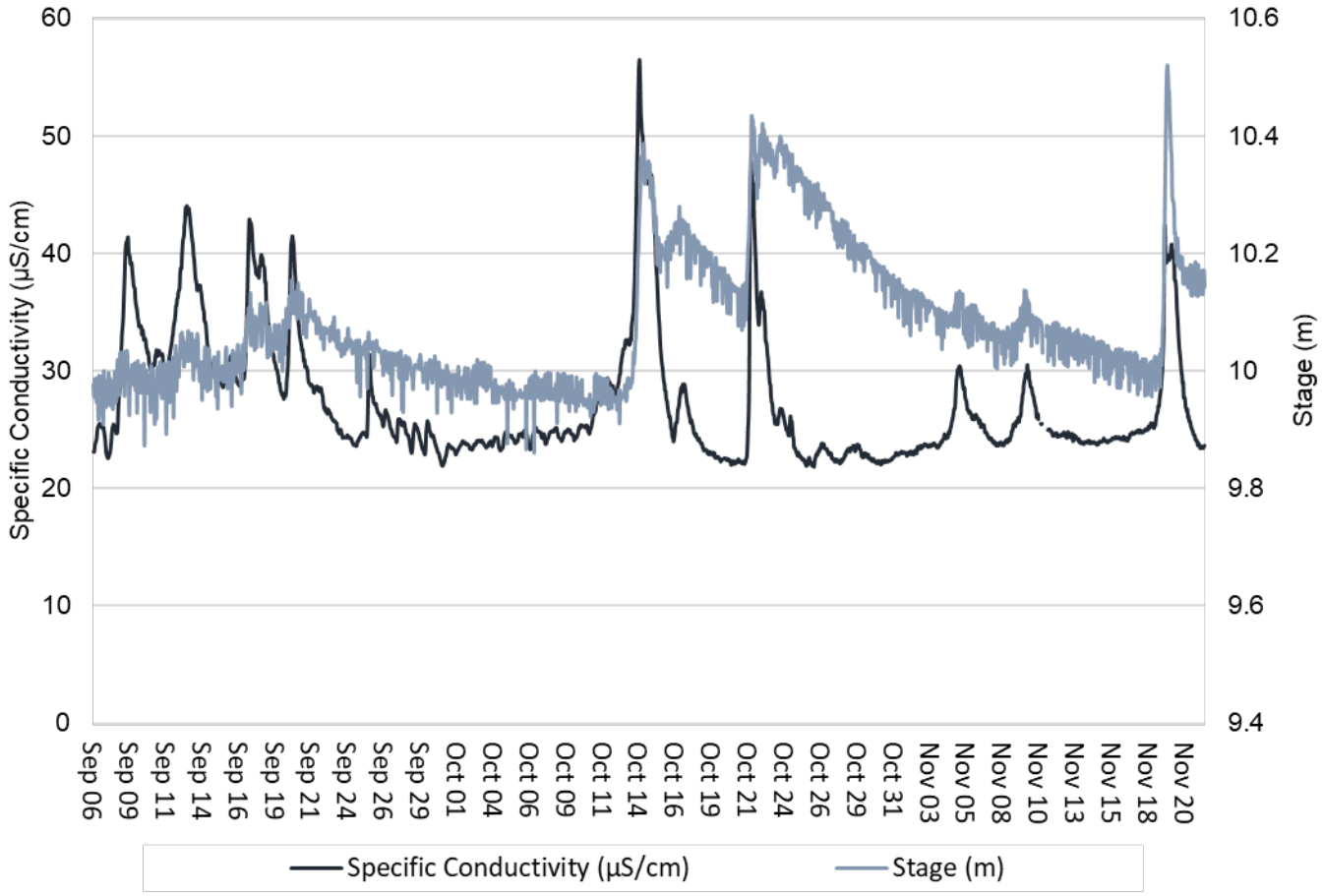


Figure 4: Specific Conductivity of Water and Stage

- The saturation of dissolved oxygen ranged from 83.3% to 105.8% and a range of 8.38 to 14.05 mg/l was found for the concentration of dissolved oxygen with a median value of 10.63 mg/l (Figure 5).
- All values were above the minimum CCME Guidelines for the Protection of Other Life Stages of Cold Water Biota, but dropped below the Guideline for Early Life Stages when the water was warmest. The guidelines are indicated in red on Figure 5.
- Dissolved oxygen content fluctuates diurnally, displaying the inverse relationship to water temperature. Dissolved oxygen increased steadily during the deployment period as water temperatures cooled into winter.

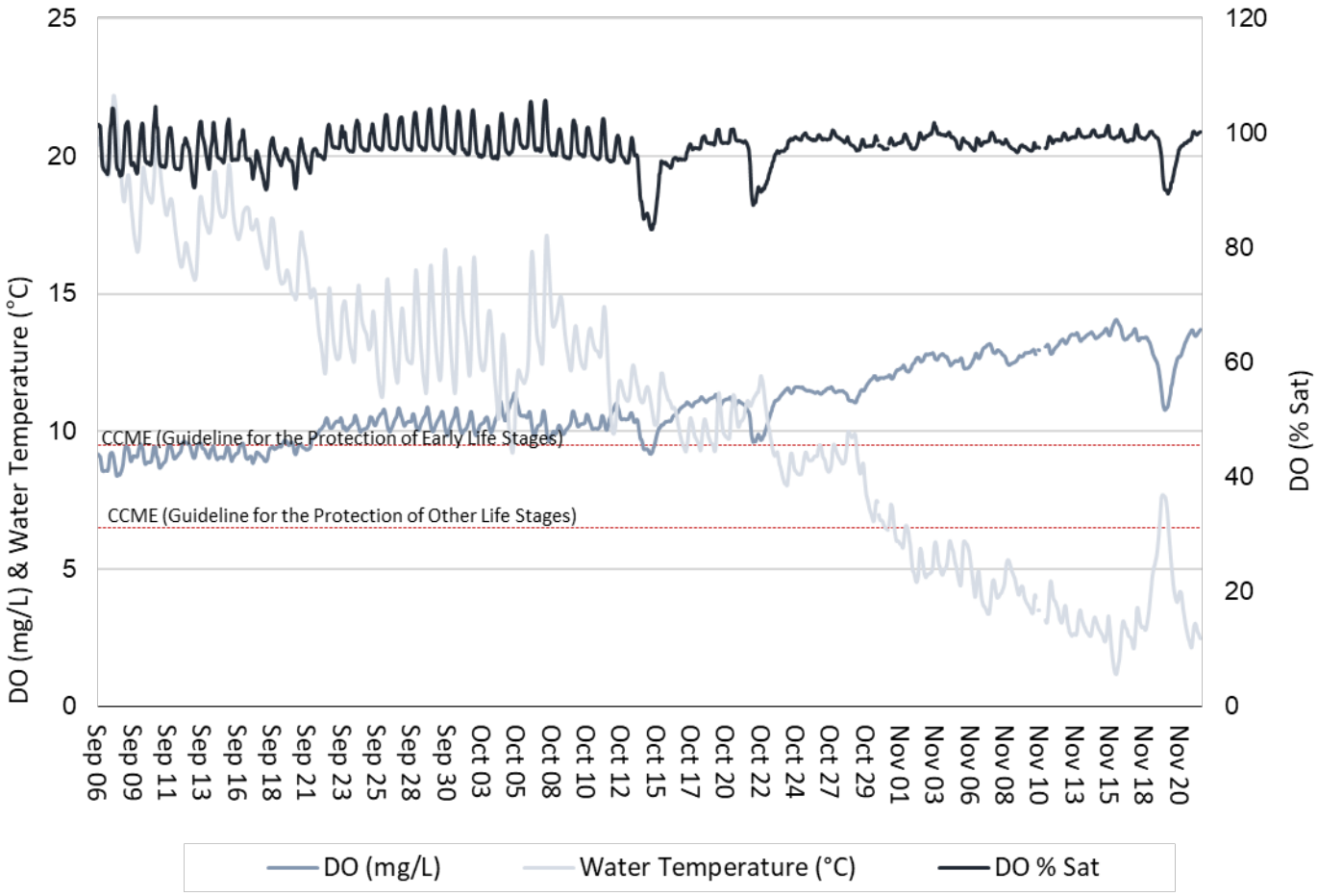


Figure 5: Dissolved Oxygen and Water Temperature

- Turbidity values range from 0.0100 NTU to 0.0400 NTU with a median of 0.0200, indicating very clear background turbidity.
- Turbidity remained very low throughout deployment with a slight increasing trend. Turbidity increased temporarily during stage events associated with precipitation. (Figure 6). This indicates rainfall associated with stage increases may stir up sediments in the area for a brief period of time before returning to background levels.

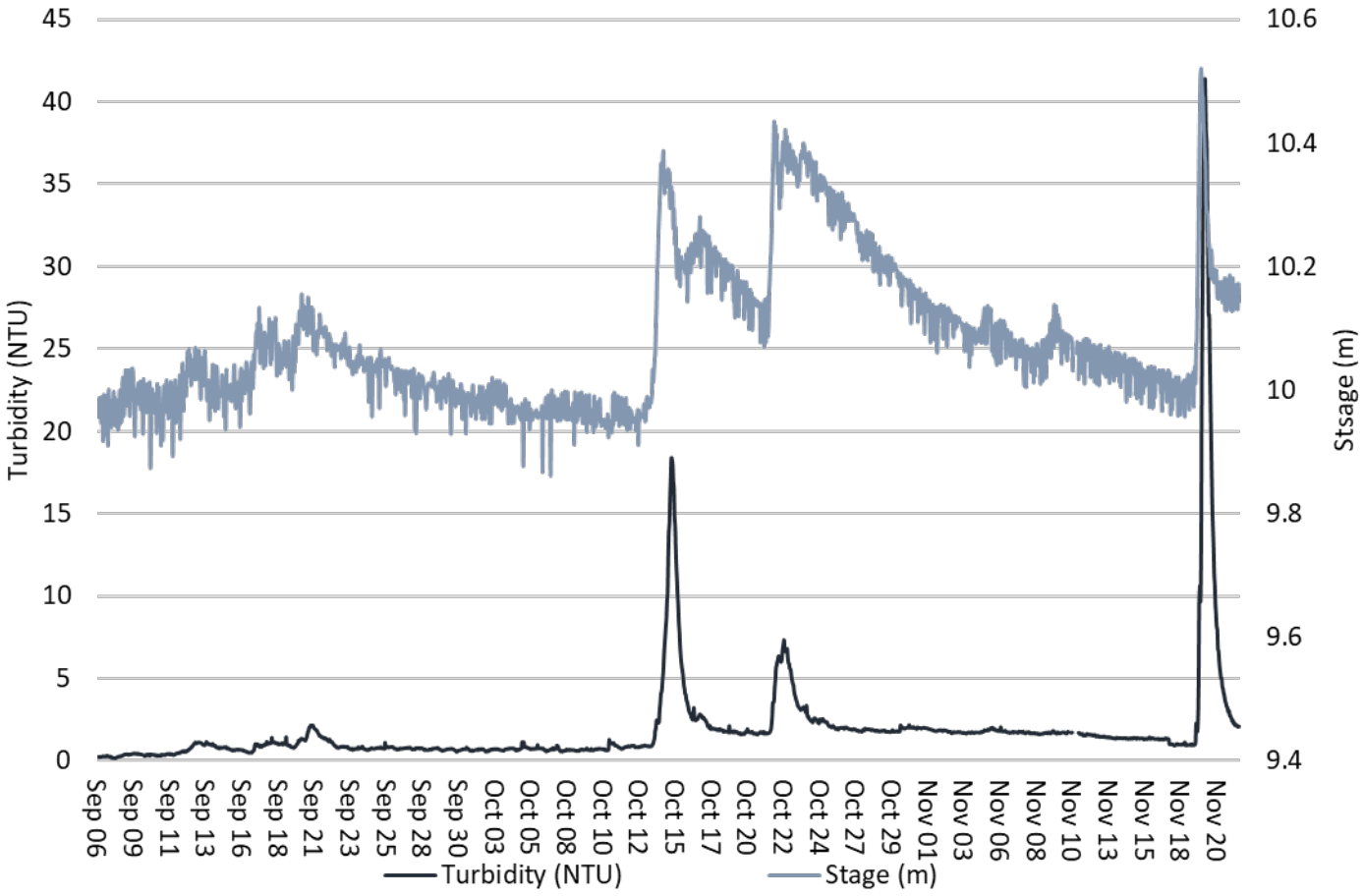


Figure 6: Turbidity and Stage

- Precipitation and stage during the deployment period are graphed below (Figure 7). Stage was increasing gradually throughout deployment with scattered spikes associated with elevated stage.
- It is notable from the data that smaller precipitation events did not always lead to an increase in stage at this location.

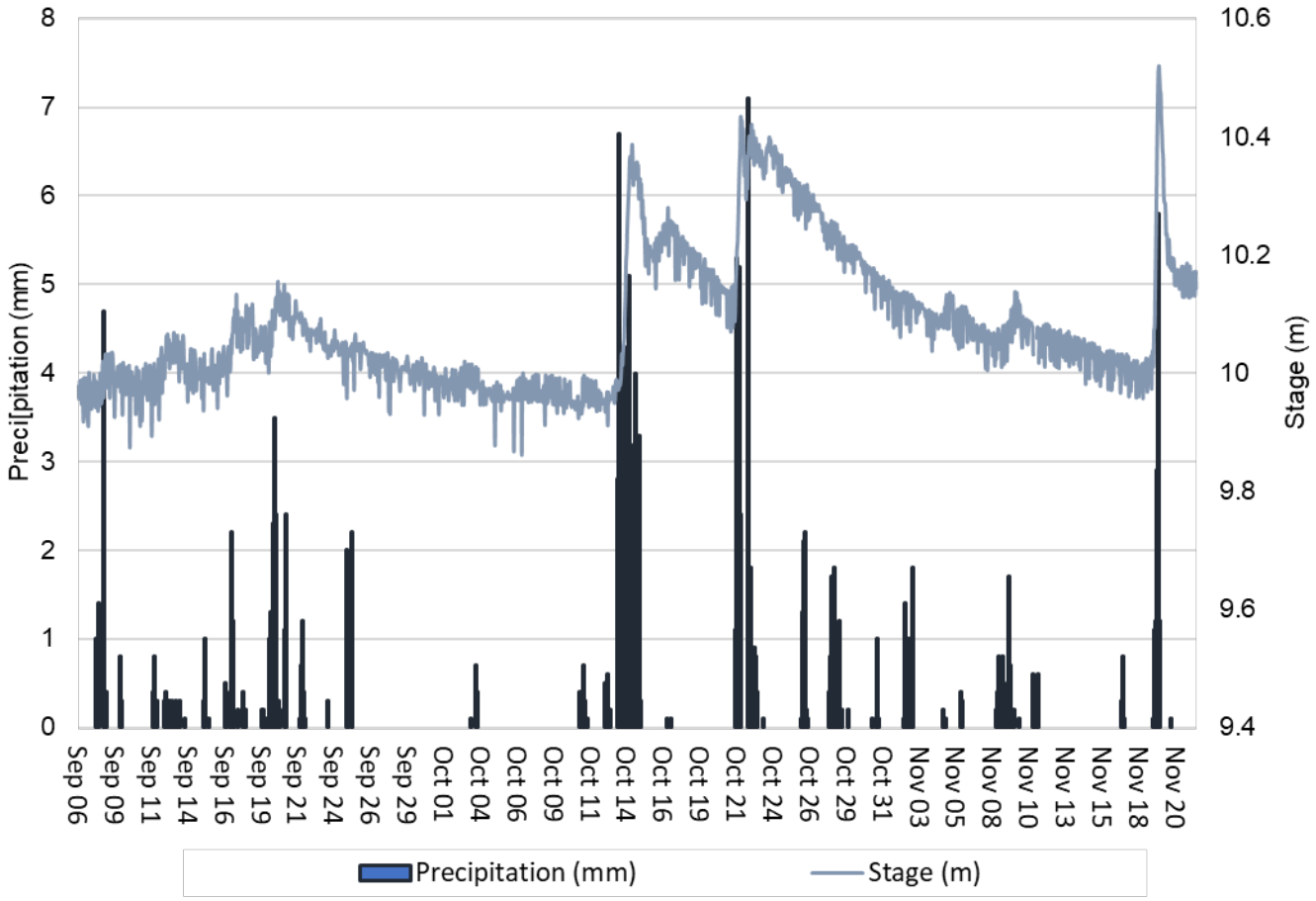


Figure 7: Precipitation and Stage

Valentine River

- Water temperature ranged from 0.41 to 21.08°C during this deployment period (Figure 8).
- Water temperature showed a decreasing trend throughout deployment, corresponding to ambient air temperatures as the season progressed into late fall (Figure 8).

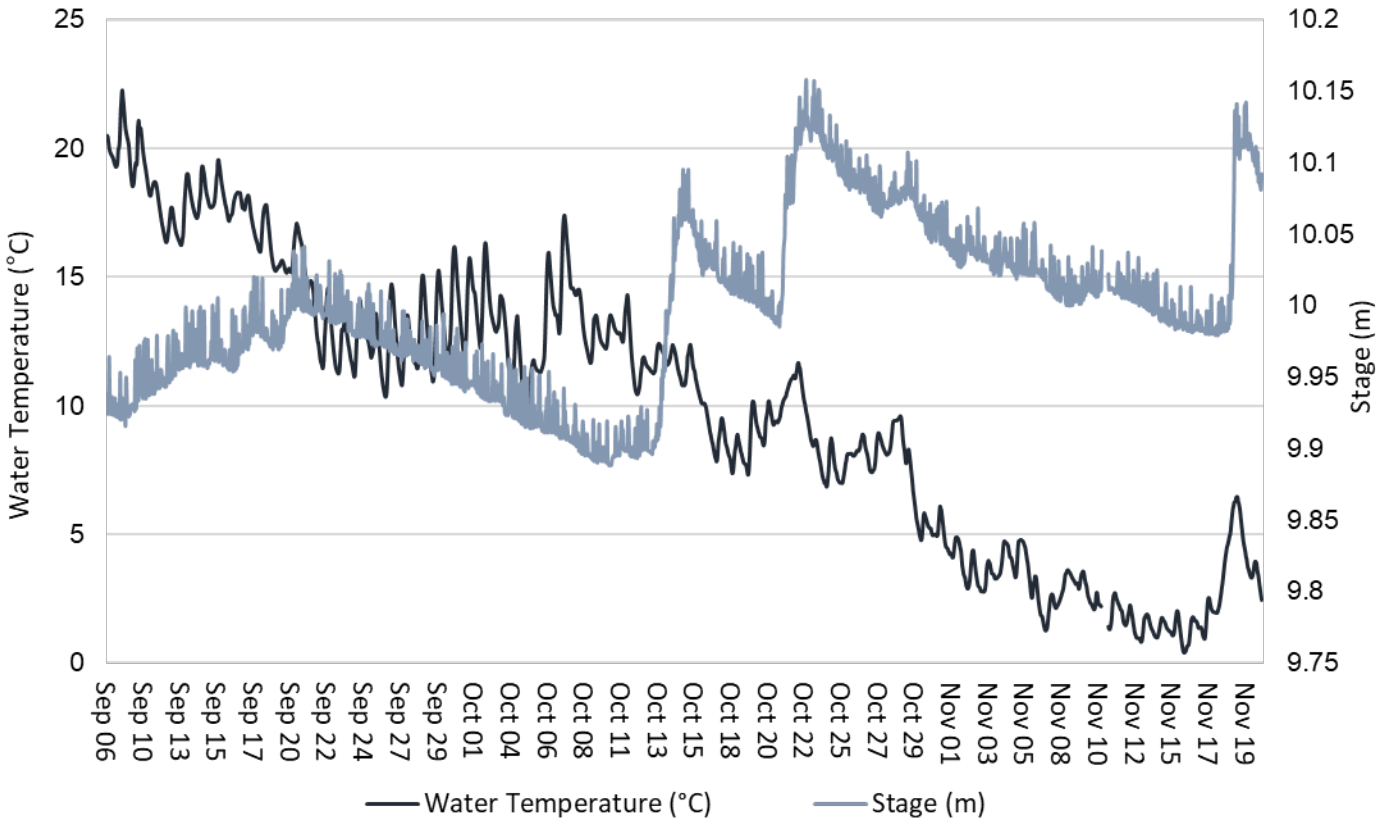


Figure 8: Water Temperature and Stage

- pH ranged between 6.52 and 7.14 pH units throughout the deployment period, with a median value of 6.79 units (Figure 9).
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). pH fluctuates slightly during the day and night.
- Overall, pH was relatively stable for the first half of deployment but showed a decreasing trend for the second portion. This is similar to Victoria River. Several increased stage events led to decreases in pH.

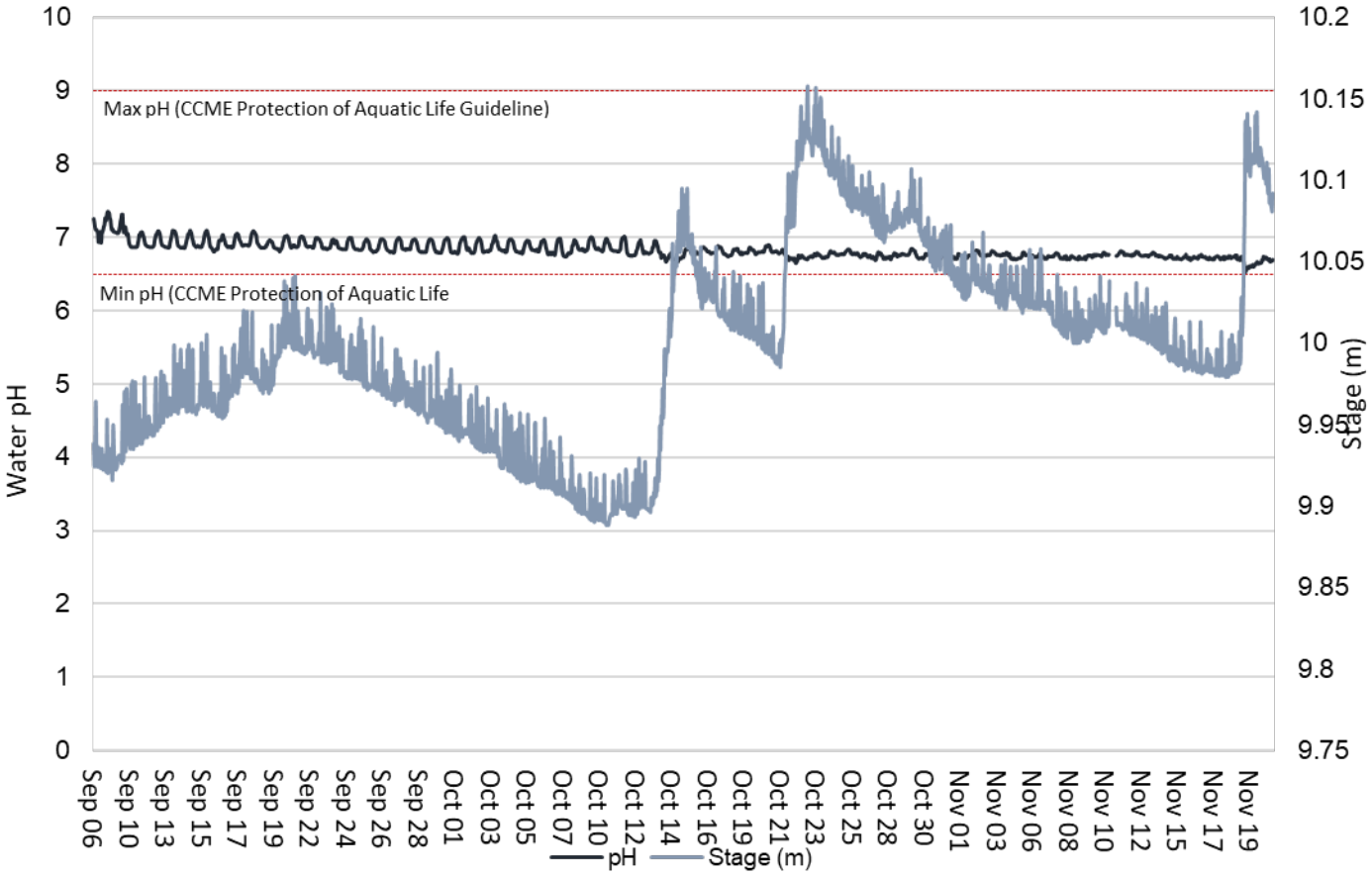


Figure 9: Water pH and Stage

- Specific conductivity ranged from 23.1 to 27.5 µs/cm (Figure 10) with a median of 25.2 µs/cm (Figure 10).
- Specific conductivity is trending downward over the course of this deployment period. Specific Conductivity increased as the stage increased on several occasions, but also decreased on another occasion (November 18th).

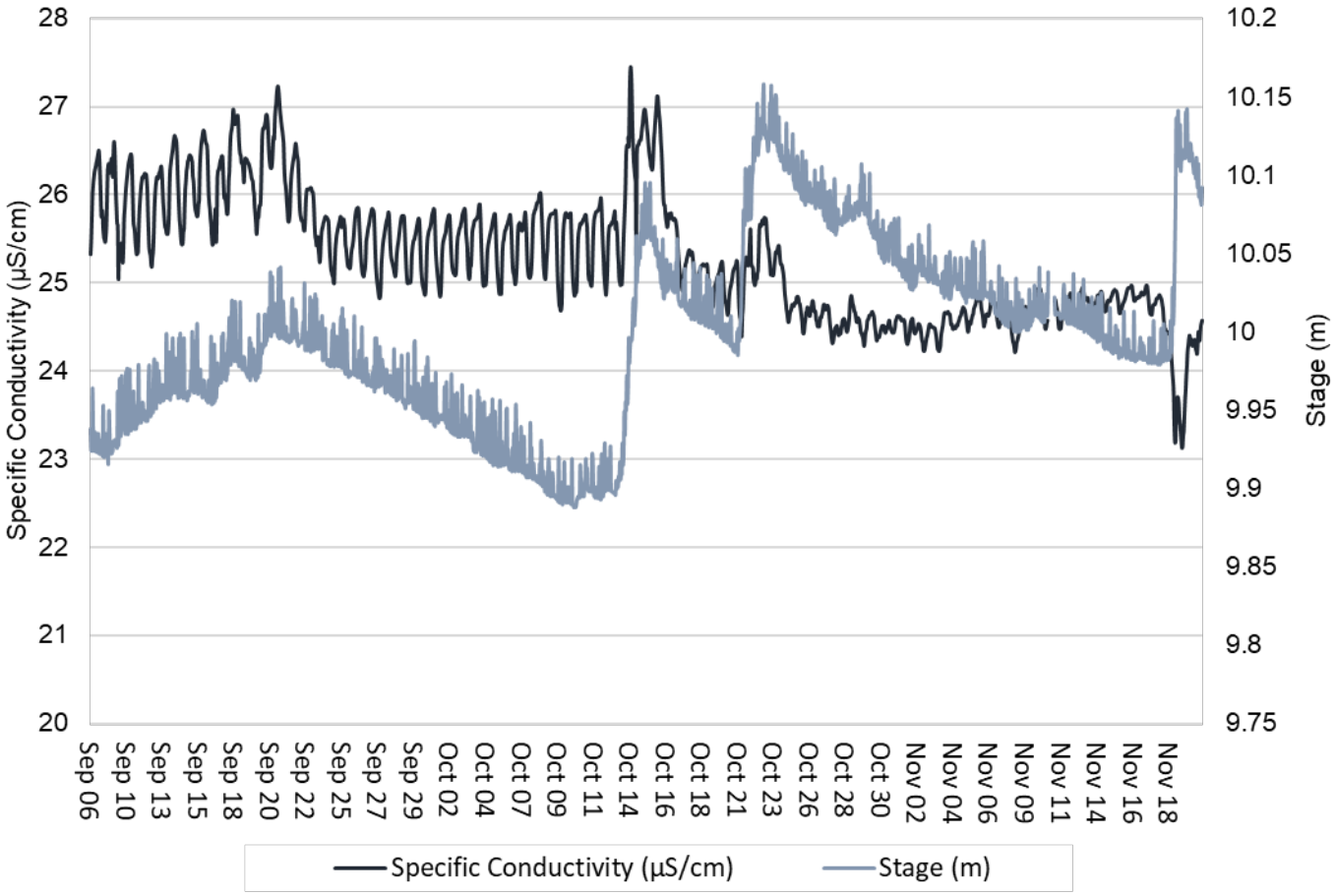


Figure 10: Specific Conductivity of Water and Stage

- The saturation of dissolved oxygen ranged from 96.6% to 102.7% and a range of 8.87 to 14.63 mg/l was found for the concentration of dissolved oxygen with a median value of 10.93 mg/l (Figure 11).
- All values were above the minimum CCME Guidelines for the Protection of Other Life Stages. Most values were above the Guidelines for the Protection of Early Life Stages, dipping just below when water temperatures were warmest. The guidelines are indicated in red on Figure 11.
- Dissolved oxygen content fluctuates diurnally, displaying the inverse relationship to water temperature. Dissolved oxygen increased steadily during the deployment period as water temperatures cooled into fall.

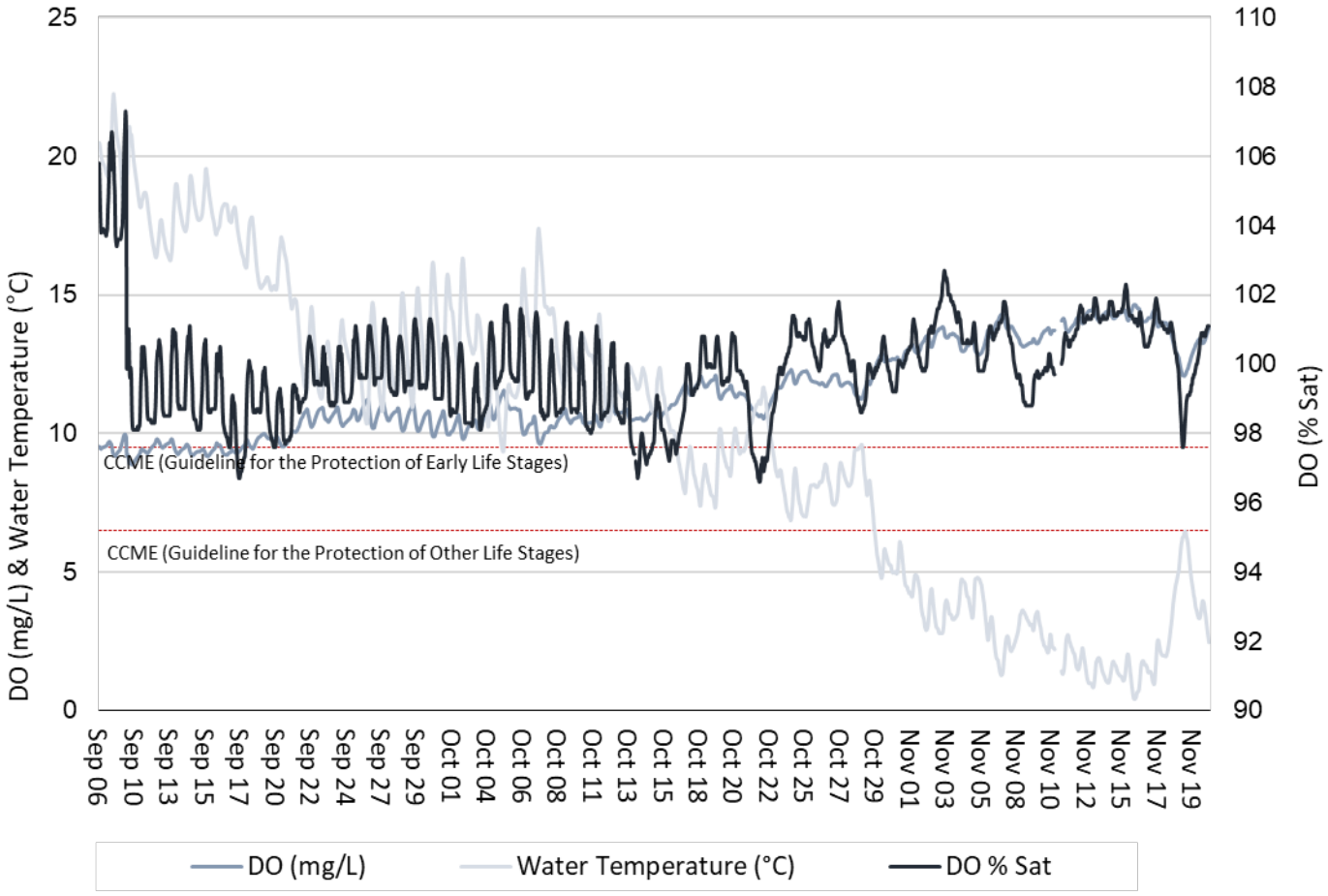


Figure 11: Dissolved Oxygen and Water Temperature

- Turbidity values range from 0.0 NTU to 70.9 NTU with a median of 0.1, indicating very clear background turbidity.
- Turbidity remained very low throughout deployment with a single spike in the middle of the deployment period that appears to be related to an increased Stage event. Turbidity remains low and does not respond to increases in stage associated with precipitation events through most of the deployment. This suggests that there may be minimal loose sediment in the river which can be stirred up by increased precipitation.

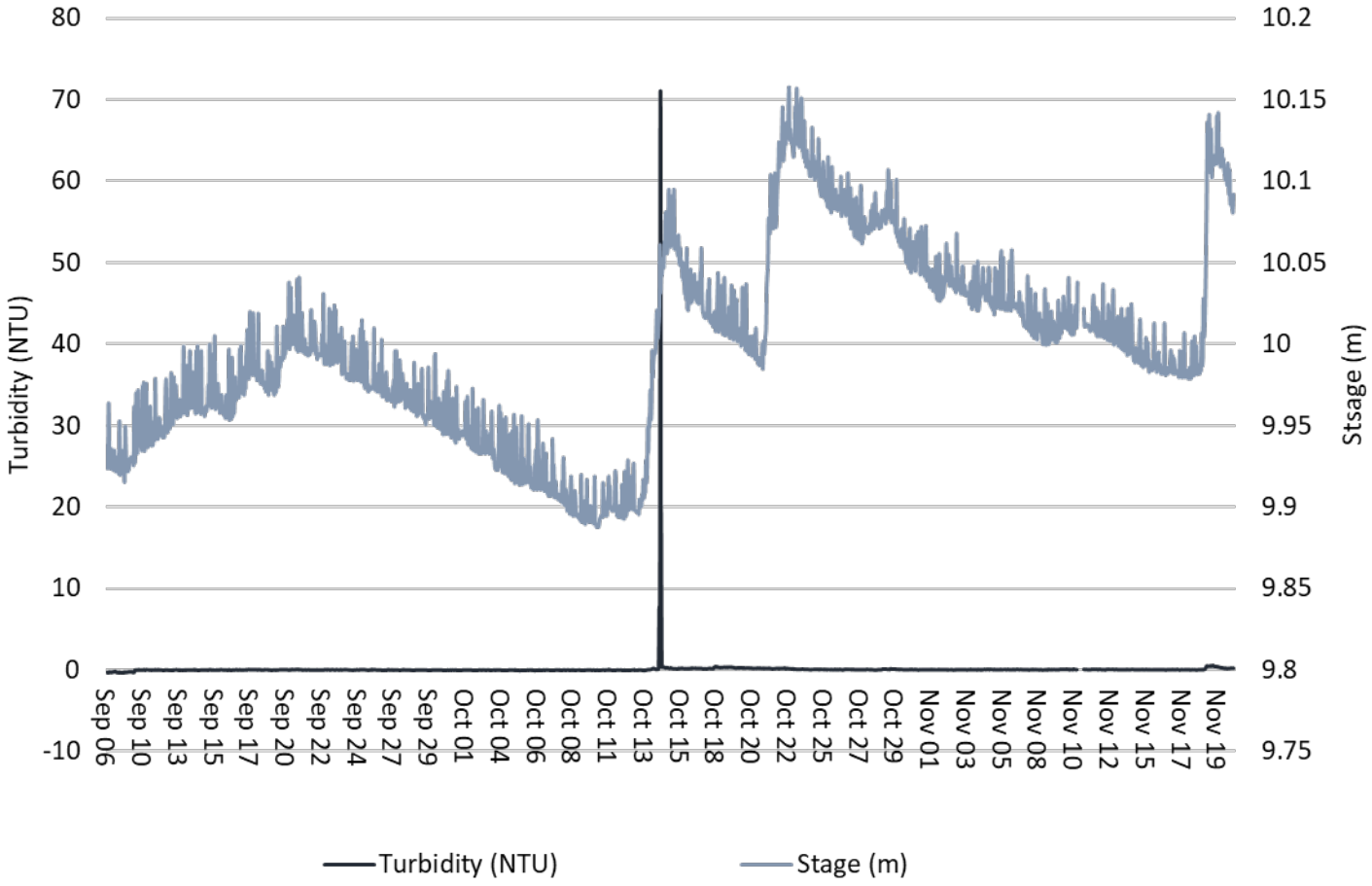


Figure 12: Turbidity and Stage

- Precipitation and stage during the deployment period are graphed below (Figure 13). Stage increased overall throughout deployment, influenced by numerous precipitation events.

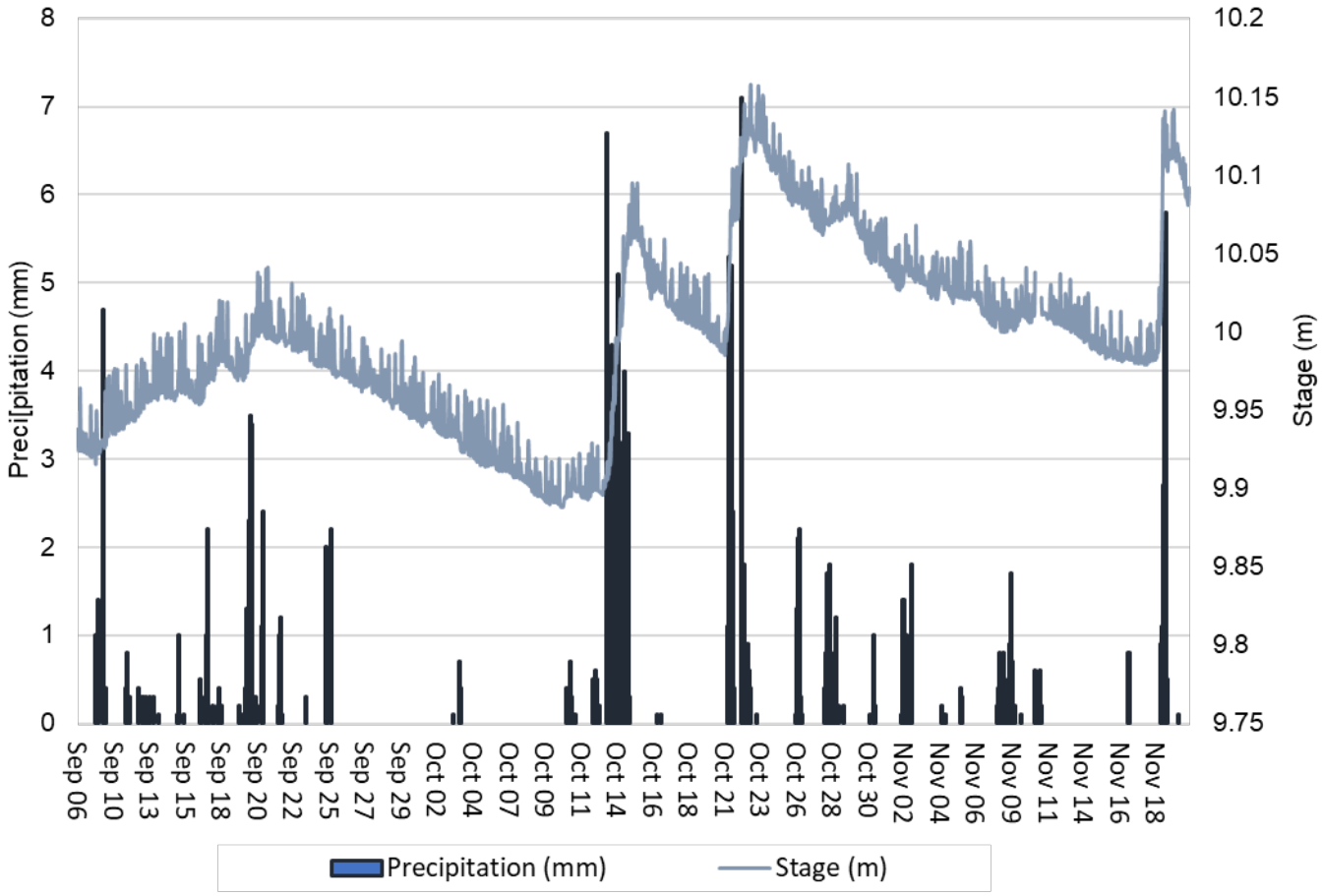


Figure 13: Precipitation and Stage

Roebucks Brook

- Water temperature ranged from 0.36 to. 22.24 ºC during this deployment period (Figure 14).
- Water temperature showed an overall decreasing trend throughout deployment, corresponding to ambient air temperatures as the season progressed to late fall. This trend was also observed at Victoria and Valentine Rivers.

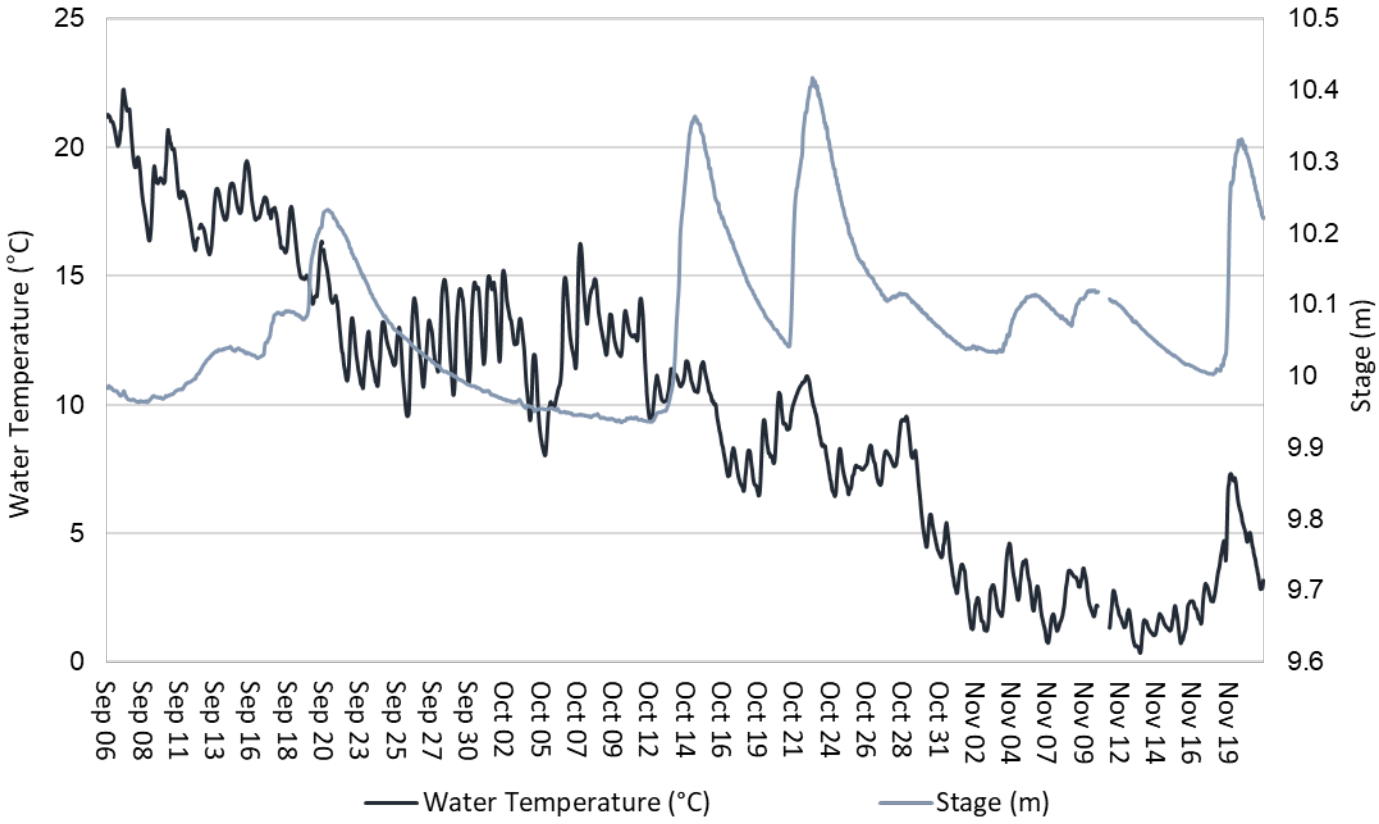


Figure 14: Water Temperature and Stage

- pH ranged between 6.12 and 17.42 pH units throughout the deployment period, with a median value of 6.99 units (Figure 15). Multiple datapoints after November 6th registered above 14 pH units, indicating that sensor is likely broken. This data after November 6th is therefore erroneous and will be removed from the dataset.
- The majority of valid values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units). Values drop below the minimum threshold periodically during high stage events. pH fluctuates slightly during the day and night.
- pH showed a decreasing trend overall, attributed largely to the numerous decreases in pH levels during high stage events. The erroneous data November 6-23 was likely failure of the pH probe. Other parameters remained normal during this period, confirming it was a technical issue with the sensor rather than environmental.

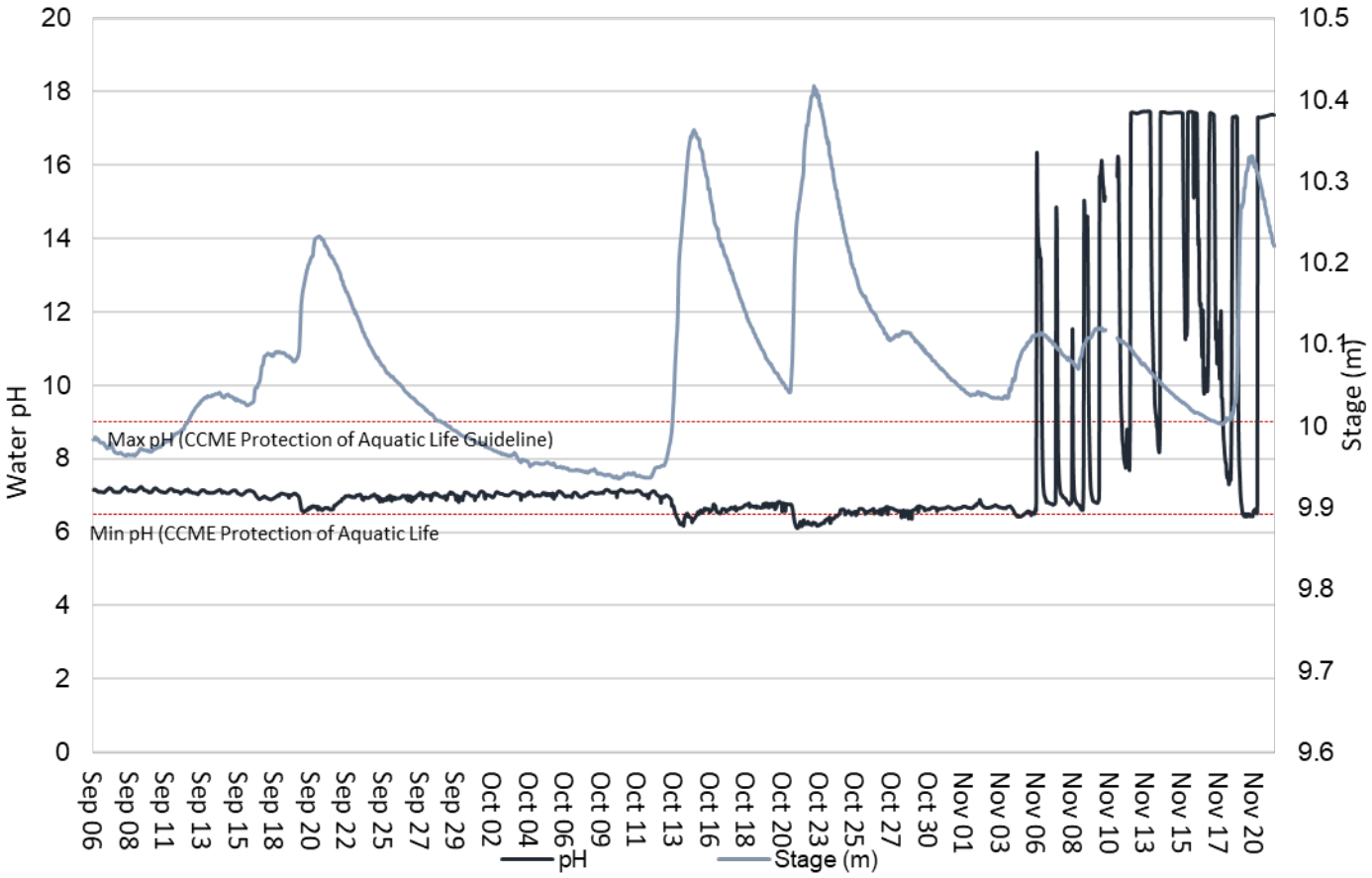


Figure 15: Water pH and Stage

- Specific conductivity ranged from 14.4 to 38.4 µs/cm (Figure 16) with a median of 25.8 µs/cm.
- Specific conductivity fluctuated but tended to decrease over the course of this deployment period. During periods of high precipitation and corresponding stage increases, conductivity in Roebucks Brook decreased.
- This drop in conductivity as stage increased indicates dilution of the water column instead of more particles being washed into the river or resuspended in the water.

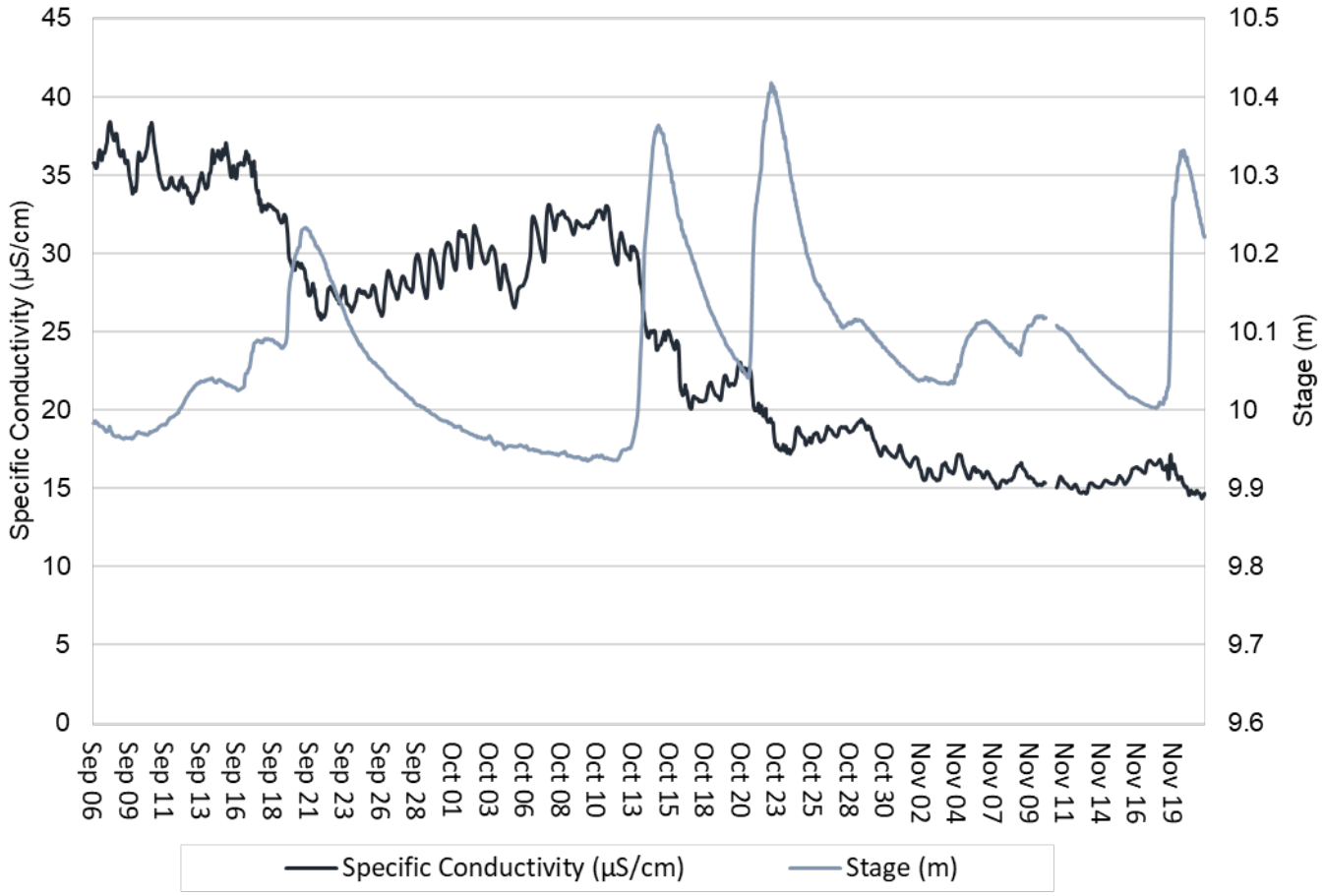


Figure 16: Specific Conductivity of Water and Stage

- The saturation of dissolved oxygen ranged from 86.7% to 99.4% and a range of 8.10 to 14.14 mg/l was found for the concentration of dissolved oxygen with a median value of 10.54 mg/l (Figure 17).
- All values were above the minimum CCME Guidelines for the Protection of Other Life Stages. The majority of values were above the Guidelines for the Protection of Early Life Stages except when the water was warmest. The guidelines are indicated in red on Figure 17.
- Dissolved oxygen content fluctuates diurnally, displaying the inverse relationship to water temperature. Dissolved oxygen tended to increase overall during the deployment period as water temperatures cooled into fall.

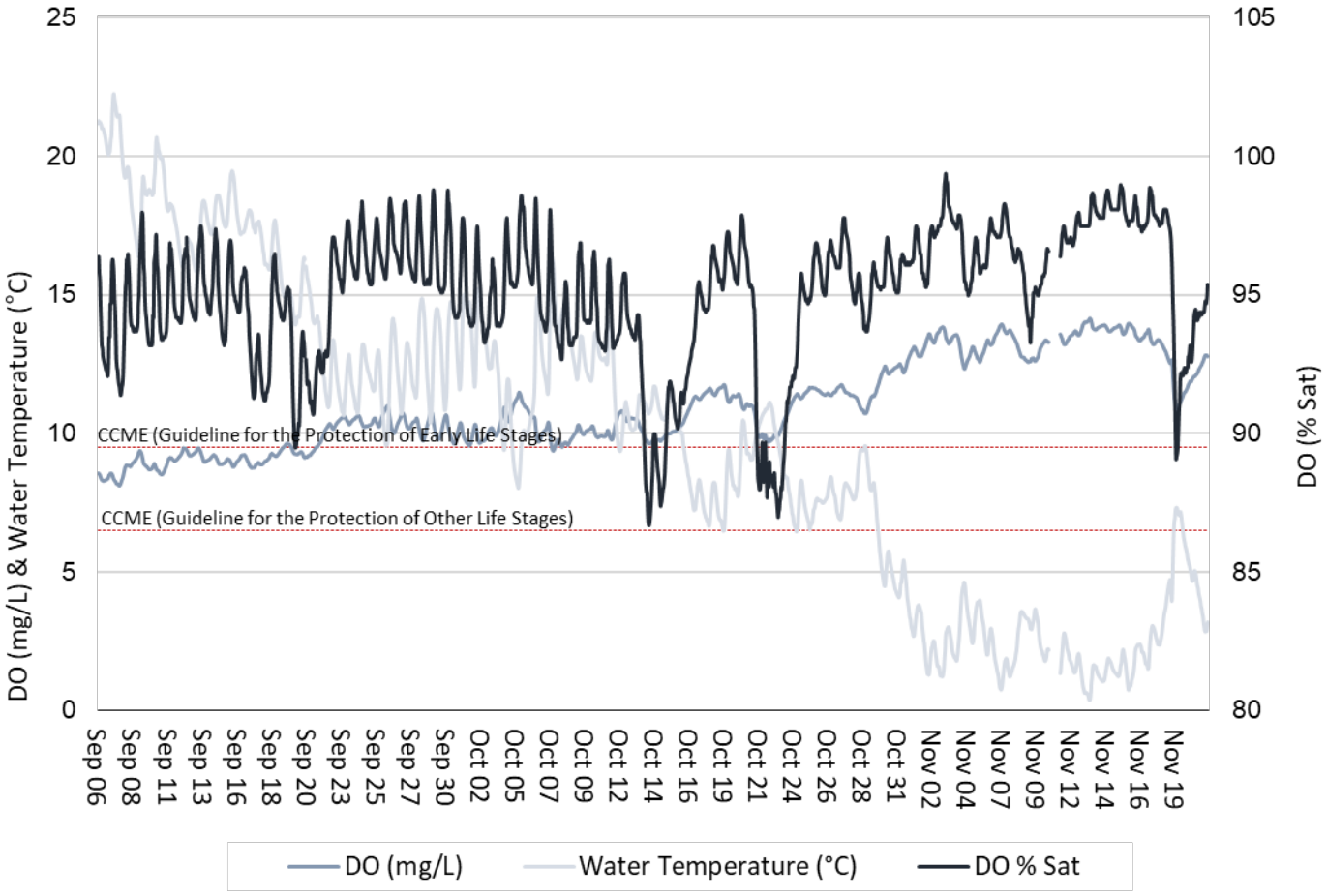


Figure 17: Dissolved Oxygen and Water Temperature

- Turbidity values range from 1.0 NTU to 182.0 NTU with a median of 2.6NTU, indicating low background turbidity which was higher than Victoria or Valentine Rivers (Figure 18).
- Turbidity remained relatively stable throughout deployment with occasional spikes during stage events associated with precipitation (Figure 18). This indicates rainfall associated with stage increases may stir up sediments in the area for a brief period of time before returning to background levels.

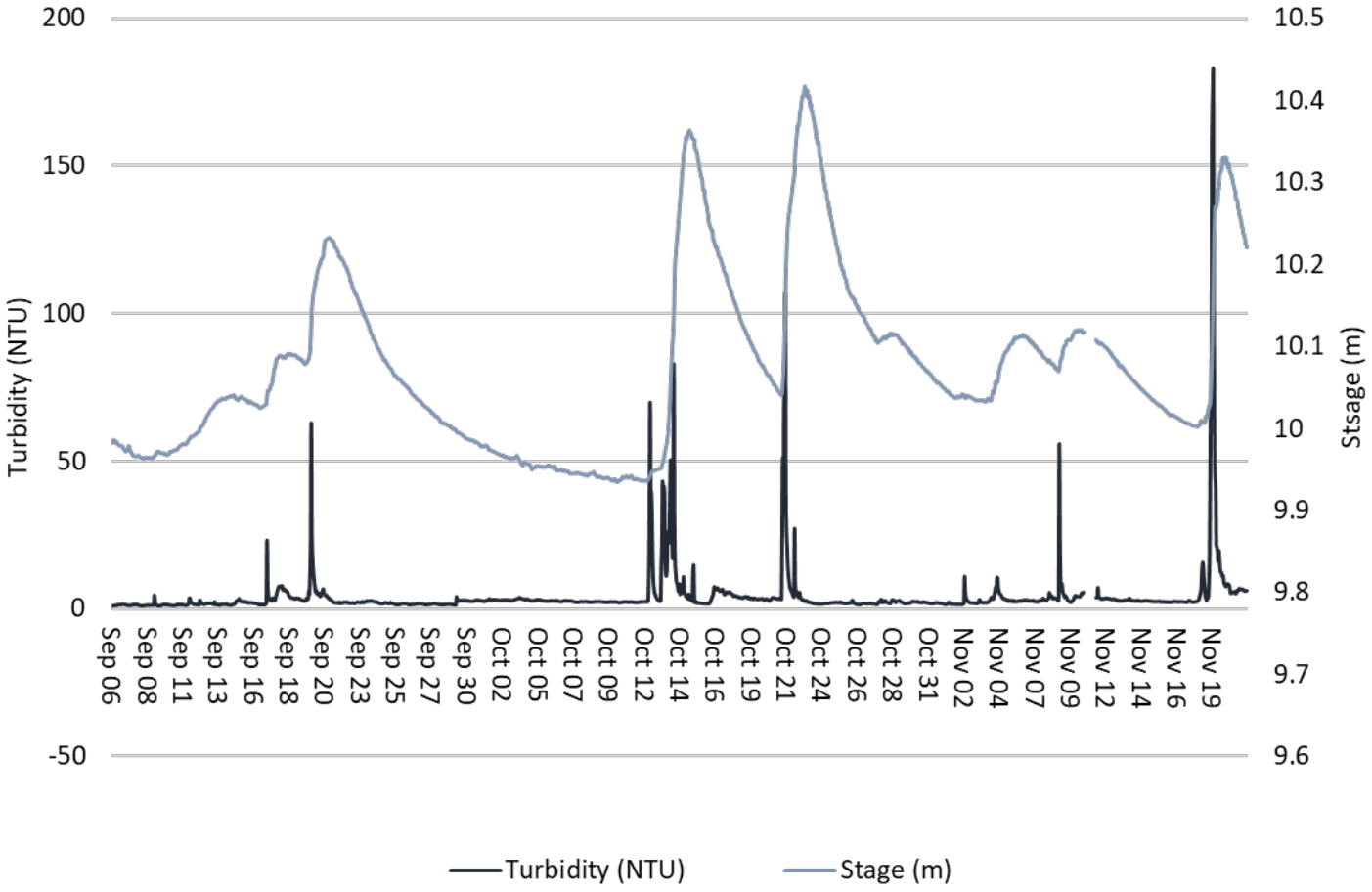


Figure 18: Turbidity and Stage

- Precipitation and stage during the deployment period are graphed below (Figure 19). Stage fluctuated throughout deployment, influenced by several major precipitation events.
- It is notable from the data that smaller precipitation events did not always lead to an increase in stage at this location.

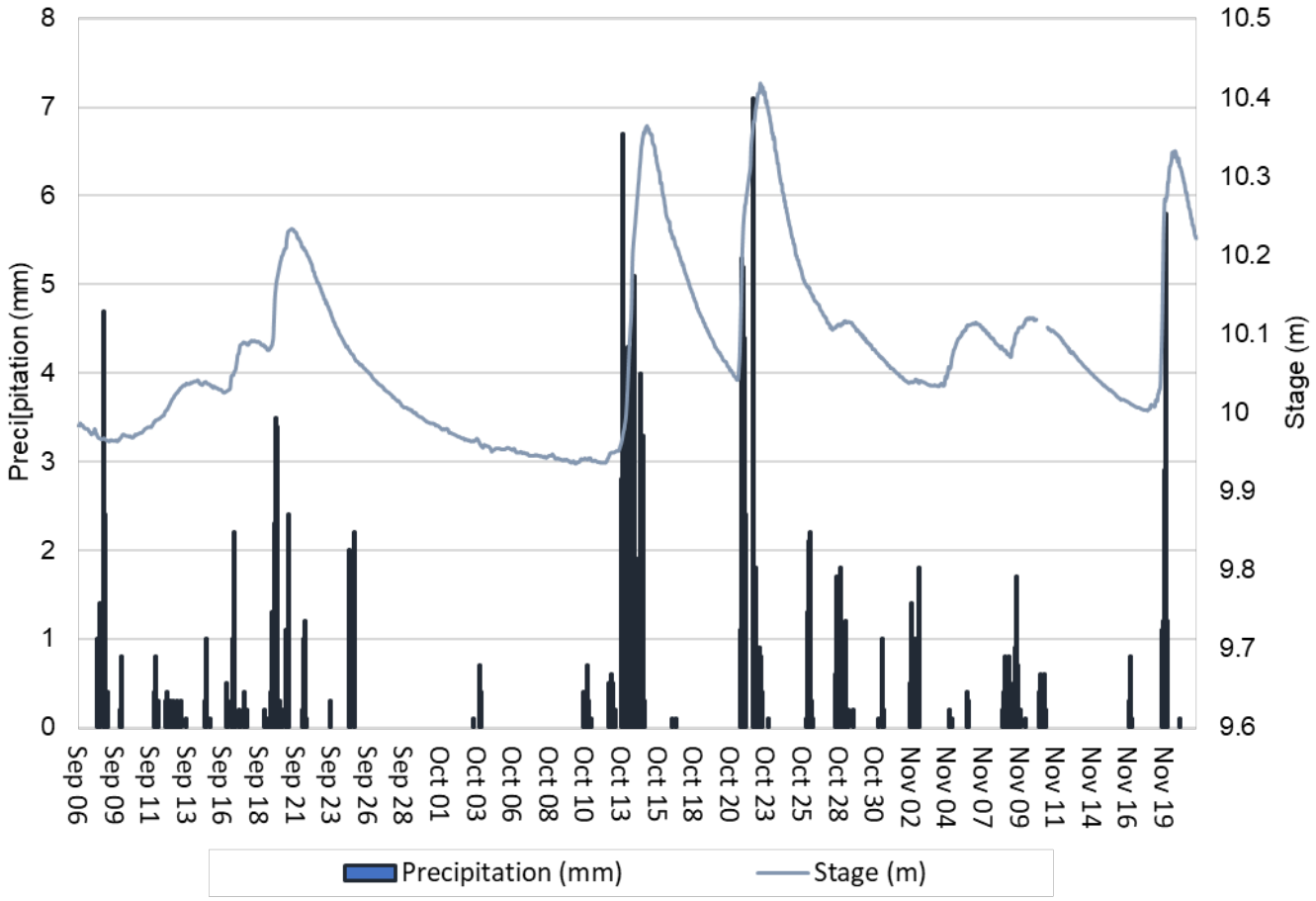


Figure 19: Precipitation and Stage

Conclusions

- Instruments were deployed at three real time water quality/quantity monitoring stations which form the Marathon Gold Corp monitoring network on September 6th and removed on November 23rd, 2023. This was the third deployment for the network in 2023. Water quality instruments were removed for the winter.
- In most cases, weather related events or increases/decreases in water level explain parameter fluctuations.
- Water temperature was found to be generally decreasing at all stations, as expected with seasonal air temperatures progressing into late fall.
- All pH values were within the recommended CCME Guidelines for the Protection of Aquatic Life at Victoria and Valentine River. At Roebucks Brook, pH dropped below the minimum guideline briefly during periods of high precipitation. However, late in the deployment period we see spikes of pH well outside of normal range. This is most likely due to probe issues rather than environmental conditions as other parameters at this station are within normal ranges. This erroneous data will be removed from the dataset.
- Specific conductivity remained relatively stable at Victoria over the course of this deployment period, with brief spikes during periods of high precipitation. Specific conductivity at Valentine River is trending downward over the course of the deployment period but is varied in how conductivity levels respond to water level changes. This suggests that conductivity changes at Valentine River may be due to factors in addition to precipitation. Specific conductivity at Roebucks fluctuated but tended to decrease over the course of this deployment period. During periods of high precipitation/stage, conductivity in Roebucks Brook decreased, suggesting low dilution in presence of low sediment load.
- Dissolved oxygen values were above the minimum CCME Guidelines for the Protection of Other Life Stages all stations throughout the deployment. Dissolved Oxygen concentration values fluctuated above and below the Guidelines for the Protection of Early Life Stages at all stations when water temperatures were warmest.
- Low median turbidity values at Victoria and Valentine Rivers indicate low background turbidity at these locations. Roebucks Brook had a higher median value, indicating background turbidity may be higher at this location, at least during this deployment. Turbidity values at Victoria and Roebucks were influenced by precipitation and associated stage increases for a short period of time before returning to background levels. Turbidity values at Valentine River are not influenced by all precipitation events.
- Stage at all locations was influenced by large precipitation events which increased the stage and showed overall increasing trends throughout the deployment.
- WRMD and Marathon Gold Crop staff will continue to work together in partnership to install, establish and maintain the real time monitoring network associated with the Valentine Lake gold project in central Newfoundland.

Prepared by:
Department of Environment & Climate Change
Water Resources Management Division

Appendix A: Real Time Surface Water Quality/Quantity Network – November 2023

Station Name	Station Number	Latitude	Longitude	Equipment Depth
Victoria River Outlet	NF02YN0047	48.407878	-57.072439	0.9m
Valentine River Outlet	NF02YN0048	-57.078128	48.424644	0.15m
Roebucks Brook	NF02YN0049	-57.013102	48.544174	0.33m

Station Descriptions:

Victoria River

Station Location: Victoria River 6.3km downstream of Victoria dam, below quarry pit. Station setup on western shoreline. Access via ATV trail below quarry pit.



Valentine River

Station Location: Valentine River at access road, 1.9km downstream of Valentine Lake outlet. Station located 15m upstream of access road crossing bridge on southern shoreline.

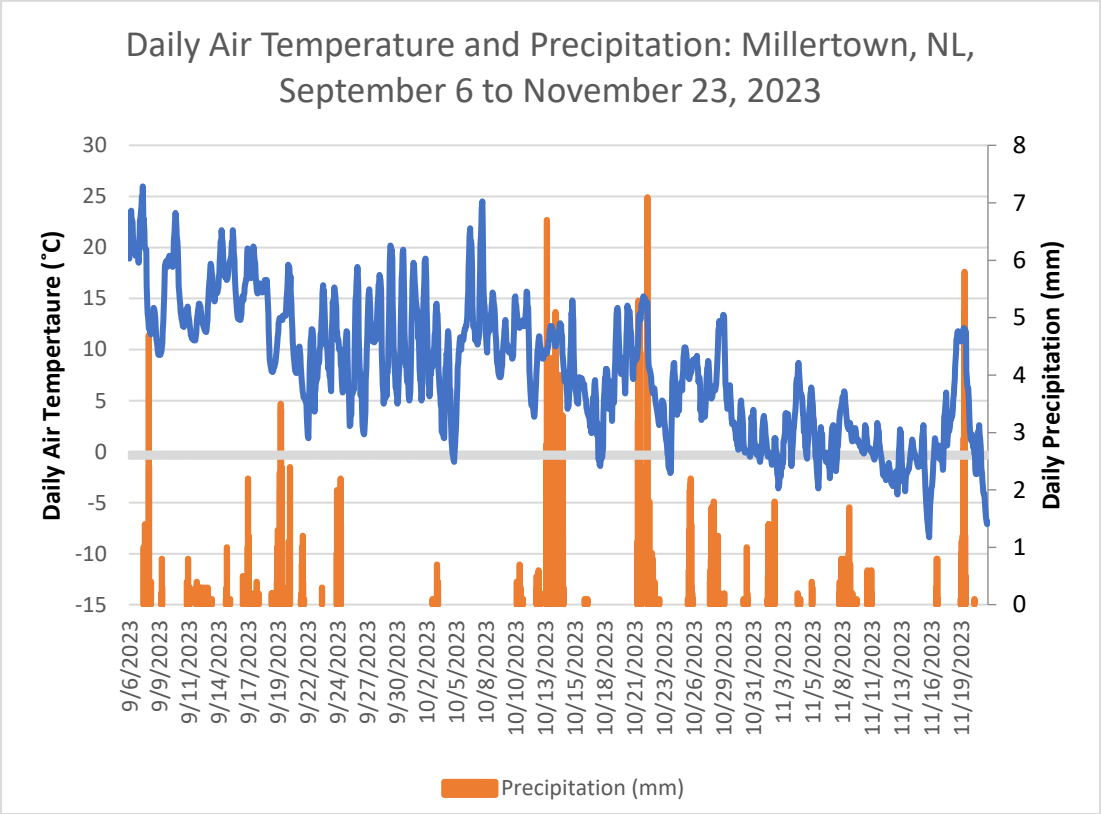


Roebucks Brook

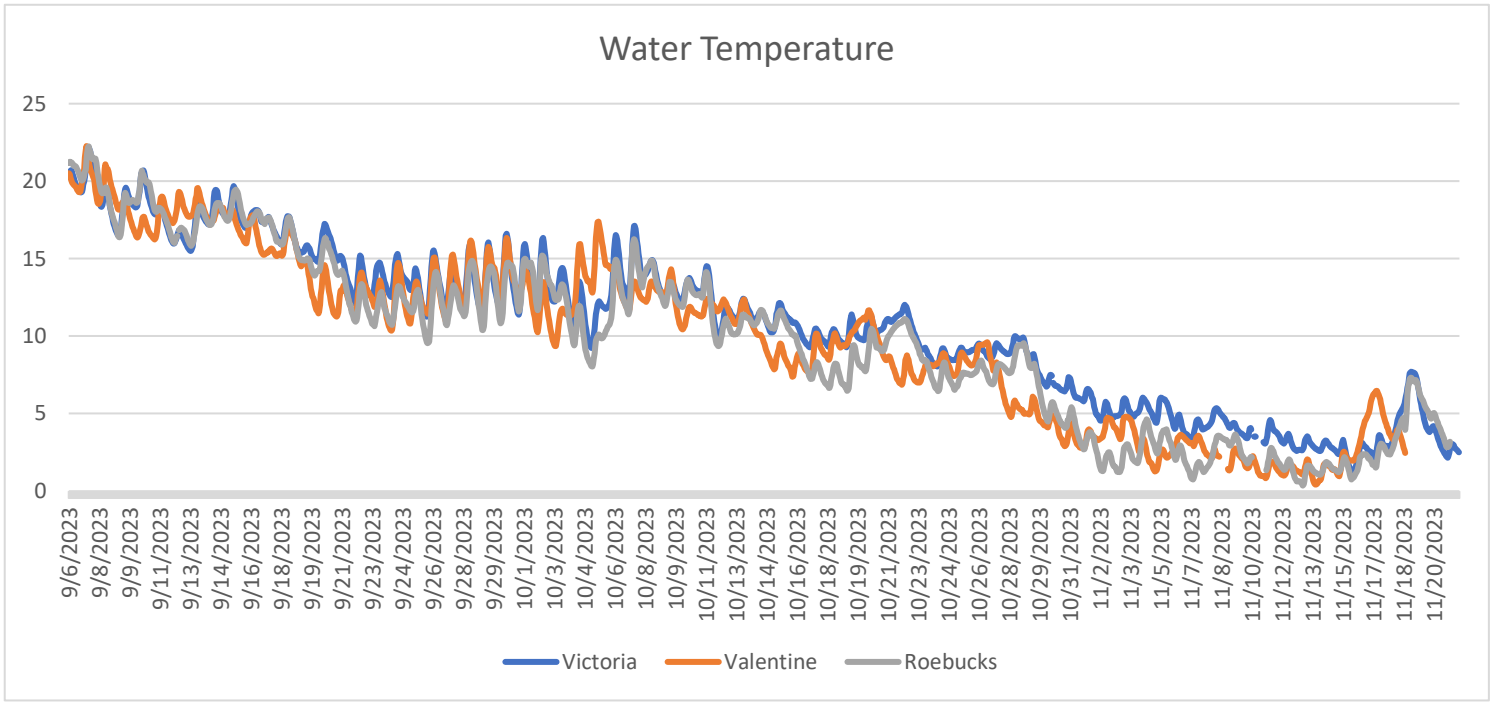
Station Location: Roebucks Brook 30m downstream of access road bridge crossing on western shoreline. Station is 1.6km downstream of Roebucks Lake outlet.

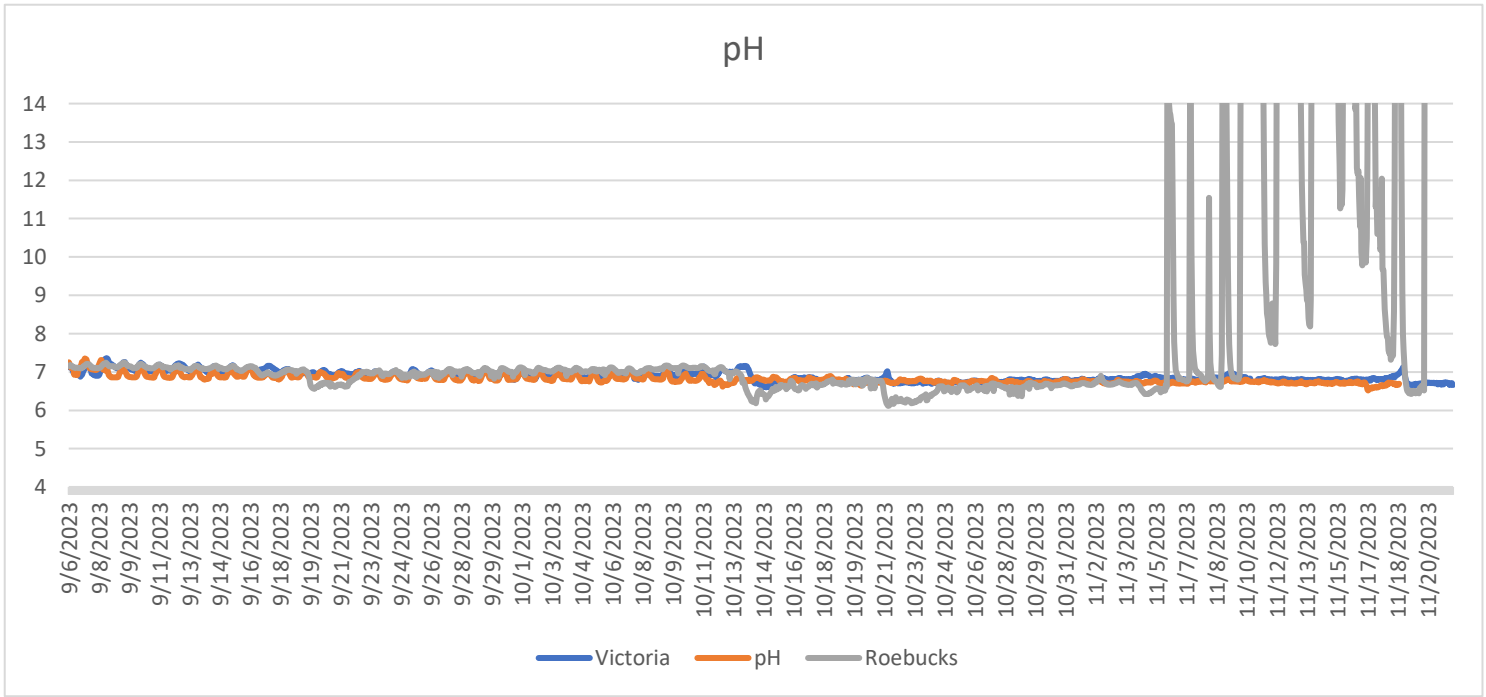


Appendix B: Weather Data from Millertown RCS



Appendix C: Station Parameter Comparison Graphs (raw data)





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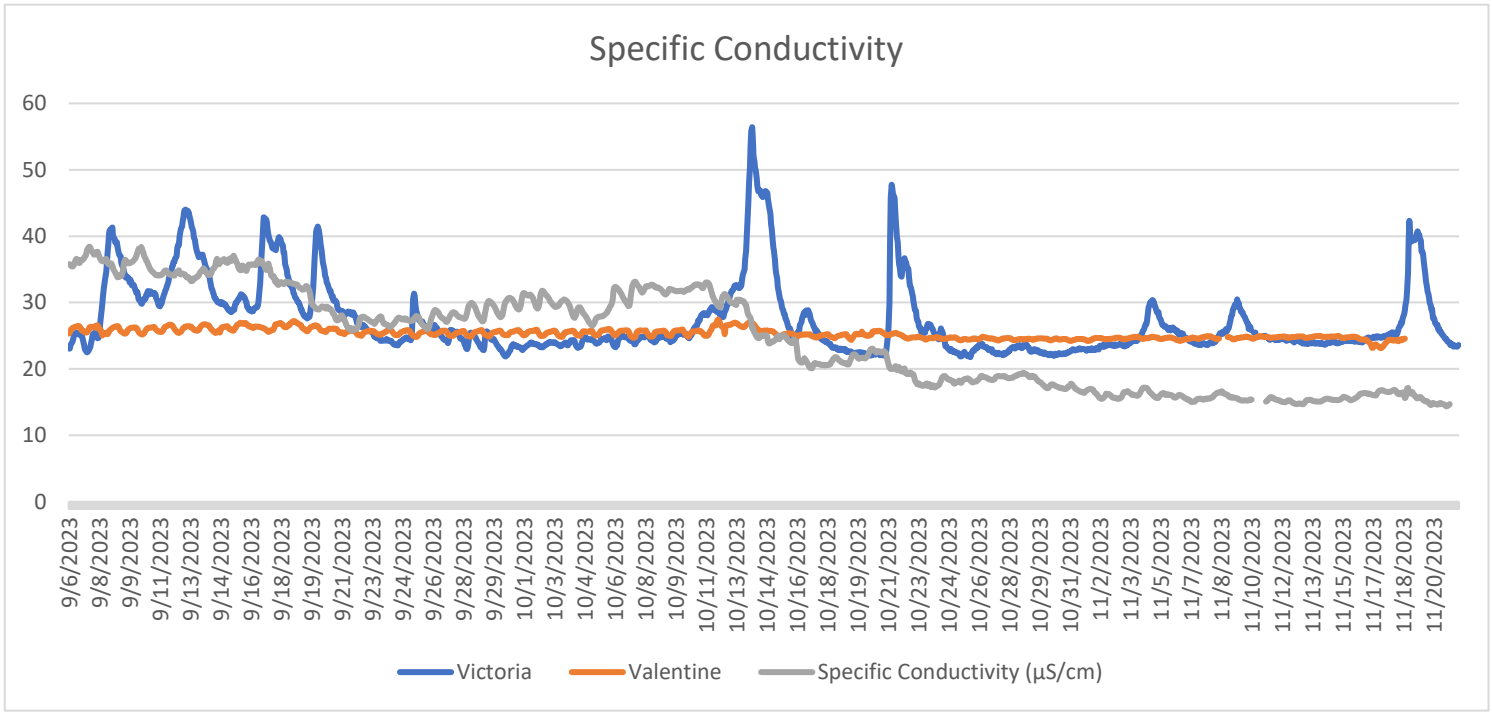
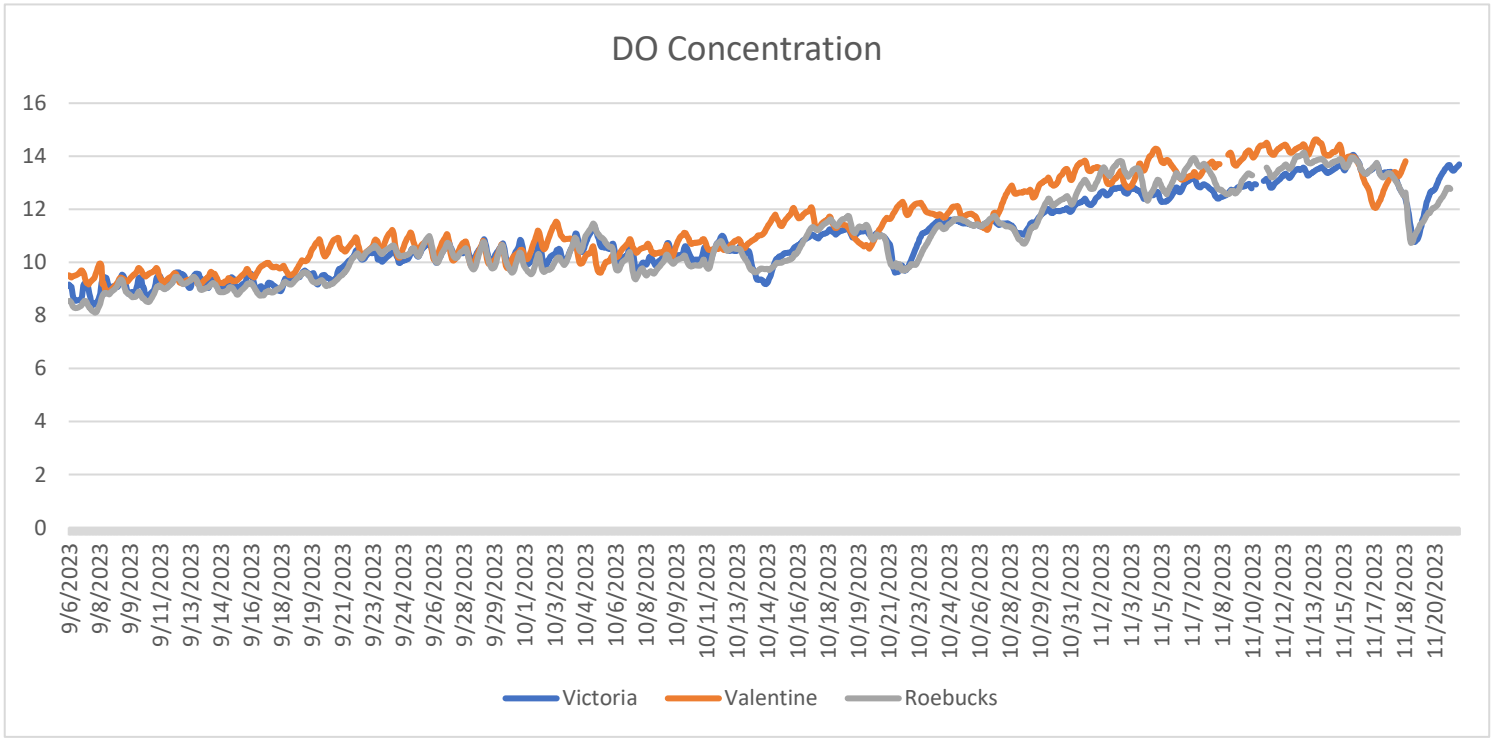
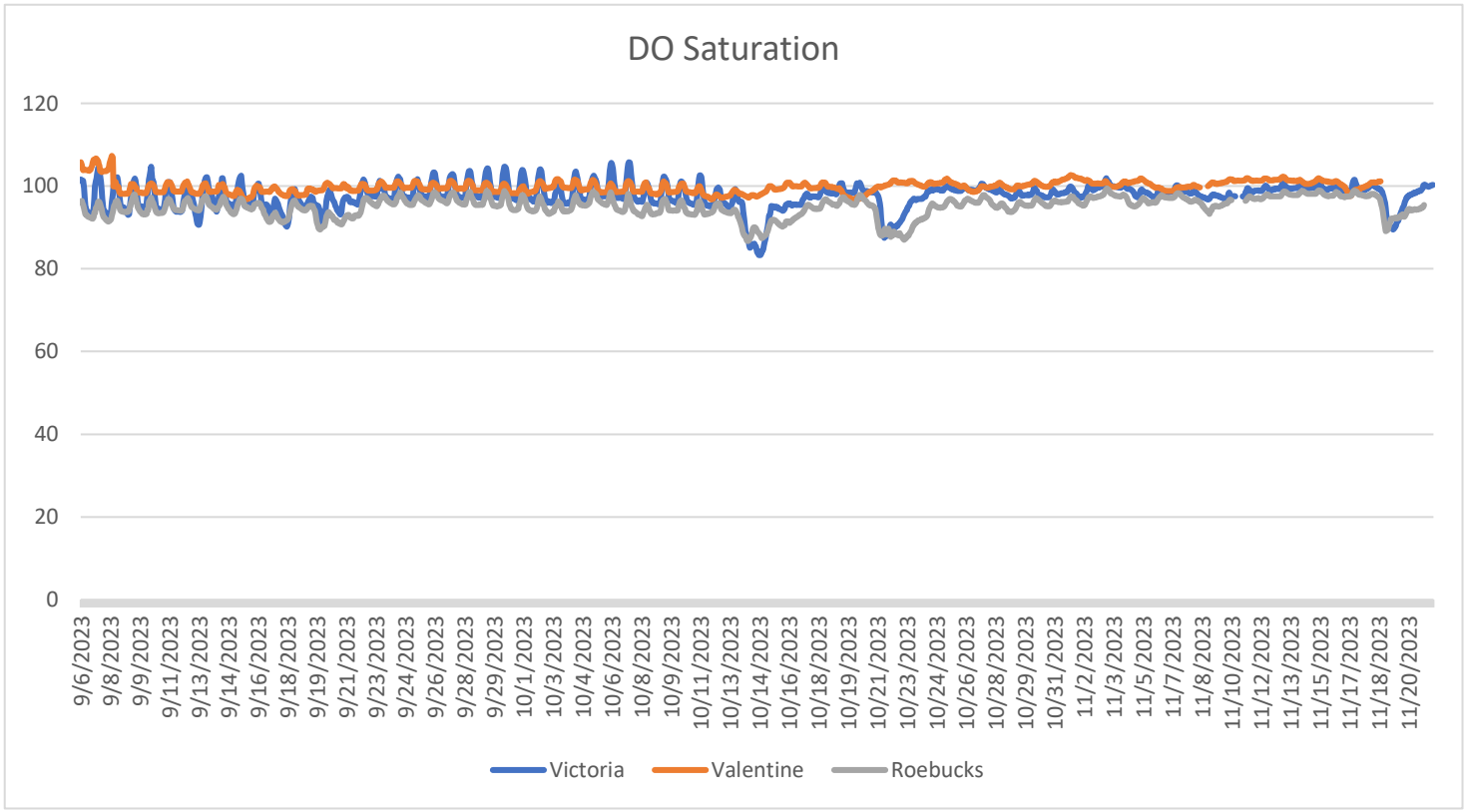
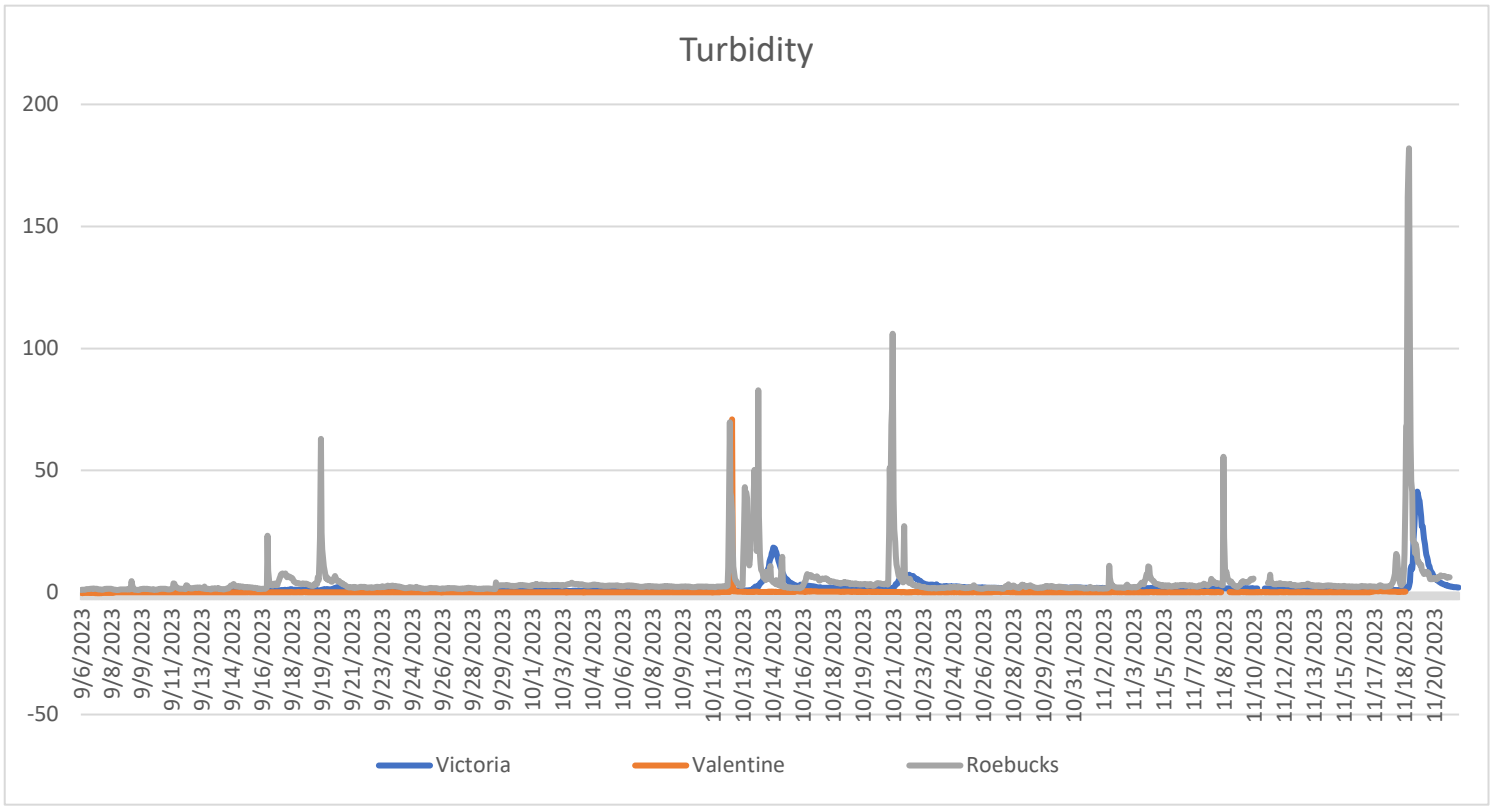




Marathon Gold Corp, Newfoundland and Labrador





Marathon Gold Corp, Newfoundland and Labrador