Real-Time Water Quality Deployment Report

Lower Churchill River Network

September 12 to
October 11, 2013

Newfoundland Labrador

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

Contents

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Real Time Water Quality Monitoring

- Department of Environment and Conservation staff monitors the real-time web pages regularly.
- This deployment report discusses water quality related events occurring at five stations on the Lower Churchill River: below Metchin River, below Grizzle Rapids, above and below Muskrat Falls and at English Point.
- There was no instrument deployed at the station on Lake Melville east of Little River. Instrument deployments at this station have been suspended for 2013 because of deployment issues in both 2011 and 2012 that caused significant damage to the instrument.
- On September 12 & 14, 2013, real-time water quality monitoring instruments were deployed at the five Lower Churchill River Stations for periods of 26-29 days. Instruments were removed on October 10 & 11, 2013.

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 along side 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 (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 > 35µS/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 Lower Churchill River stations deployed from September 12 & 14 to October 10 & 11 are summarized in Table 2.

Table 2: Comparison rankings for Lower Churchill River stations, September 12 & 14 to October 10 & 11, 2013

Churchill River Station and Instrument Number	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Below Metchin River (45701)	Sep 14, 2013	Deployment	Excellent	Good	Excellent	Excellent	Excellent
	Oct 10, 2013	Removal	Good	n/a*	Excellent	Excellent	Excellent
Below Grizzle Rapids (47590)	Sep 14, 2013	Deployment	Excellent	n/a*	Excellent	Excellent	Excellent
	Oct 10, 2013	Removal	Excellent	n/a*	Excellent	Excellent	Excellent
Above Muskrat Falls (47589)	Sep 12, 2013	Deployment	Excellent	Fair	Excellent	Excellent	Good
	Oct 11, 2013	Removal	Excellent	n/a*	Excellent	Excellent	Excellent
Below Muskrat Falls (45708)	Sep 12, 2013	Deployment	Good	Marginal	Excellent	Excellent	Excellent
	Oct 11, 2013	Removal	Good	n/a*	Excellent	Good	Fair
At English Point (45709)	Sep 12, 2013	Deployment	Excellent	Fair	Excellent	Excellent	Good
	Oct 11, 2013	Removal	Excellent	n/a*	Excellent	Excellent	Poor

*Comparison ranking unavailable due to pH sensor malfunction on QAQC instrument 47592.

- At the station below Metchin River, all parameters rank 'good' or 'excellent' at deployment.

  At removal, temperature, specific conductivity, dissolved oxygen and turbidity all rank either 'good' or 'excellent'. pH was not ranked due to sensor malfunction.
- At the station below Grizzle Rapids, temperature, specific conductivity, dissolved oxygen and turbidity all rank 'excellent' at deployment and removal. pH was not ranked at deployment or removal due to sensor malfunction.
- At the station above Muskrat Falls, temperature, specific conductivity, dissolved oxygen and turbidity rank either 'good' or 'excellent' at deployment while pH is ranked 'fair'. For pH, the field instrument read a value of 6.56 while the QAQC instrument read a value of 7.14. The discrepancy in the values may in part be due to the time the field instrument has to stabilize to the environment. At the time of the first

transmission at 1:30pm the field instrument read a value of 6.76 which when compared to the QAQC instrument value of 7.14 yields a 'good' ranking.

At removal, temperature, specific conductivity, dissolved oxygen and turbidity all rank 'excellent'. pH is not ranked due to sensor malfunction.

- At the station below Muskrat Falls, temperature, specific conductivity, dissolved oxygen and turbidity rank either 'good' or 'excellent' at deployment while pH is ranked 'marginal'. For pH, the field instrument read a value of 6.30 while the QAQC instrument read a value of 7.29. The discrepancy in the values may in part be due to the time the field instrument has to stabilize to the environment. At the time of the first transmission at 3:30pm the field instrument read a value of 6.89 which when compared to the QAQC instrument value of 7.29 yields a 'good' ranking.

  At removal, temperature, specific conductivity and dissolved oxygen all rank either 'good' or 'excellent' while turbidity ranks 'fair'. For turbidity, the field instrument reads a value of 11.4NTU while the QAQC instrument reads a value of 5.2NTU. The discrepancy between the values may in apart be due to the placement of the instruments on the river bottom adjacent to one another. pH is not ranked due to sensor malfunction.

- At the station at English Point, temperature, specific conductivity, dissolved oxygen and turbidity rank either 'good' or 'excellent' at deployment while pH ranks 'fair'. For pH, the field instrument read a value of 6.69 and the QAQC instrument read a value of 7.36, a difference of 0.67. The discrepancy in the values may in part be due to the time the field instrument has to stabilize to the environment. At the time of the first transmission at 3:30pm the field instrument read a value of 7.10 which when compared to the QAQC instrument value of 7.36 yields a 'good' ranking.

  At removal, temperature, specific conductivity and dissolved oxygen all rank 'excellent' while turbidity ranks 'poor'. For turbidity, the field instrument reads a value of 633NTU while the QAQC instrument reads a value of 3.1NTU. This large discrepancy is most likely caused by silt and sediment build up near the turbidity sensor. Data will be inspected for irregularities and inaccurate data trends. pH is not ranked due to sensor malfunction.

Data Interpretation

- The following graphs and discussion illustrate water quality related events occurring between September 12 and October 11 in the Lower Churchill River 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.

Churchill River below Metchin River

- Water temperature ranges from 7.20°C to 10.90°C during the deployment period (Figure 1).
- Water temperature is decreasing slightly throughout the deployment period. This trend is expected due to the cooling air temperatures in the fall season (Figure 2). Water temperature generally fluctuates diurnally.

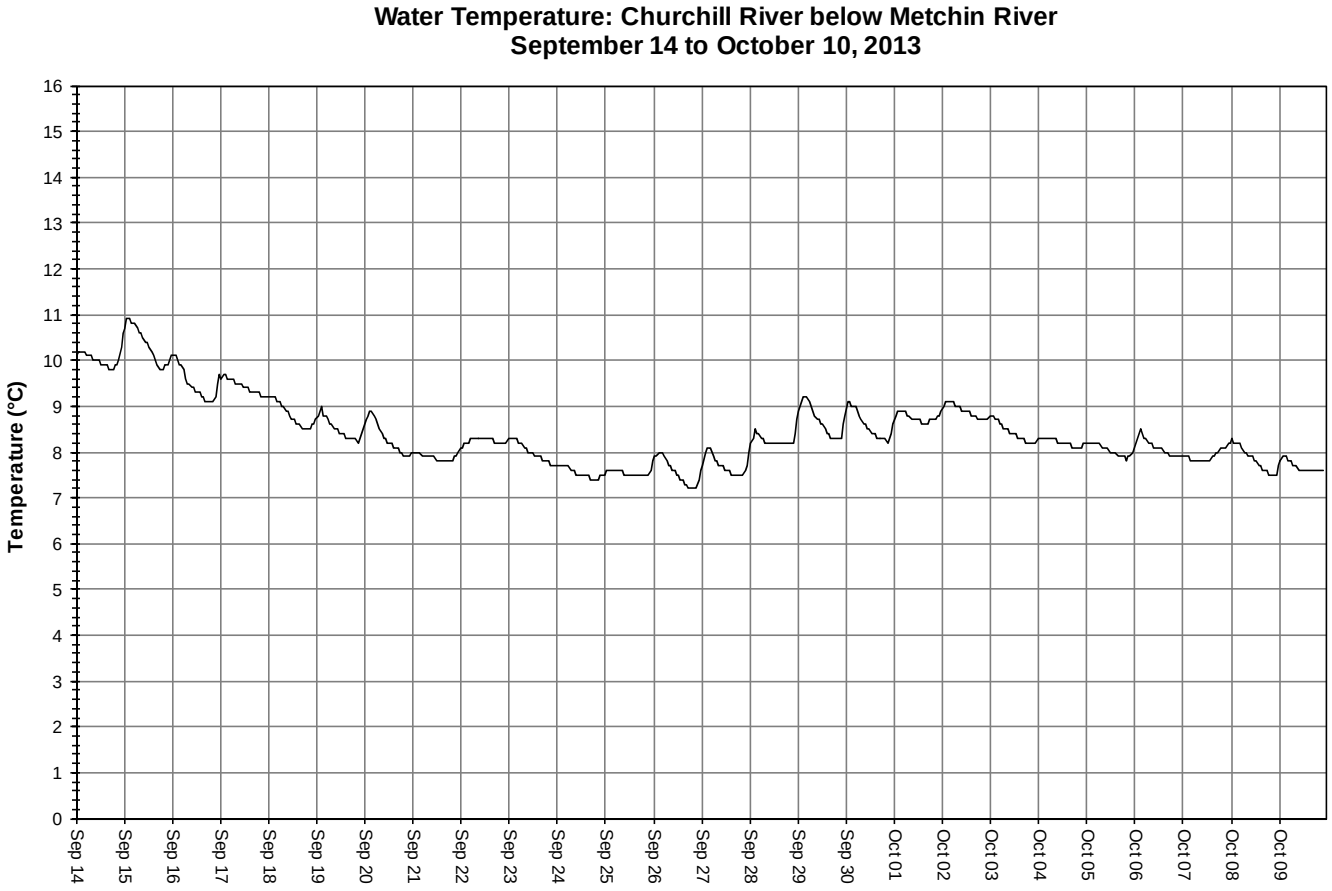


Figure 1: Water temperature at Churchill River below Metchin River

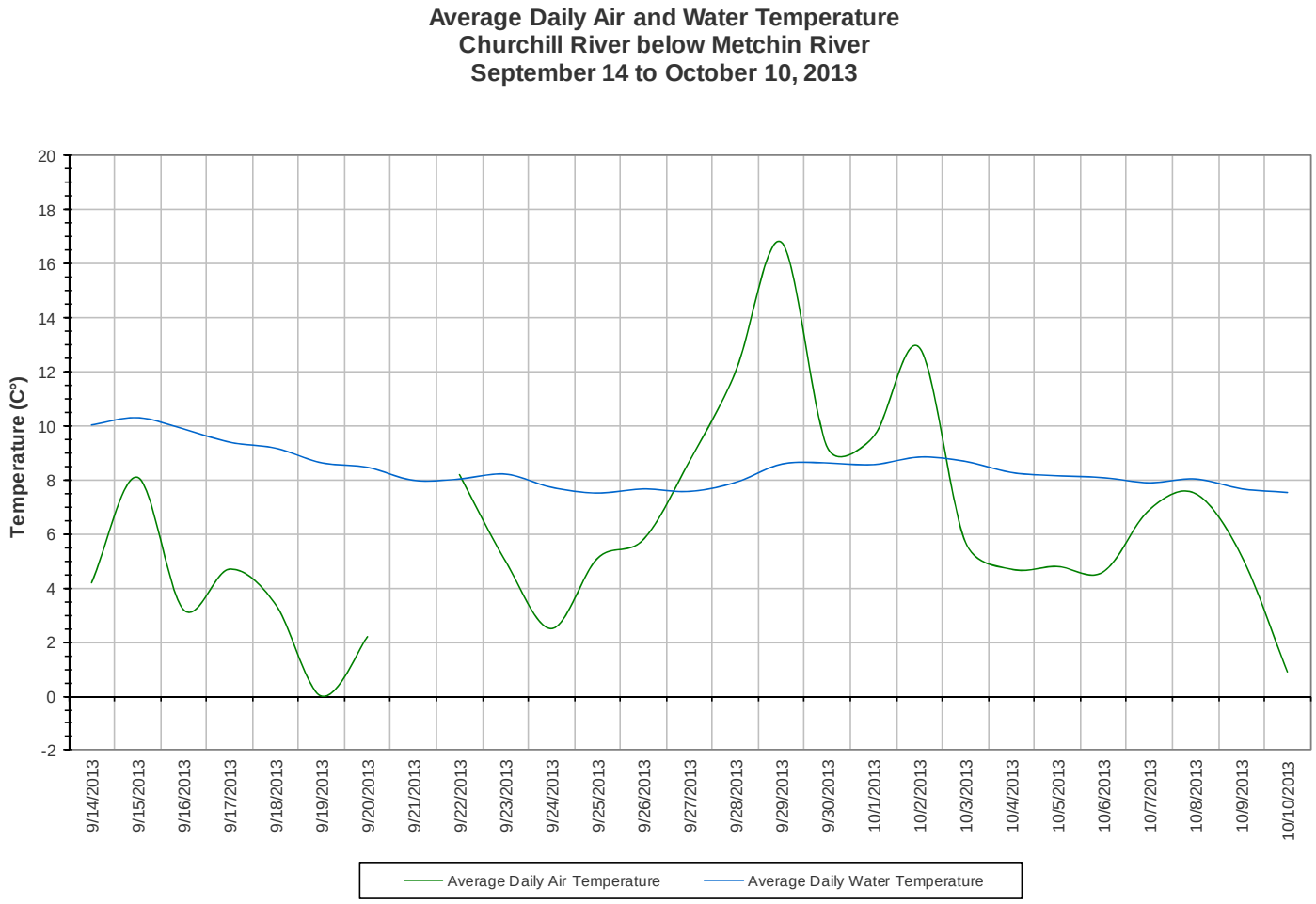


Figure 2: Average daily air and water temperature at Churchill River below Metchin River (weather data recorded at Churchill Falls, NL)

- pH ranges between 7.22 and 7.48 pH units and is very stable throughout the deployment period regardless of the changing stage levels (Figure 3). pH values fluctuate slightly on a daily basis.
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 3).

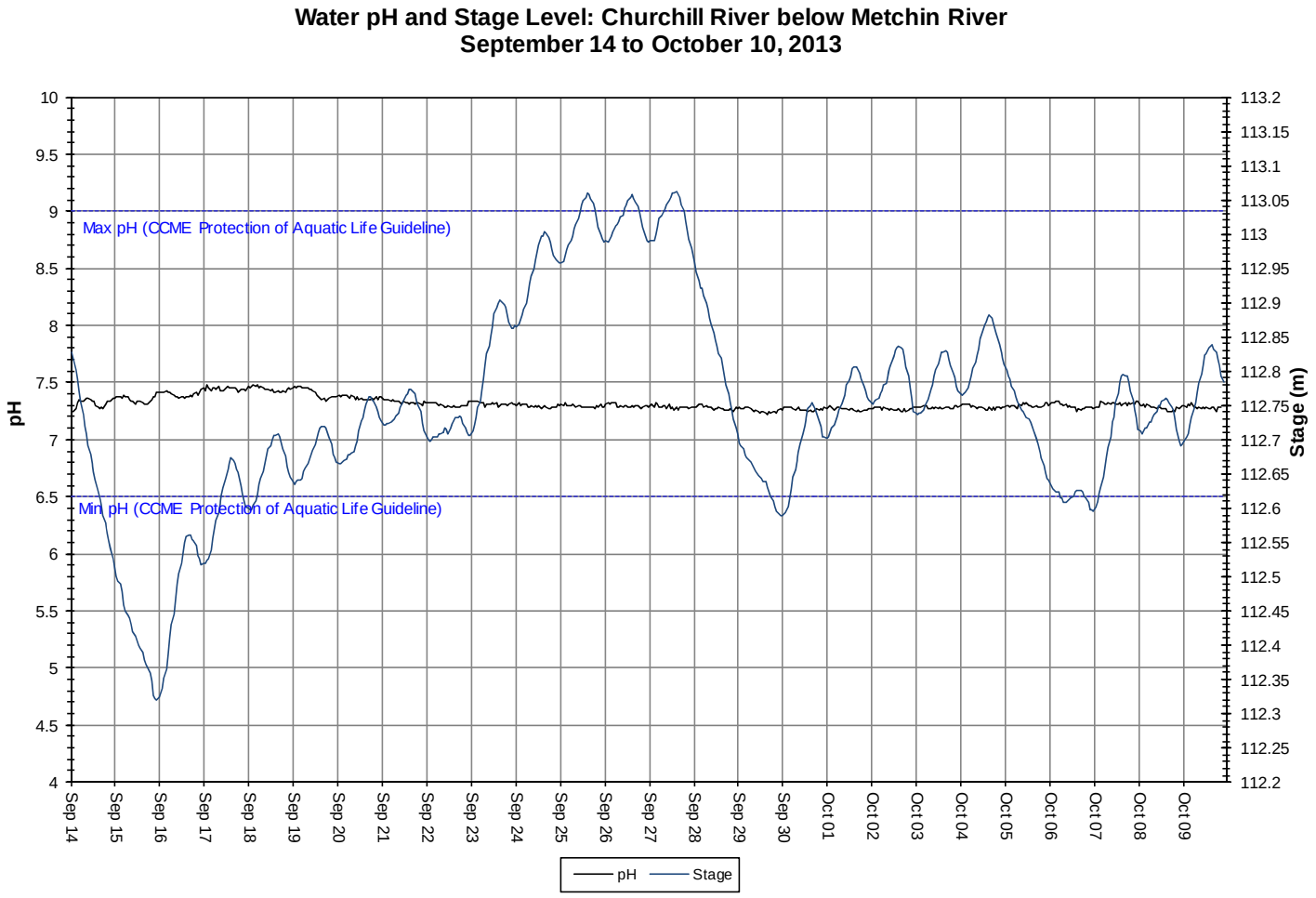


Figure 3: pH and stage level at Churchill River below Metchin River

- Specific conductivity ranges between 19.8µS/cm to 21.8µS/cm during the deployment period, averaging 20.9µS/cm (Figure 4).
- Stage is included in Figure 4 to illustrate the inverse relationship between conductivity and water level. Stage is fluctuating significantly throughout the deployment period. Generally, as stage levels decrease, specific conductivity generally increases due to the increasing concentration of dissolved solids in the water column. Inversely, when stage increases, specific conductivity usually decreases as the concentration of dissolved solids is diluted. This trend is not clearly visible in the data collected during the deployment period and that is typical of this station. Specific conductivity is very stable despite changing water levels.

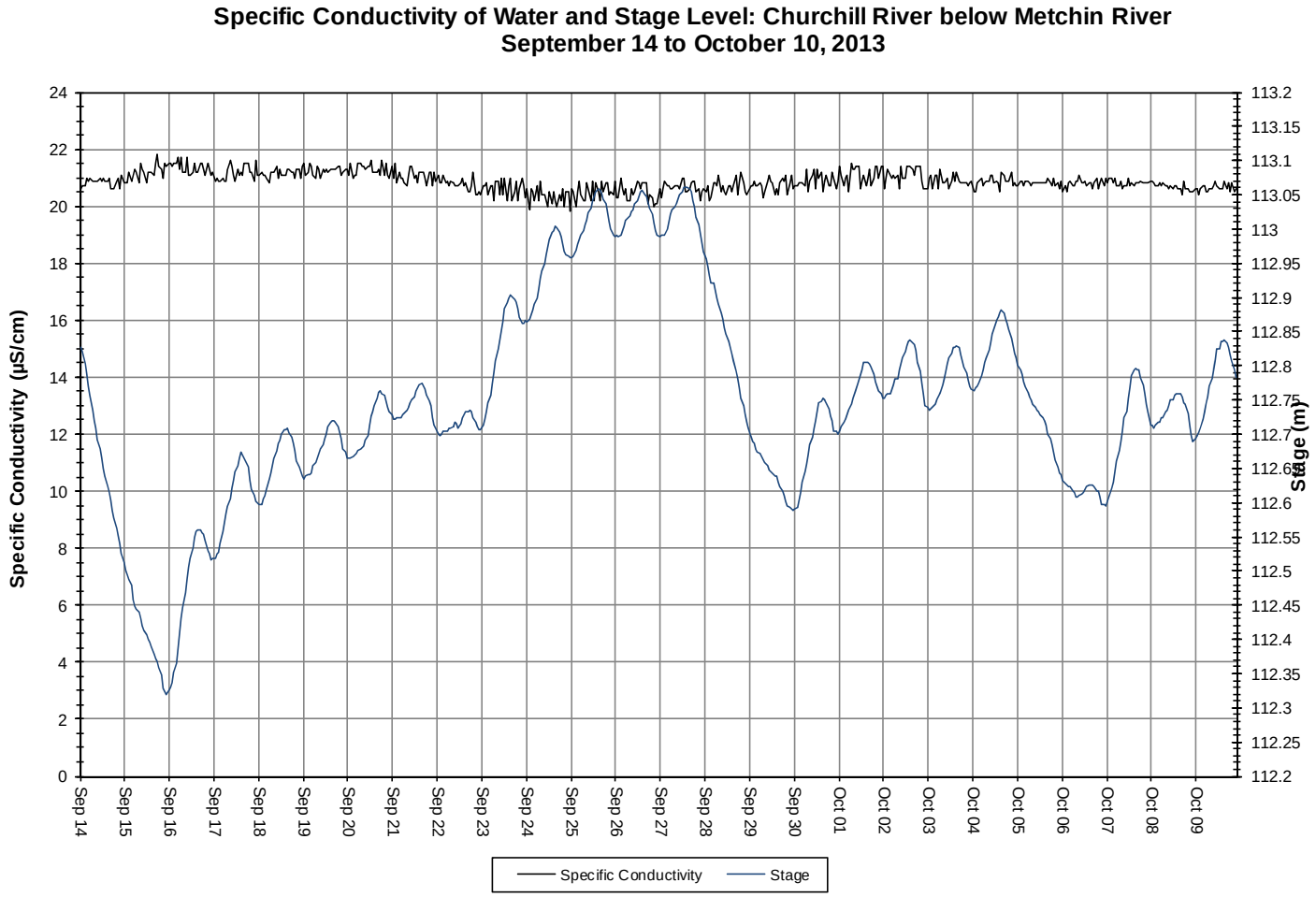


Figure 4: Specific conductivity and stage level at Churchill River below Metchin River

- Dissolved oxygen content ranges between 10.24mg/l and 11.20mg/l. The saturation of dissolved oxygen ranges from 90.3% to 97.0% (Figure 5).
- All values are above both the minimum CCME Guideline for the Protection of Cold Water Biota at Other Life Stages of 6.5mg/l and at Early Life Stages of 9.5mg/l. The guidelines are indicated in blue on Figure 5.
- Dissolved oxygen content is increasing slightly throughout the deployment period. This trend is expected given the cooling air and water temperatures (Figure 2).

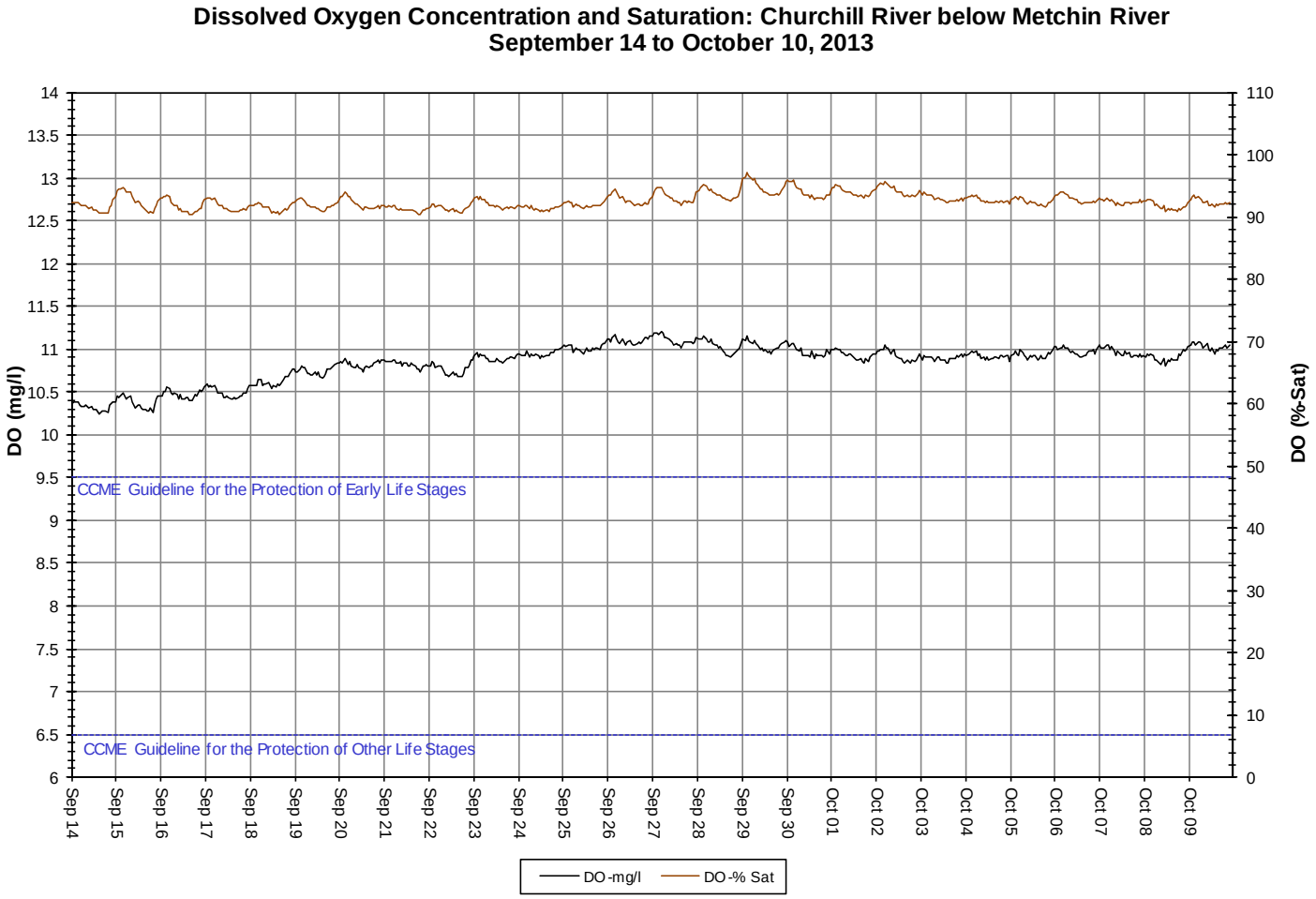


Figure 5: Dissolved oxygen and percent saturation at Churchill River below Metchin River

- Turbidity generally remains at 0NTU for the majority of the deployment period (Figure 6). A median value of 0NTU indicates there is no natural background turbidity value at this station.

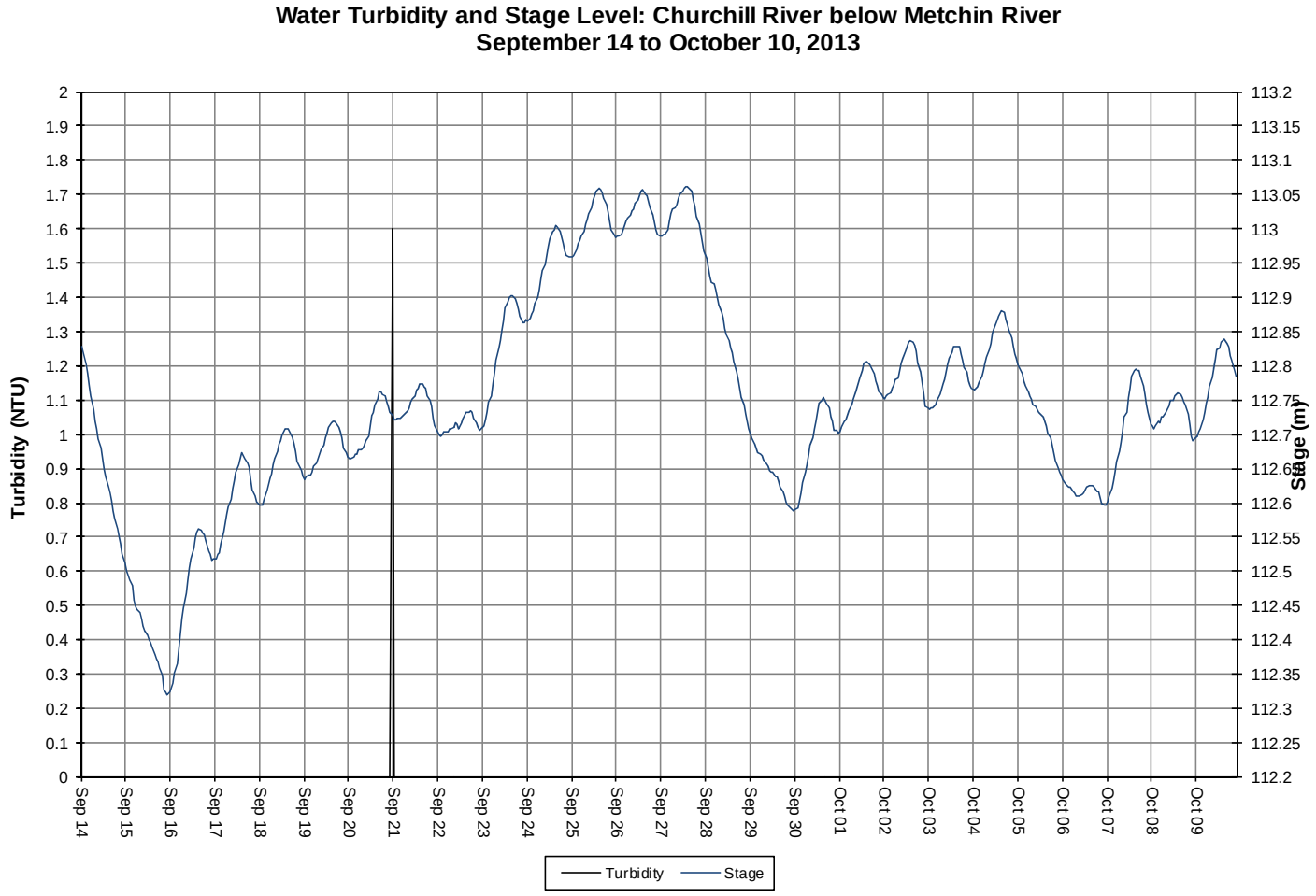


Figure 6: Turbidity and stage level at Churchill River below Metchin River

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 7). Stage is fluctuating throughout the deployment period. Precipitation occurs on >50% of the days in the deployment period however amounts are generally low except for one +25mm event on September 22. Stage ranges between 112.32m and 113.06m, a difference of 0.74m.

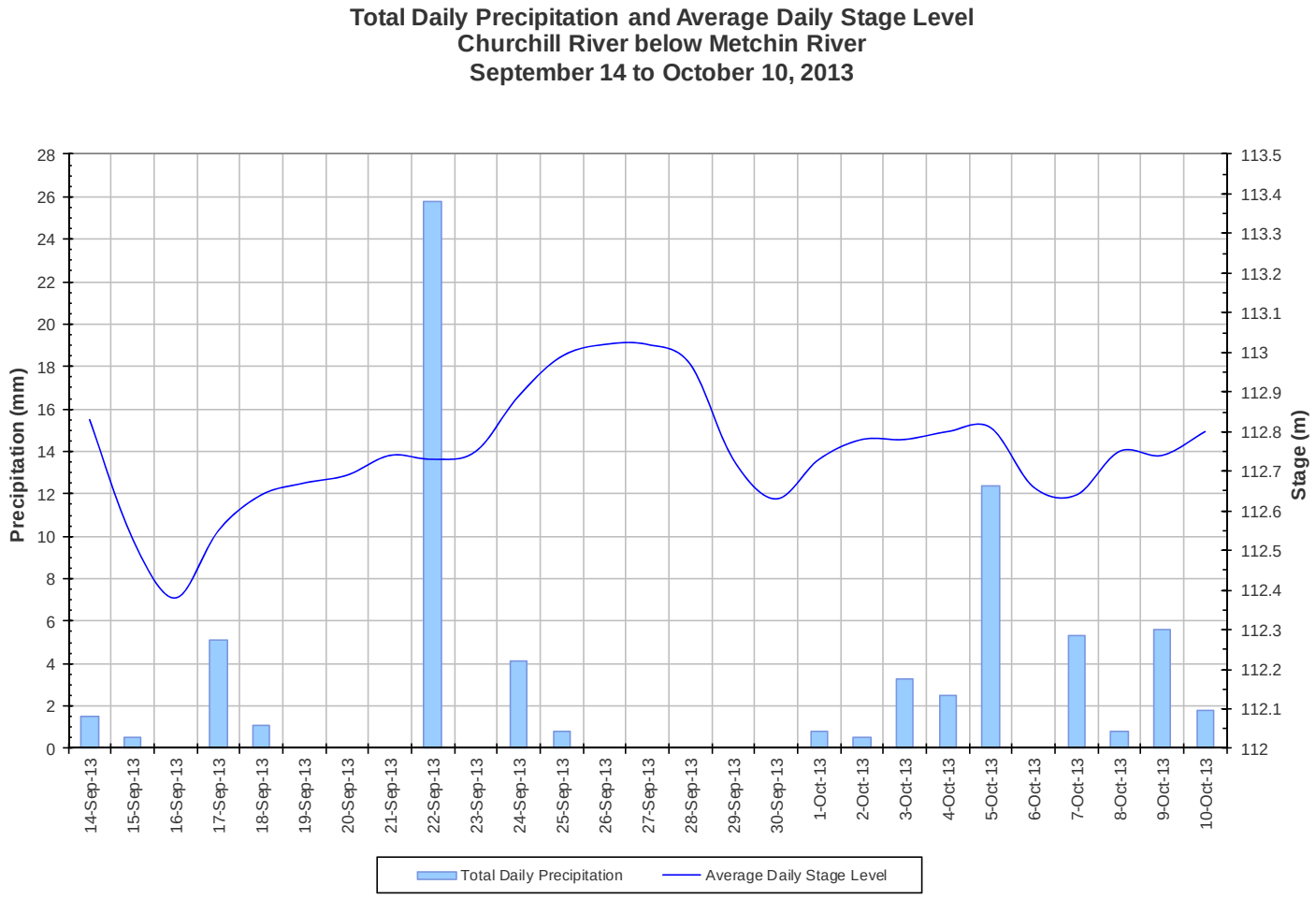


Figure 7: Daily precipitation and average daily stage level at Churchill River below Metchin River (weather data recorded at Churchill Falls)

Churchill River below Grizzle Rapids

- Water temperature ranges from 8.40°C to 13.10°C during the deployment period (Figure 8).
- Water temperature is decreasing throughout the deployment period. This trend is expected due to the cooling ambient air temperatures in the fall season (Figure 9). Water temperature generally fluctuates diurnally.

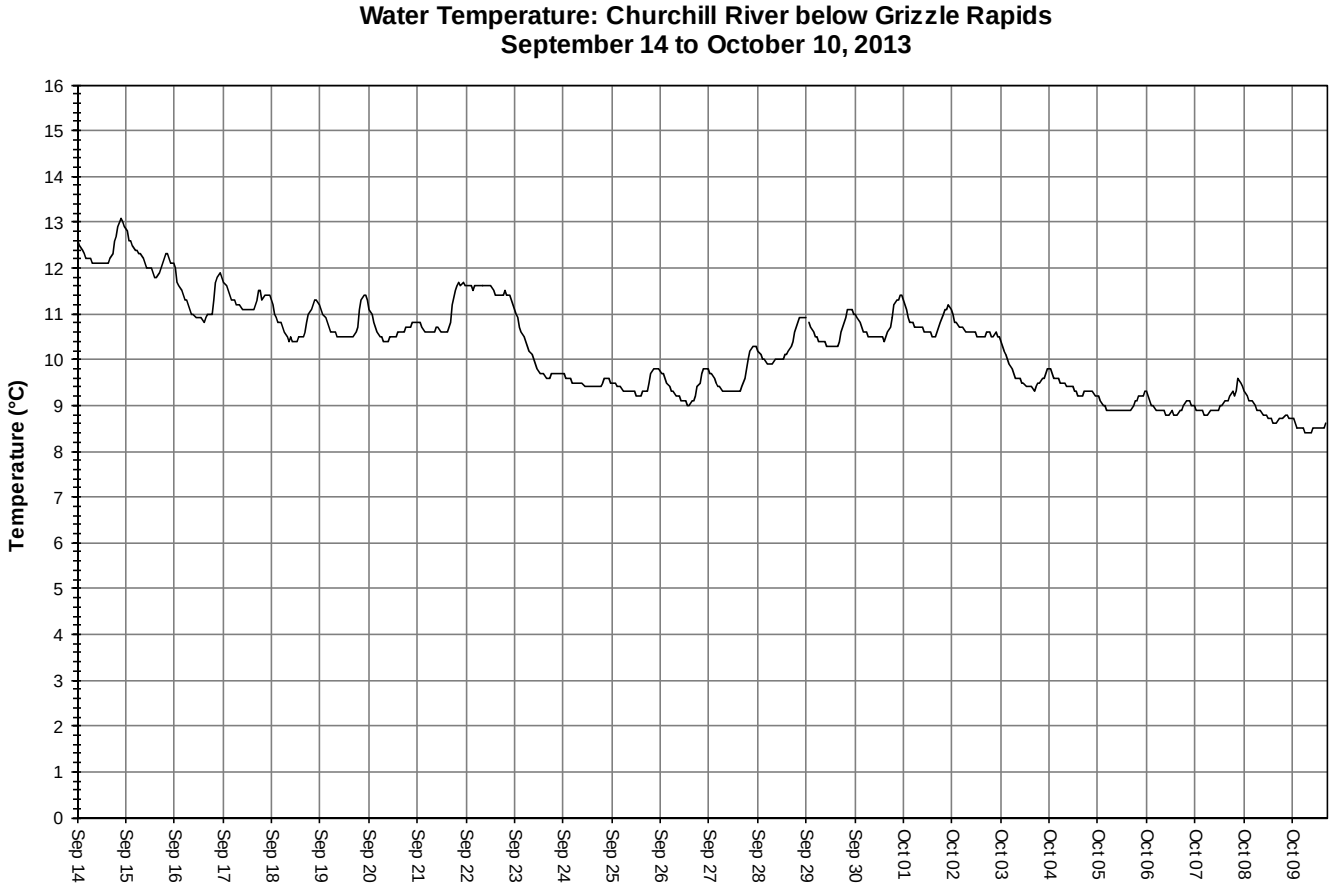


Figure 8: Water temperature at Churchill River below Grizzle Rapids

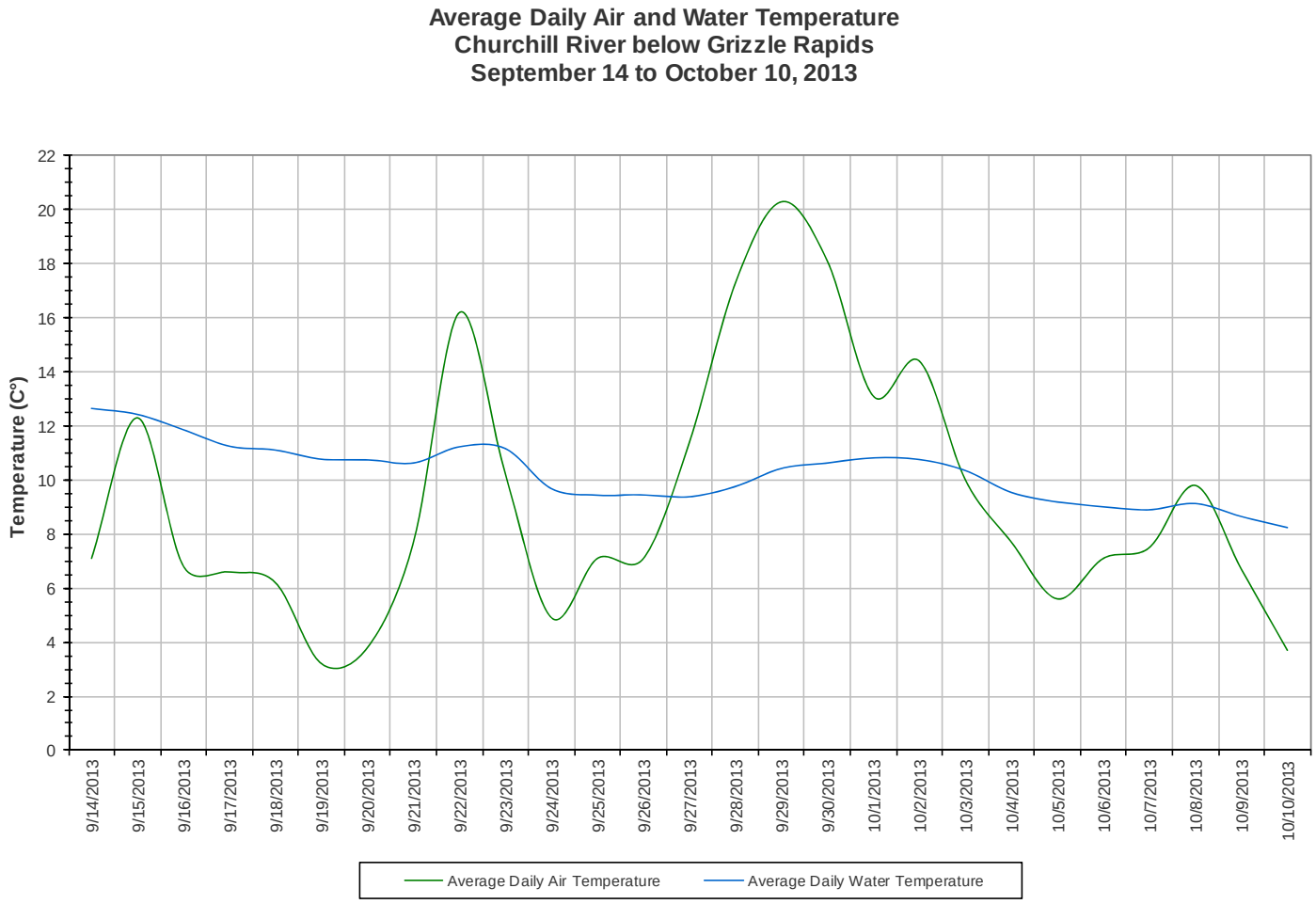


Figure 9: Average daily air and water temperature at Churchill River below Grizzle Rapids

(weather data recorded at Goose Bay)

- pH ranges between 6.94 and 7.19 pH units (Figure 10).
- pH values are very stable throughout the deployment period regardless of changing water levels. pH values fluctuate consistently on a daily basis.
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 10).

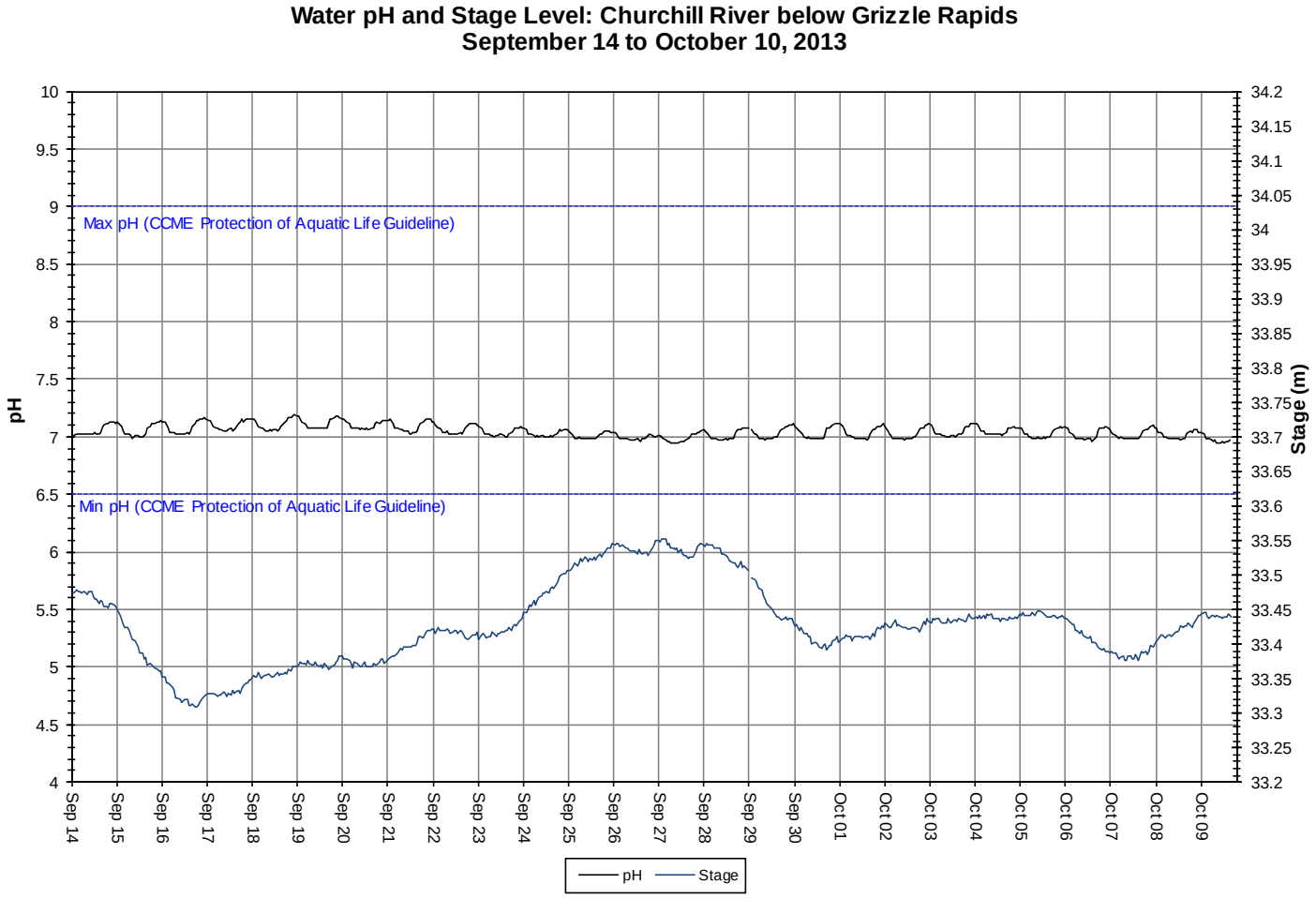


Figure 10: pH and stage level at Churchill River below Grizzle Rapids

- Specific conductivity ranges from 18.9µS/cm to 20.3µS/cm during the deployment period, averaging 19.5µS/cm (Figure 11).
- Specific conductance is decreasing slightly in the middle of the deployment period during a period of increased stage. This event is highlighted in red on Figure 11.
- Stage is included in Figure 11 to illustrate the inverse relationship between conductivity and water level. Typically, stage is increasing throughout the deployment period with minimal fluctuations. Generally, as stage levels increase, specific conductivity decreases due to the dilution of dissolved solids in the water column. Inversely, when stage decreases, specific conductivity usually increases as the concentration of dissolved solids is increased. This trend is not clearly visible in the data collected during the deployment period however, this is typical at this station.

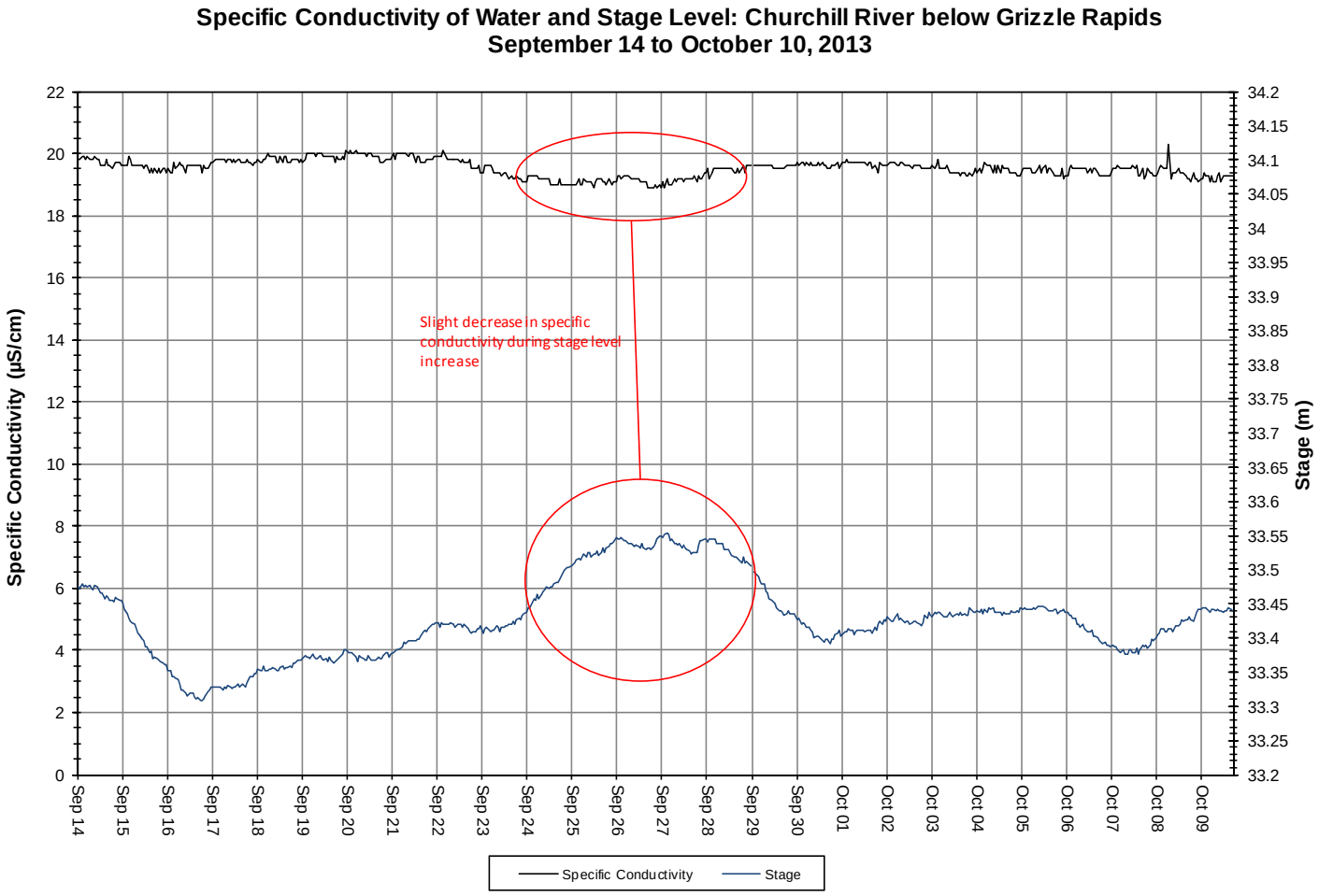


Figure 11: Specific conductivity and stage level at Churchill River below Grizzle Rapids

- Dissolved oxygen content ranges between 10.30mg/l and 11.48mg/l. The saturation of dissolved oxygen ranges from 95.1% to 100.8% (Figure 12).
- All values were above both the minimum CCME Guideline for the Protection of Cold Water Biota at Other Life Stages of 6.5mg/l and at Early Life Stages of 9.5mg/l. The guidelines are indicated in blue on Figure 9.
- Dissolved oxygen content is increasing slightly throughout the deployment period. This trend is expected given the cooling air and water temperatures (Figure 9).

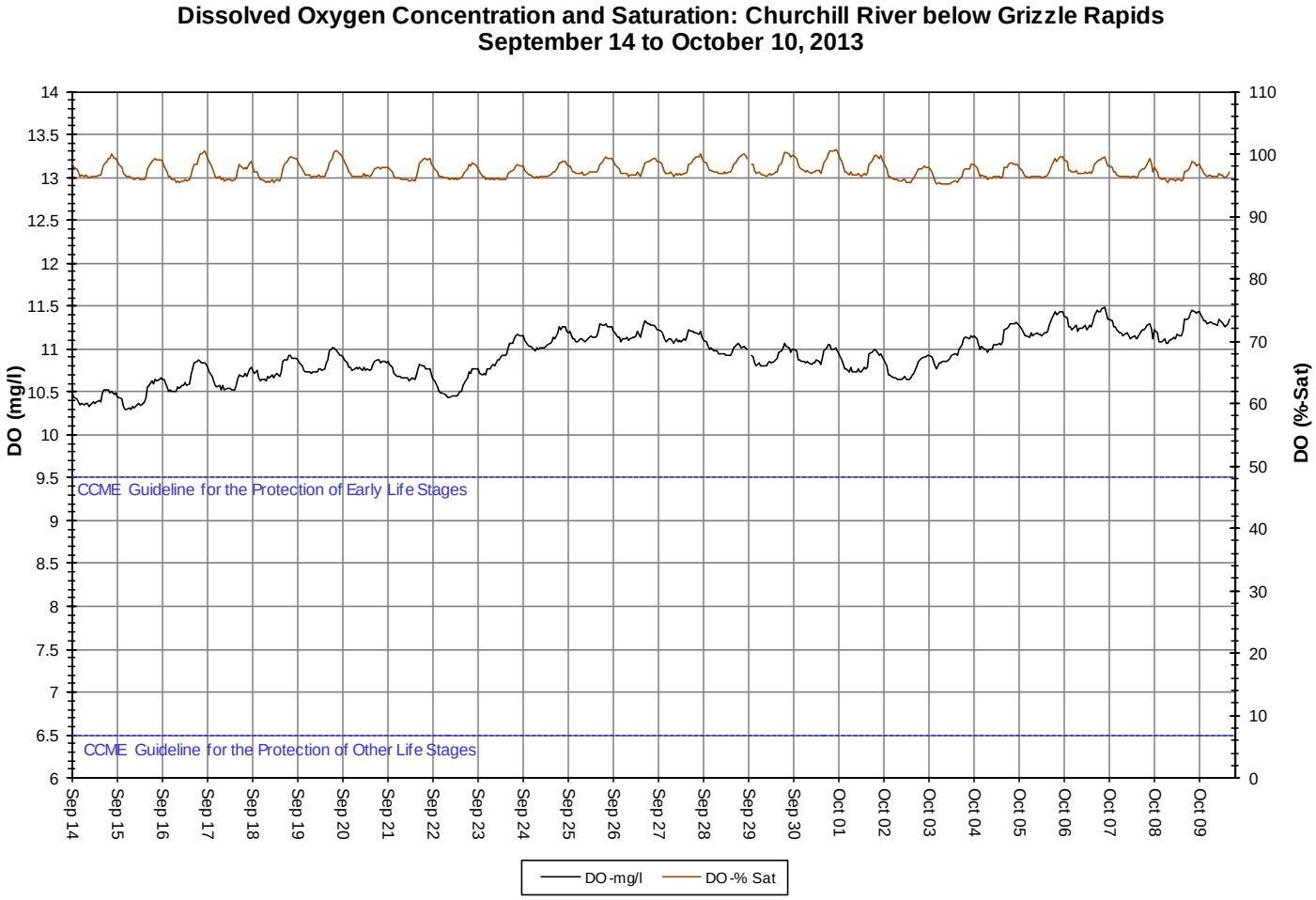


Figure 12: Dissolved oxygen and percent saturation at Churchill River below Grizzle Rapids

- Turbidity values remained at 0NTU for the entire deployment period (Figure 13). A median value of 0NTU at this station indicates there is no natural background turbidity.
- This trend is typical of this station as the river reach runs clearly and quickly though Grizzle Rapids.

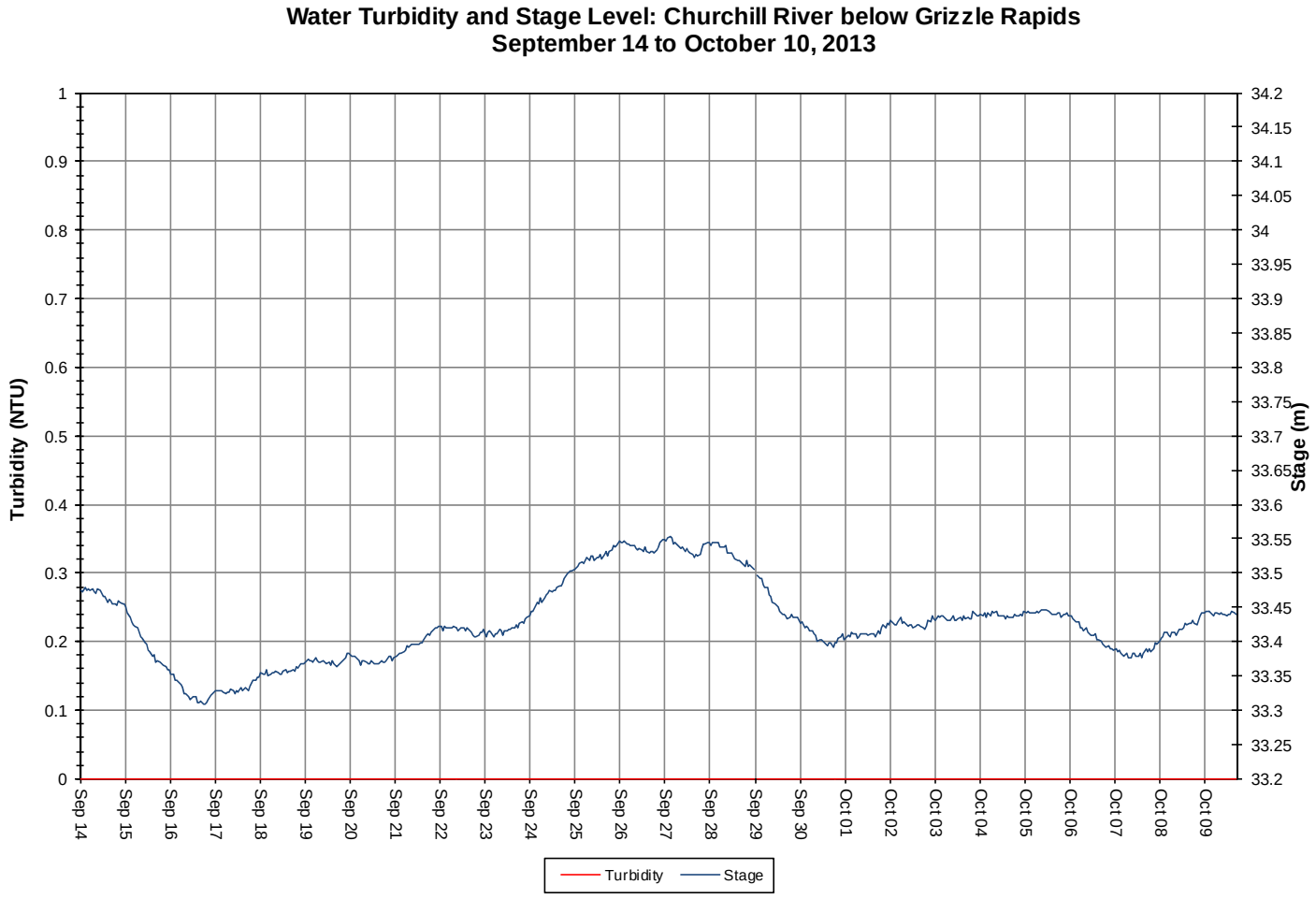


Figure 13: Turbidity and stage level at Churchill River below Grizzle Rapids

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 14). Stage is fluctuating throughout the deployment period. Precipitation occurs on >50% of the days in the deployment period however amounts are generally low except for two +18mm events on September 23-24. Stage ranges between 33.31m and 33.55m, a difference of 0.24m.

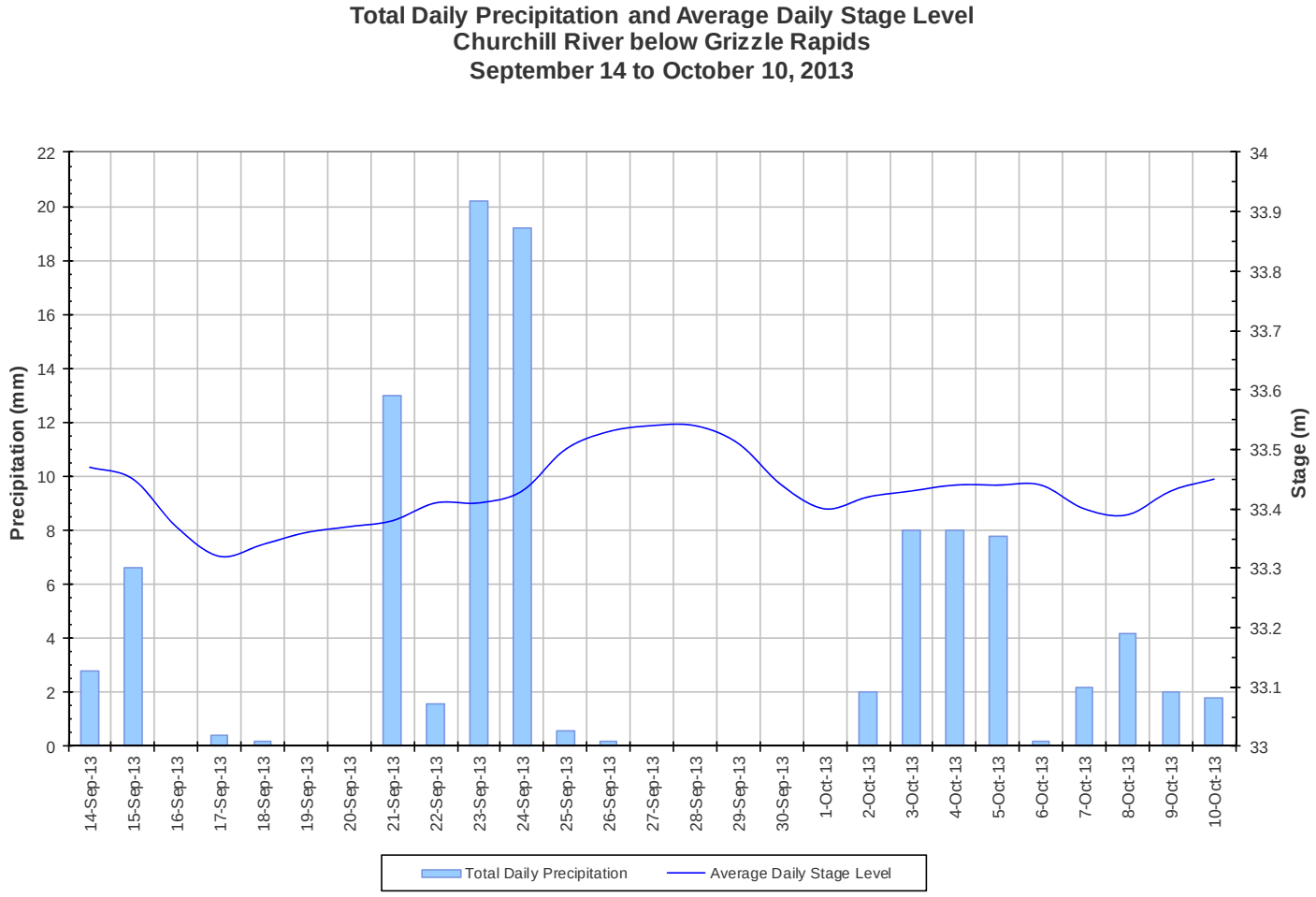


Figure 14: Daily precipitation and average daily stage level at Churchill River below Grizzle Rapids (weather data recorded at Goose Bay)

Churchill River above Muskrat Falls

- Water temperature ranges from 7.67°C to 12.94°C during the deployment period (Figure 15).
- Water temperature is decreasing throughout the deployment period. This trend is expected given the cooling ambient air temperatures in the fall season (Figure 16). Water temperature generally fluctuates diurnally.

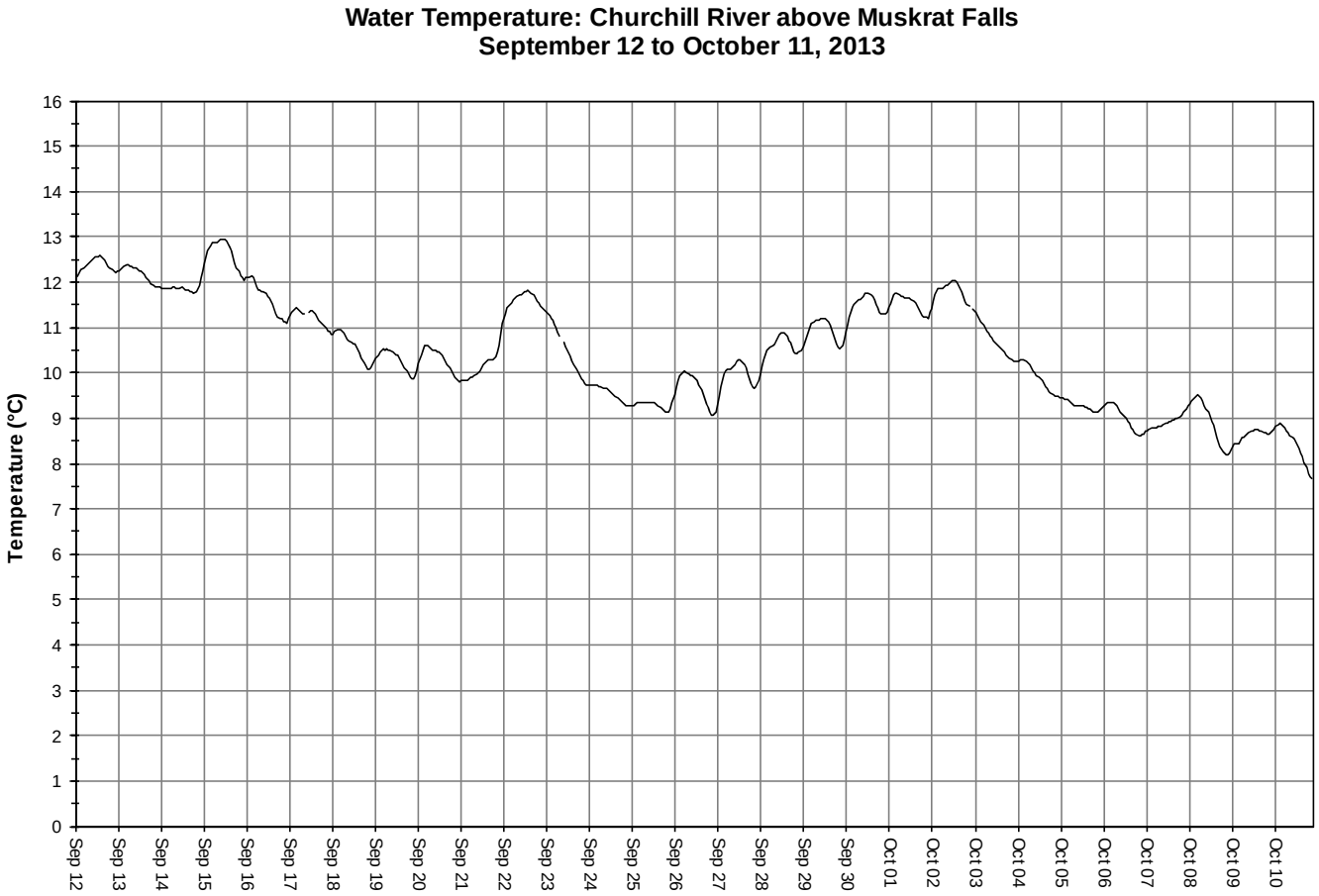


Figure 15: Water temperature at Churchill River above Muskrat Falls

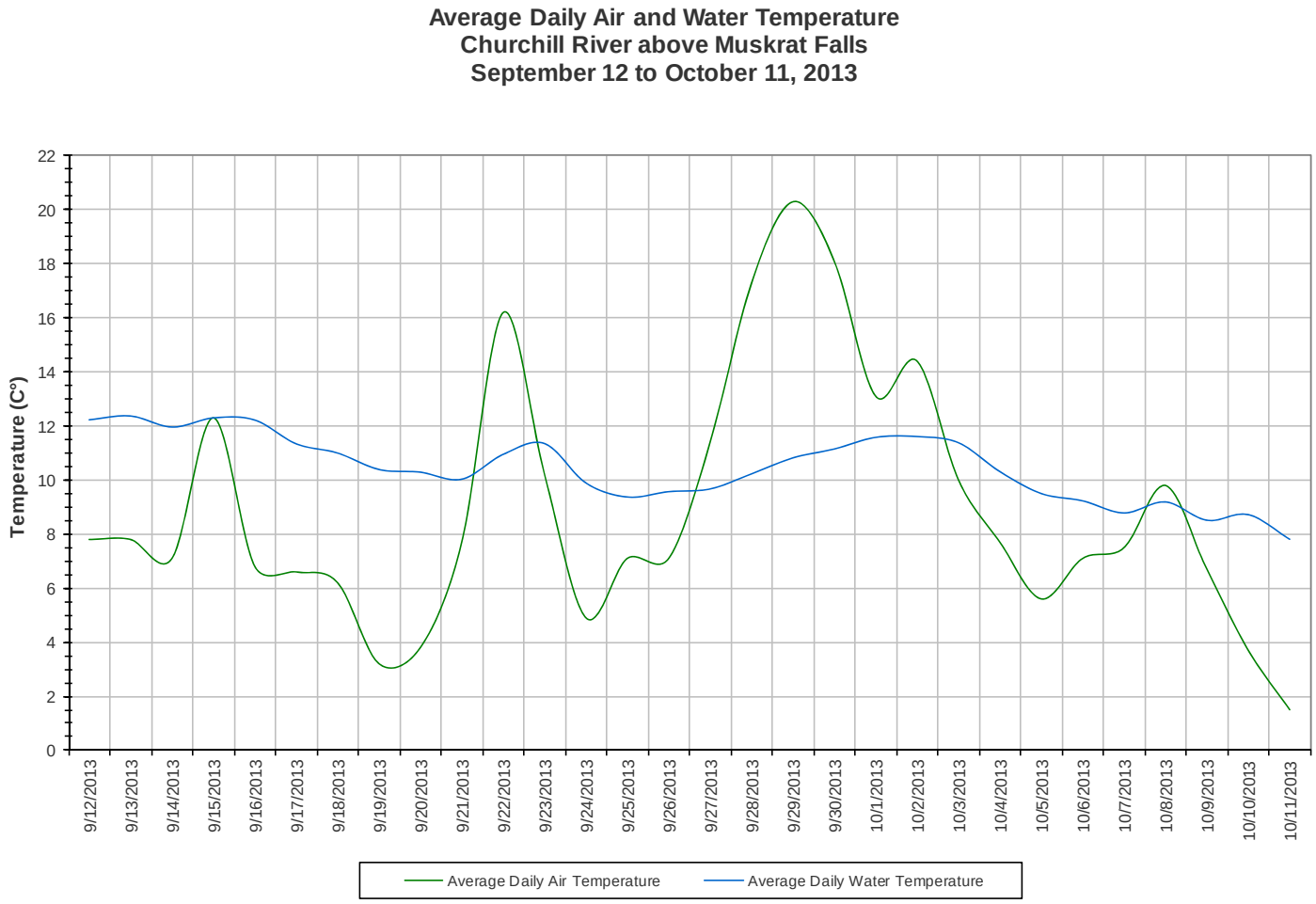


Figure 16: Average daily air and water temperature at Churchill River above Muskrat Falls (weather data recorded at Goose Bay)

- pH ranges between 6.64 and 6.96 pH units (Figure 17). pH values tend to decrease slightly throughout the deployment period.
- All pH values recorded are within the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 17).

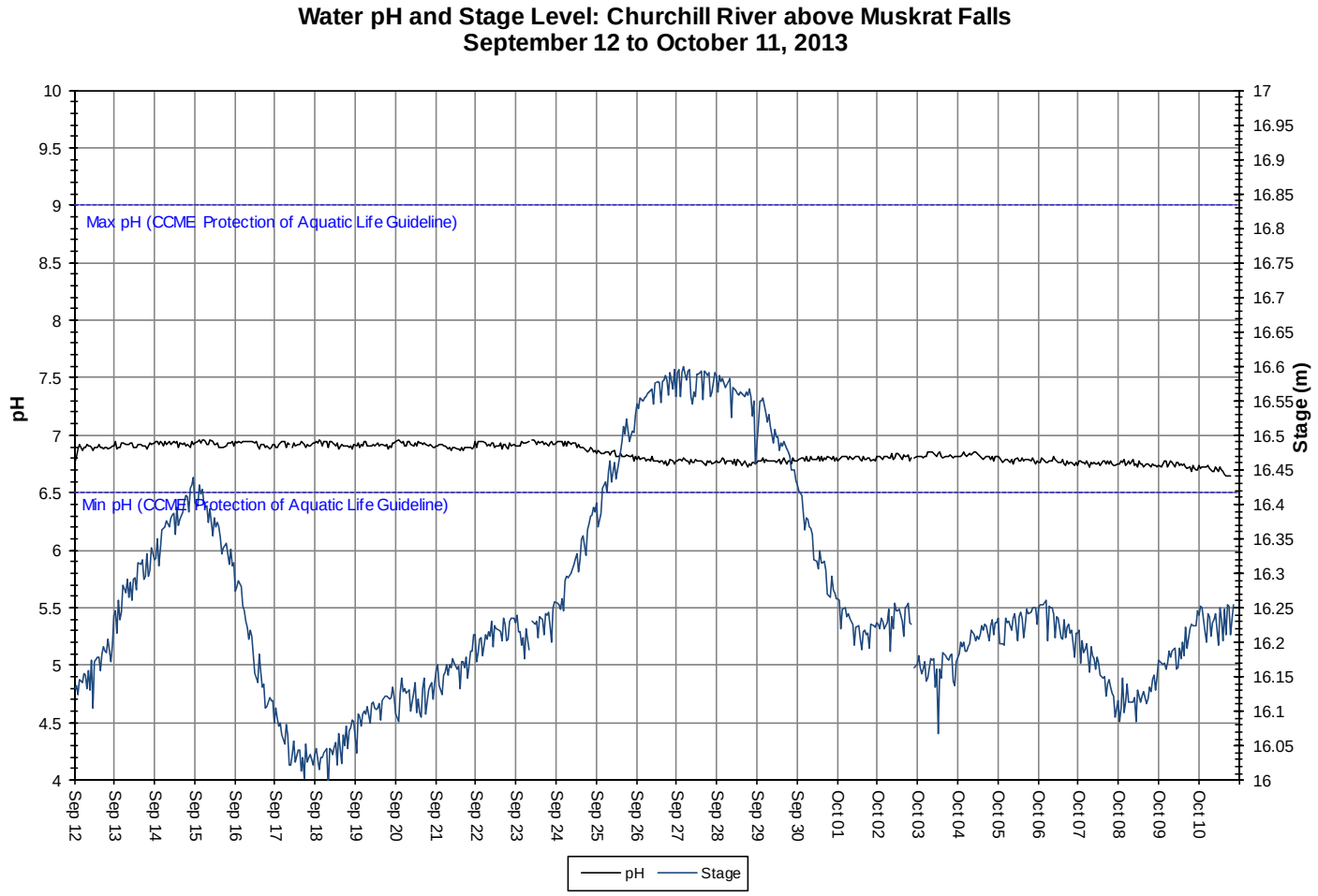


Figure 17: pH and stage at Churchill River above Muskrat Falls

- Specific conductivity ranges from 19.6µS/cm to 21.4µS/cm during the deployment period, averaging 20.7µS/cm. (Figure 18).
- Specific conductance is relatively stable throughout the deployment period.
- Stage is included in Figure 18 to illustrate the inverse relationship between conductivity and water level. Generally, as stage levels increase, specific conductivity decreases due to the dilution of dissolved solids in the water column. Inversely, when stage decreases, specific conductivity usually increases as the concentration of dissolved solids is increased. This trend is not clearly visible in the data collected during the deployment period. There are slight decreases in specific conductivity on September 25-29 which corresponds with an increase in stage level. This event is highlighted in red on Figure 18.

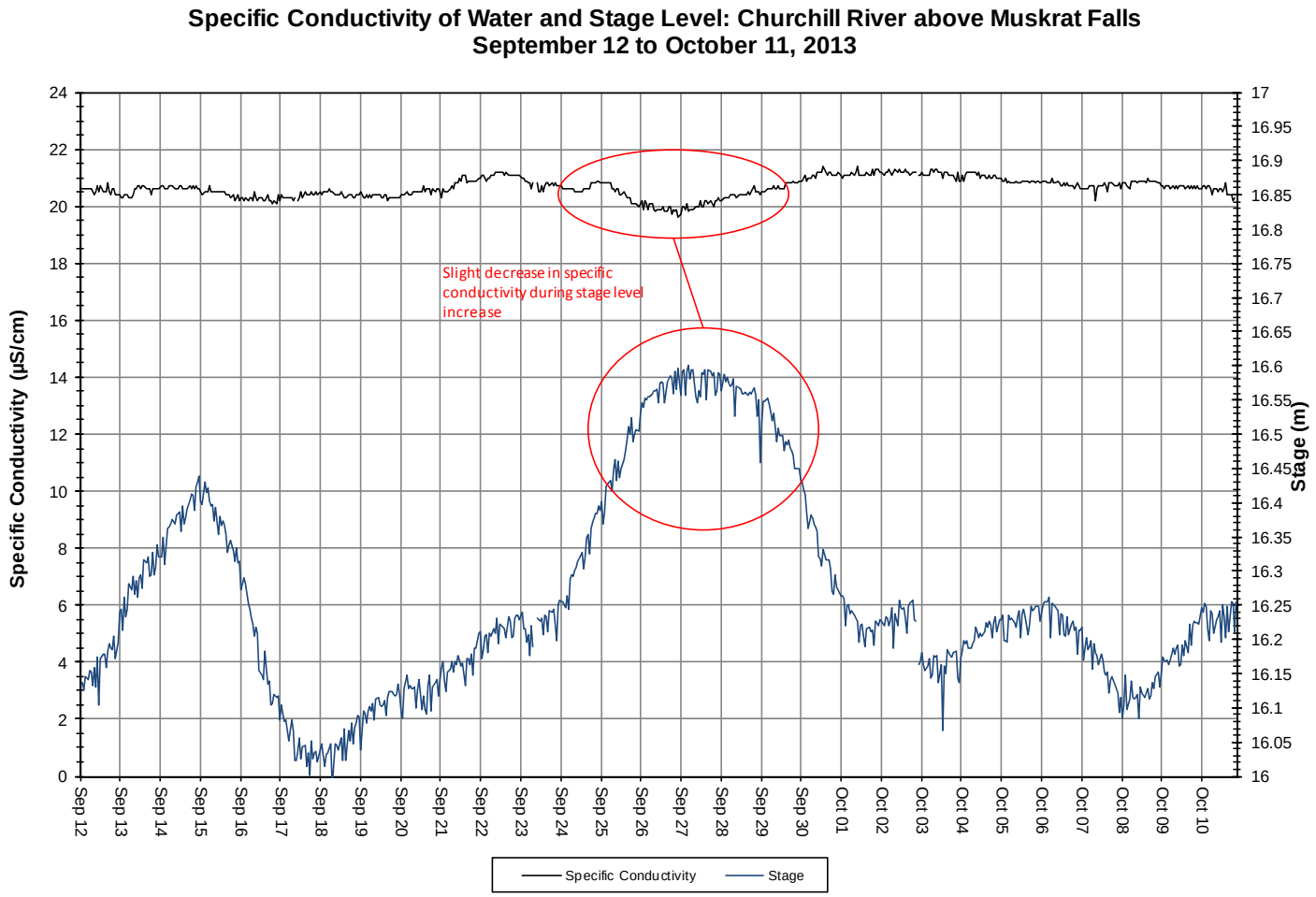


Figure 18: Specific conductivity and stage level at Churchill River above Muskrat Falls

- Dissolved oxygen content ranges between 10.17mg/l and 11.27mg/l. The saturation of dissolved oxygen ranges from 93.7% to 99.1% (Figure 19).
- All values were above both the minimum CCME Guideline for the Protection of Cold Water Biota at Other Life Stages of 6.5mg/l and at Early Life Stages of 9.5mg/l. The guidelines are indicated in blue on Figure 19.
- Dissolved oxygen content is increasing slightly throughout the deployment period. This trend is expected given the cooling air and water temperatures (Figure 16).

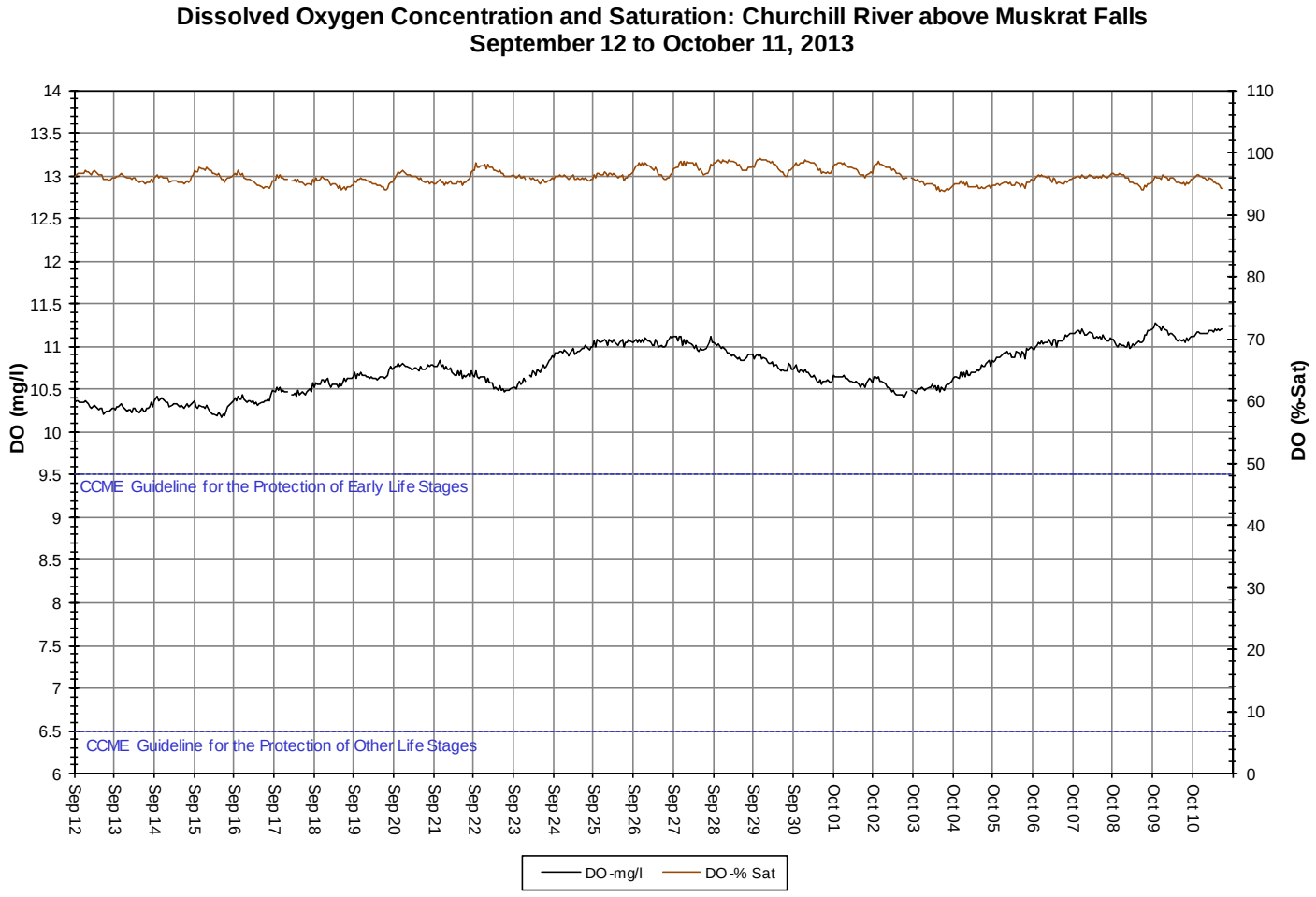


Figure 19: Dissolved oxygen and percent saturation at Churchill River above Muskrat Falls

- Turbidity ranges between 0.0NTU and 11.7NTU, averaging 0.9 NTU during the first week of the deployment (Figure 20). A median value of 0.0NTU suggests there is no consistent natural background turbidity value. This trend is not typical at this station which usually sees a median turbidity value ranging between 1.5NTU and 7NTU.
- There is a significant turbidity increase between September 23 and 26 which corresponds with heavy rainfall in the area. An increase in stage is also noticed following this event.

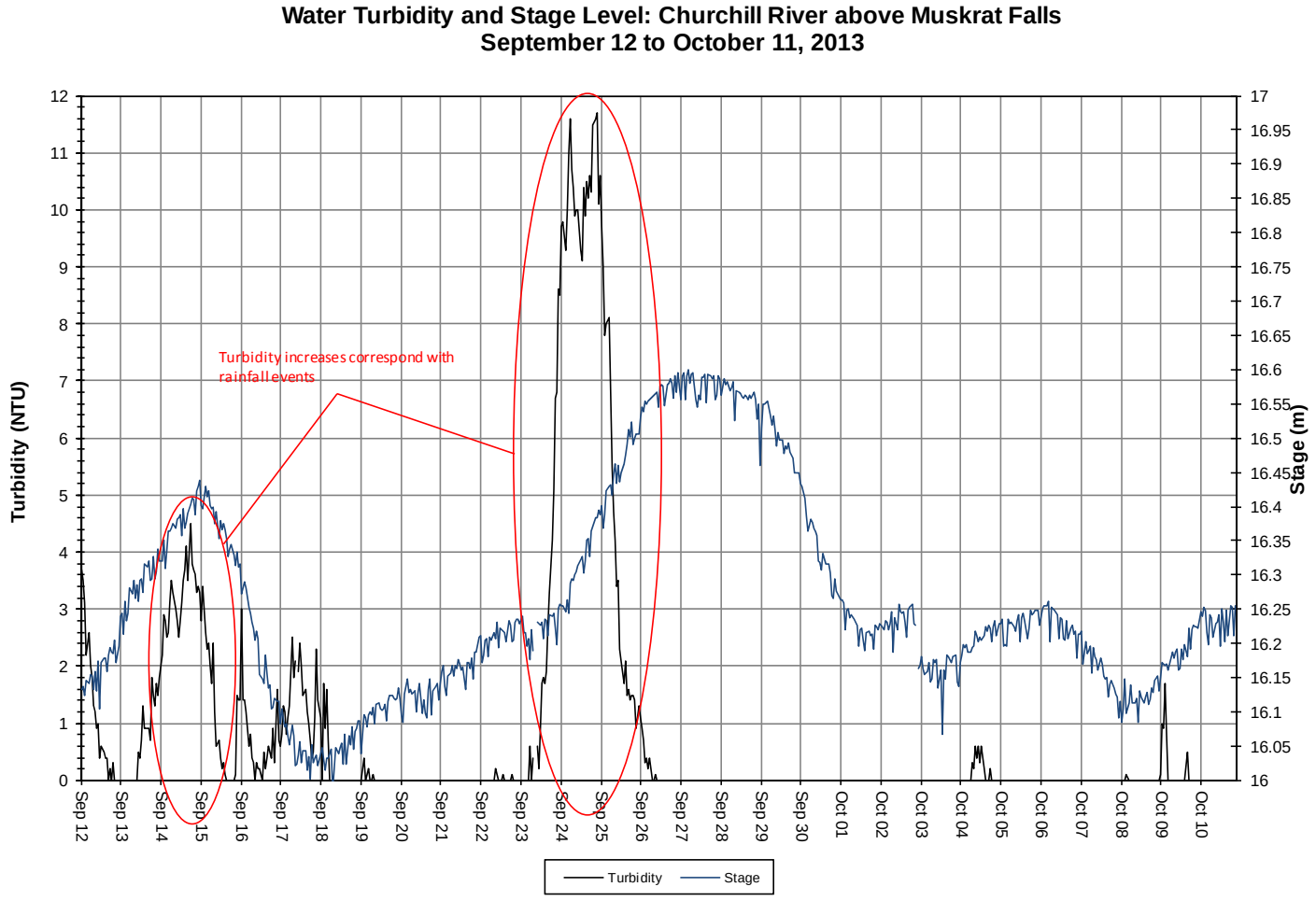


Figure 20: Turbidity and stage level at Churchill River above Muskrat Falls

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 22). Stage is fluctuating throughout the deployment period. Precipitation occurs on >50% of the days in the deployment period however amounts are generally low except for two +18mm events on September 23-24. Stage ranges between 15.99m and 16.60m, a difference of 0.61m. Discharge ranges from 1260m^3/s to 1600m^3/s.

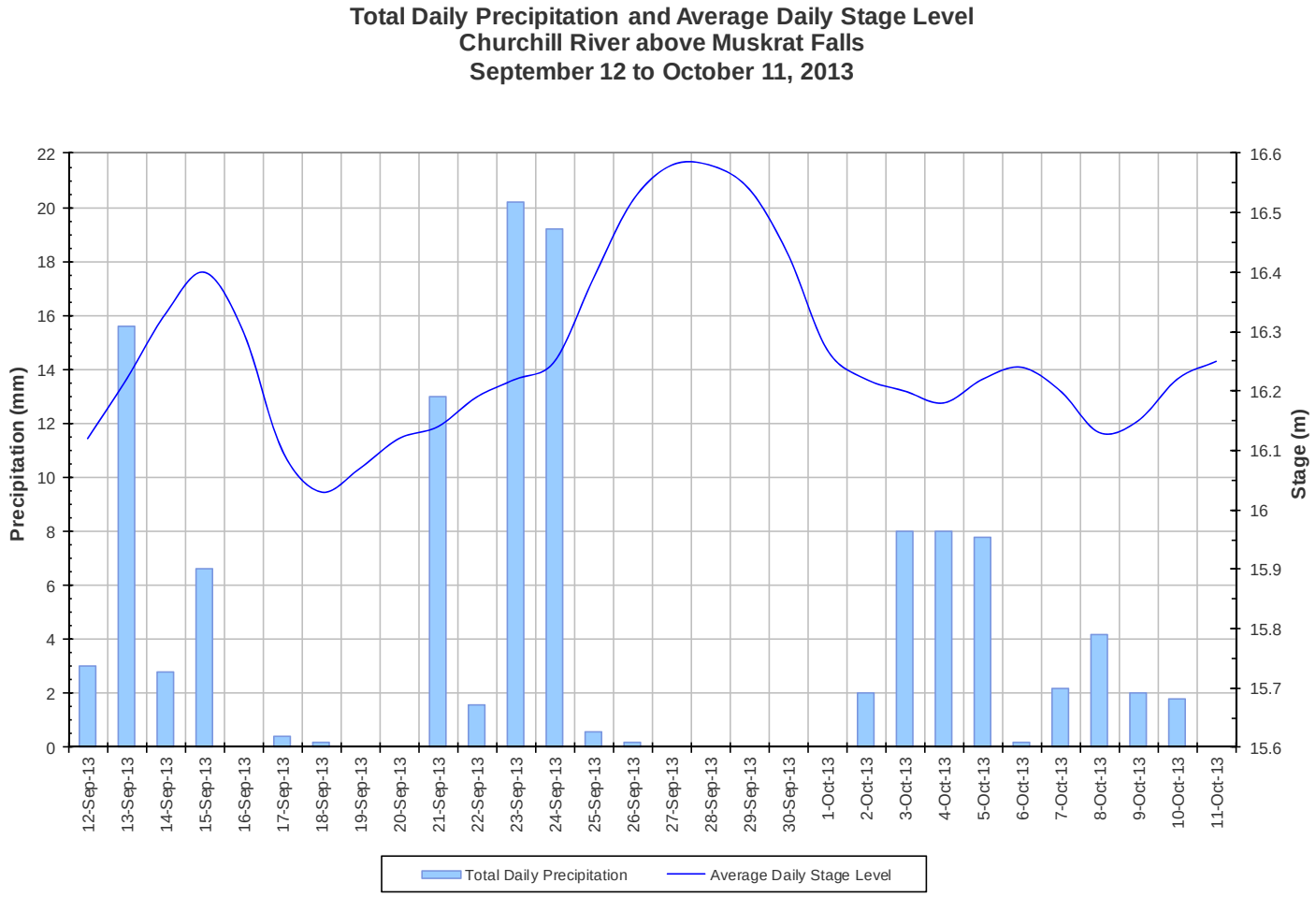


Figure 22: Daily precipitation and average daily stage level at Churchill River above Muskrat Falls (weather data recorded at Goose Bay)

Churchill River below Muskrat Falls

- Water temperature ranges from 8.10°C to 12.80°C during the deployment period (Figure 23).
- Water temperature is decreasing throughout the deployment period. This trend is expected given the cooling ambient air temperatures in the fall season (Figure 24). Water temperature generally fluctuates each 24 hour period.

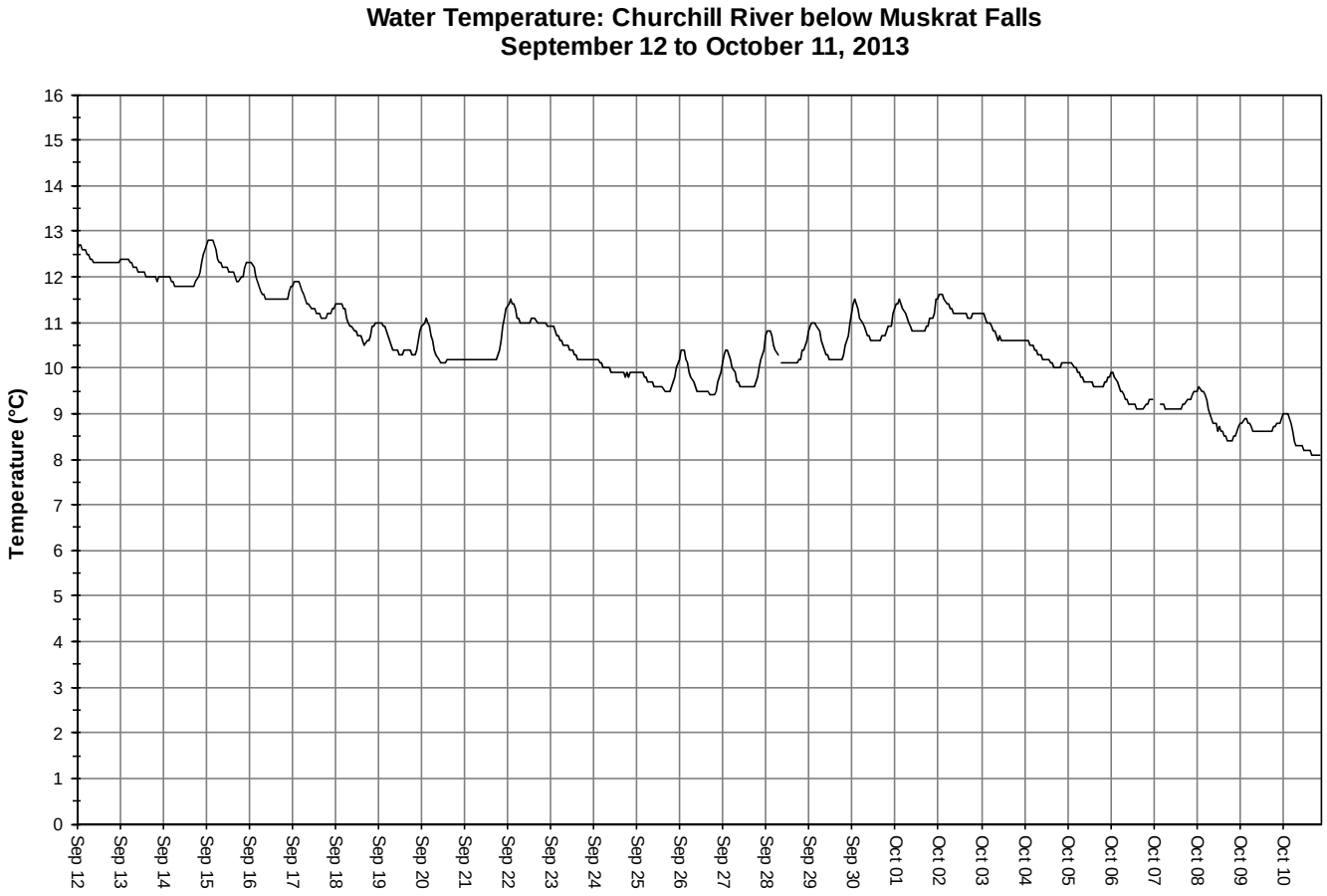


Figure 23: Water temperature at Churchill River below Muskrat Falls

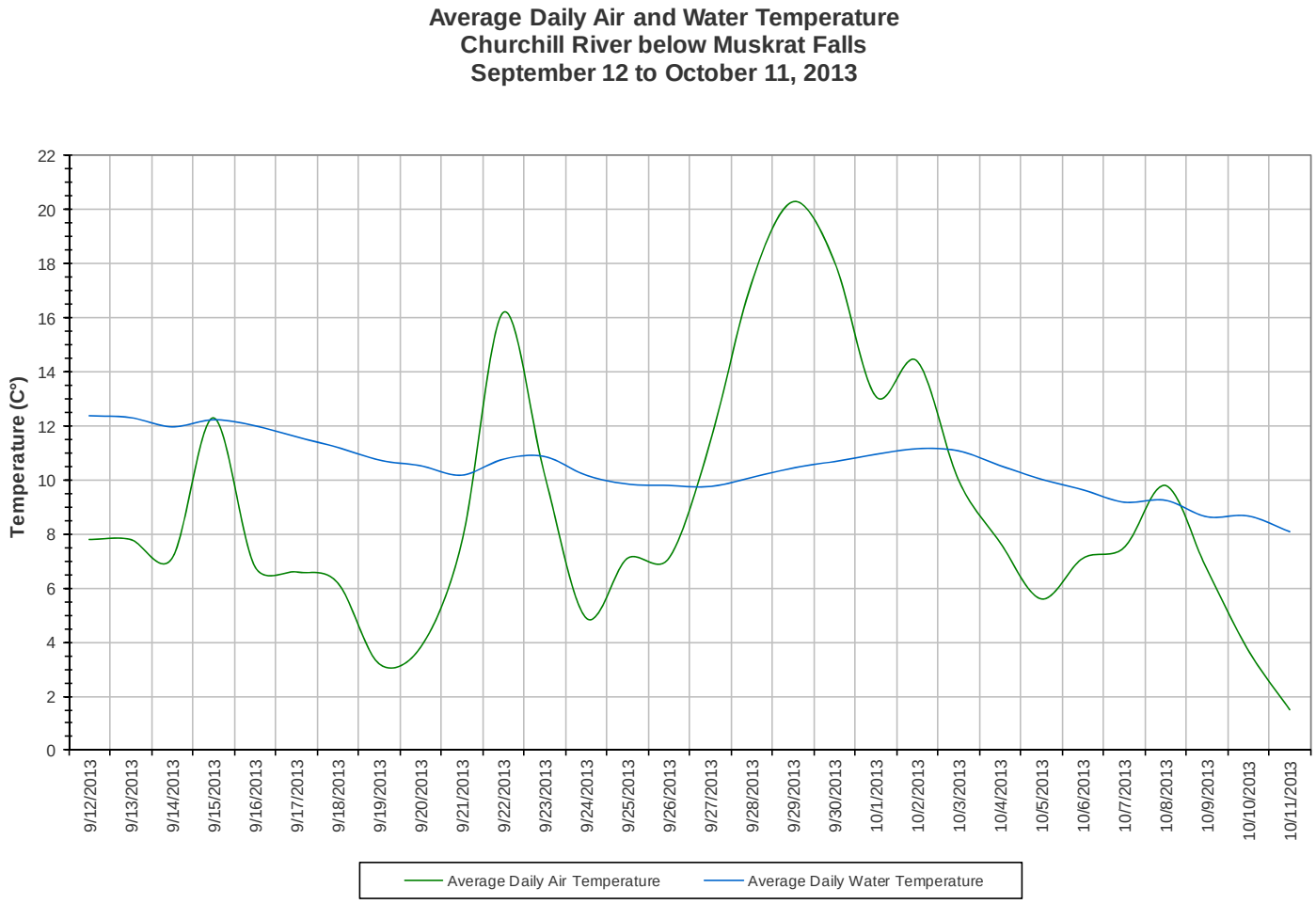


Figure 24: Average daily air and water temperature at Churchill River below Muskrat Falls

(weather data recorded at Goose Bay)

- pH ranges between 6.64 and 7.18 pH units (Figure 25). pH is relatively stable at this station.
- pH appears to decrease slowly in the last ten days of the deployment period. It is unknown what caused this decrease.
- All values during the deployment are within the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 25).

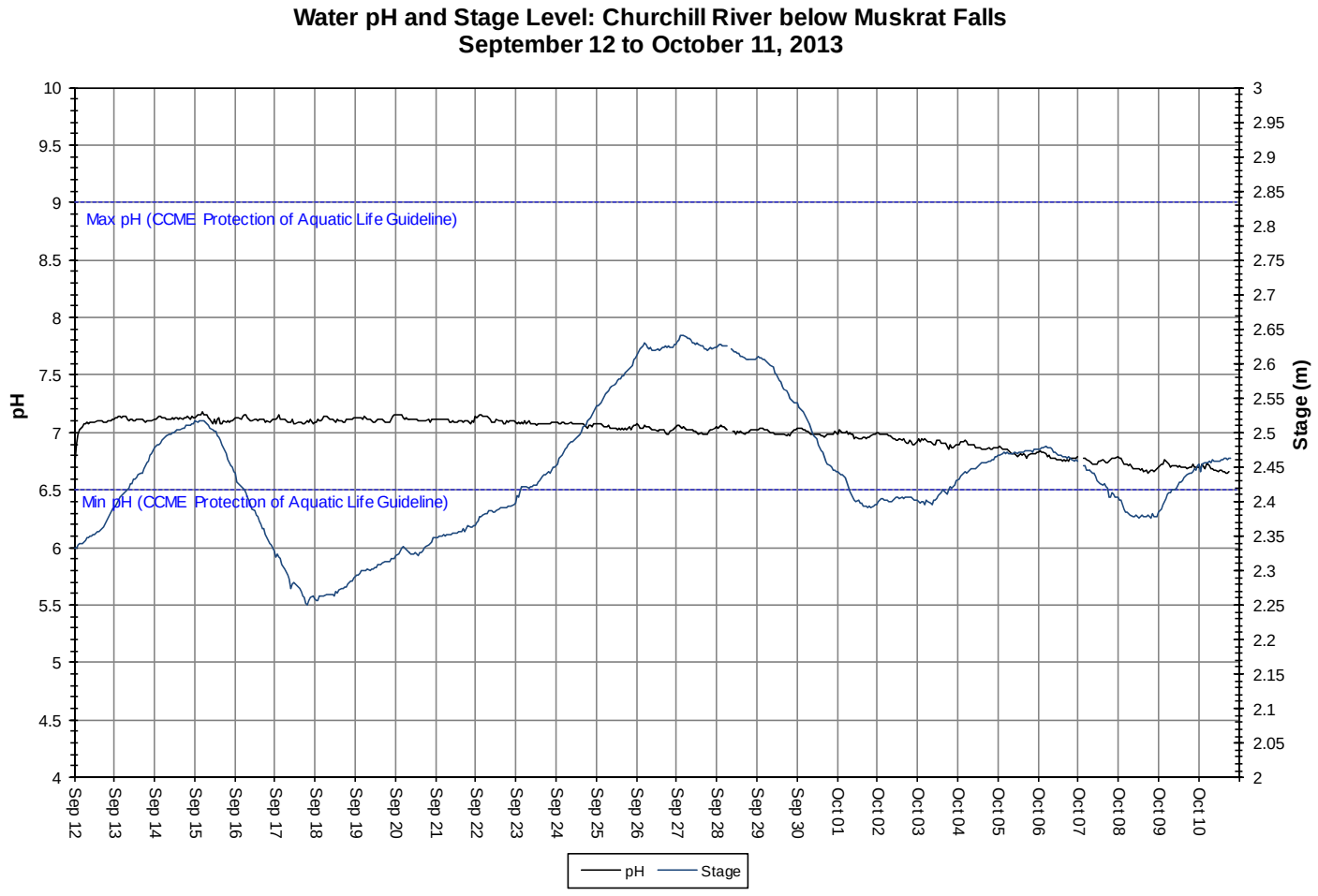


Figure 25: pH and stage level at Churchill River below Muskrat Falls

- Specific conductance ranges between 18.6µS/cm and 20.0µS/cm during the deployment period, averaging 19.3µS/cm (Figure 26).
- Specific conductivity is very stable throughout the deployment period.
- Stage is included in Figure 26 to illustrate the inverse relationship between conductivity and water level. Generally, as stage levels increase, specific conductivity decreases due to the dilution of dissolved solids in the water column. Inversely, when stage decreases, specific conductivity usually increases as the concentration of dissolved solids is increased. This trend is not clearly visible in the data collected during the deployment period. Specific conductivity remains stable during the changes in water level.

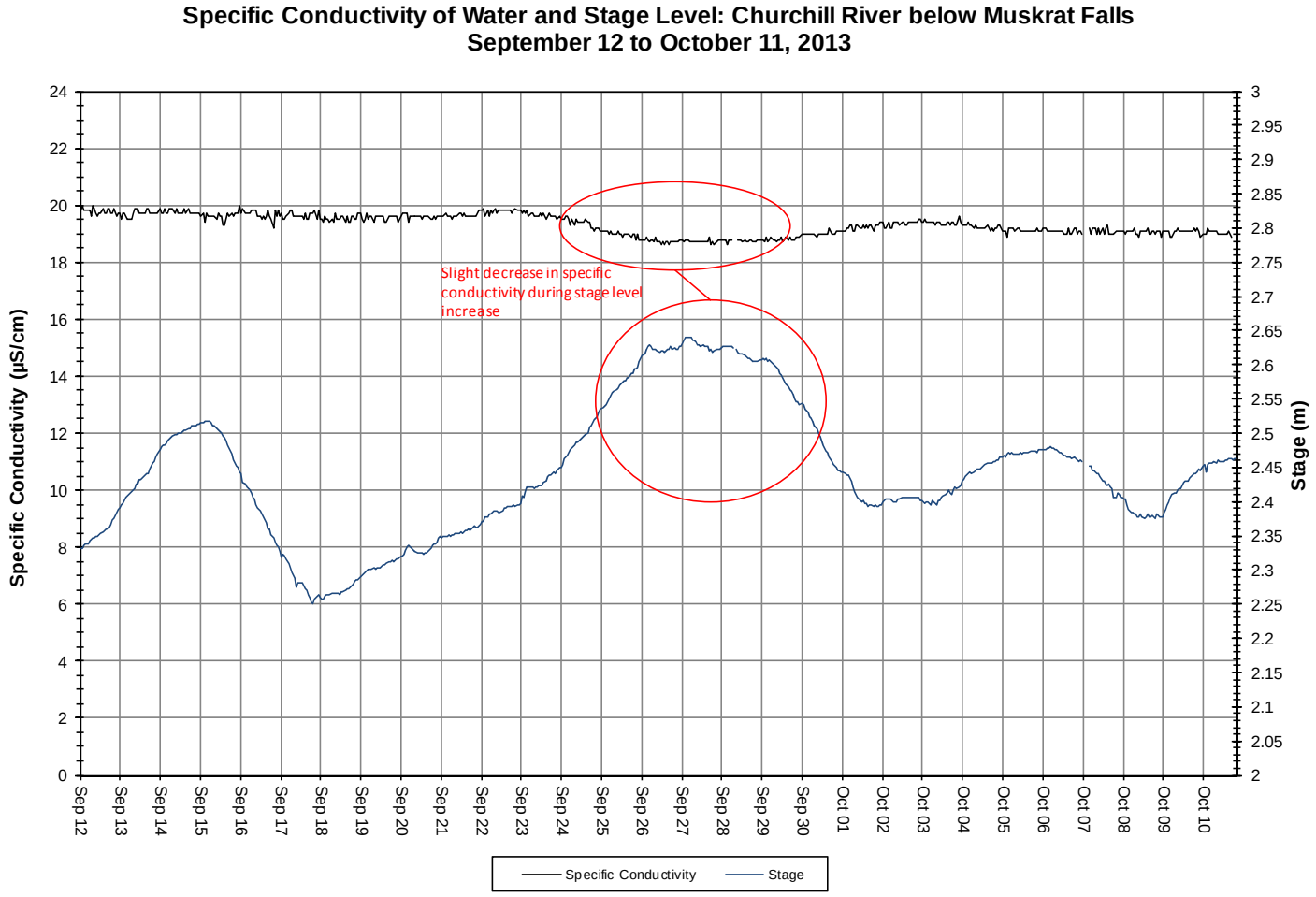


Figure 26: Specific conductivity and stage level at Churchill River below Muskrat Falls

- Dissolved oxygen content ranges between 10.77mg/l and 12.13mg/l. The saturation of dissolved oxygen ranges from 100.4% to 110.7% (Figure 27).
- All values were above both the minimum CCME Guidelines for the Protection of Cold Water Biota at Other Life Stage of 6.5mg/l and at Early Life Stages of 9.5mg/l. The guidelines are indicated in blue on Figure 27.
- Dissolved oxygen content is increasing throughout the deployment period. This trend is expected given the cooling air and water temperatures (Figure 24). Dissolved oxygen is typically higher at this station compared to the other stations further upstream due to the addition of oxygen to the water at Muskrat Falls.

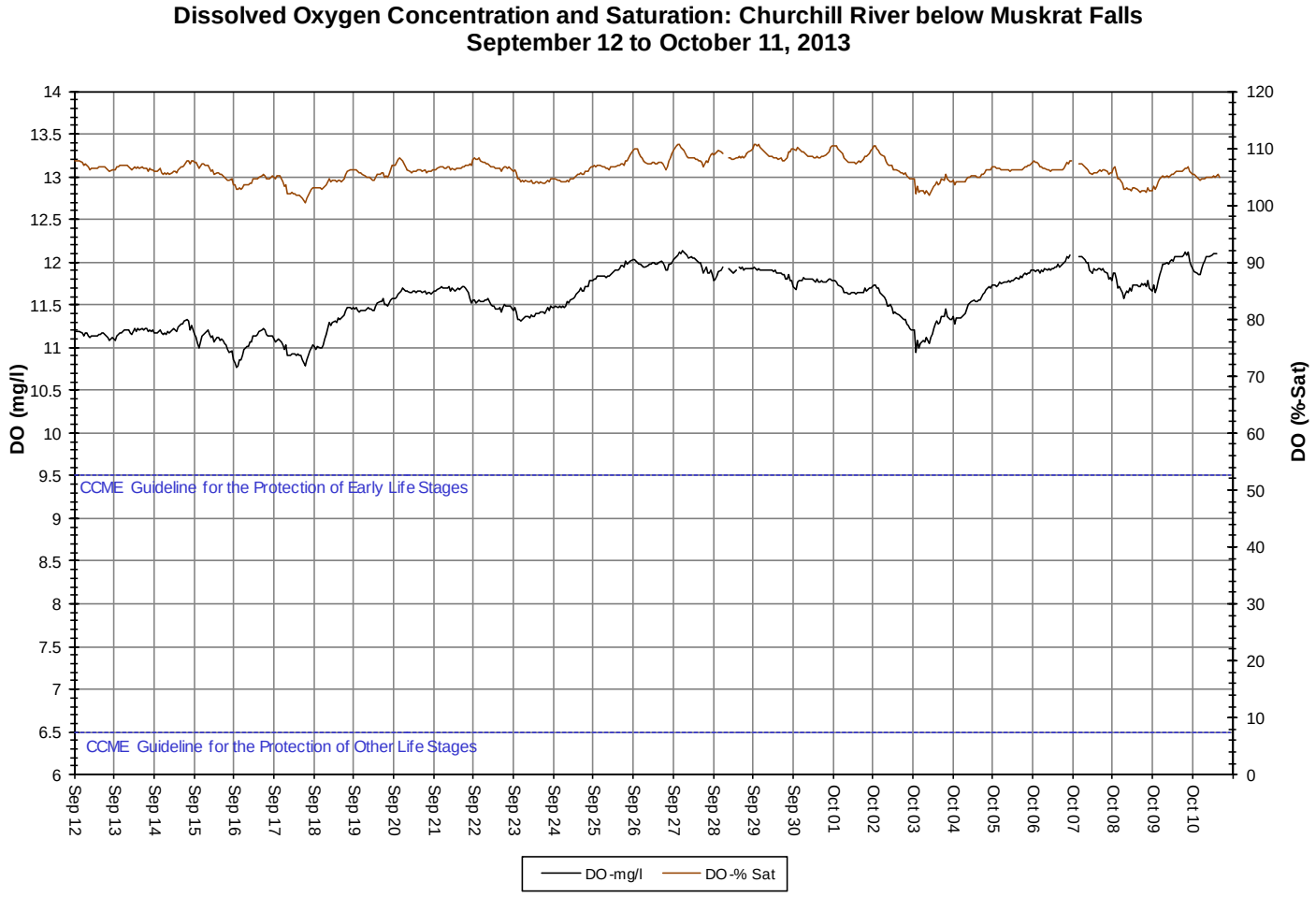


Figure 27: Dissolved oxygen and percent saturation at Churchill River below Muskrat Falls

- Turbidity ranges between 0.0NTU and 20.2NTU, averaging 2.4NTU (Figure 20). A median value of 1.8NTU during this time indicates there is a consistent natural background turbidity value. This trend is typical at this station.
- Turbidity values increase above background levels on a number of occasions. Most of these events do not correspond with rainfall or precipitation events. The turbidity increase on October 3-4 does correspond with rainfall events recorded on the same day.

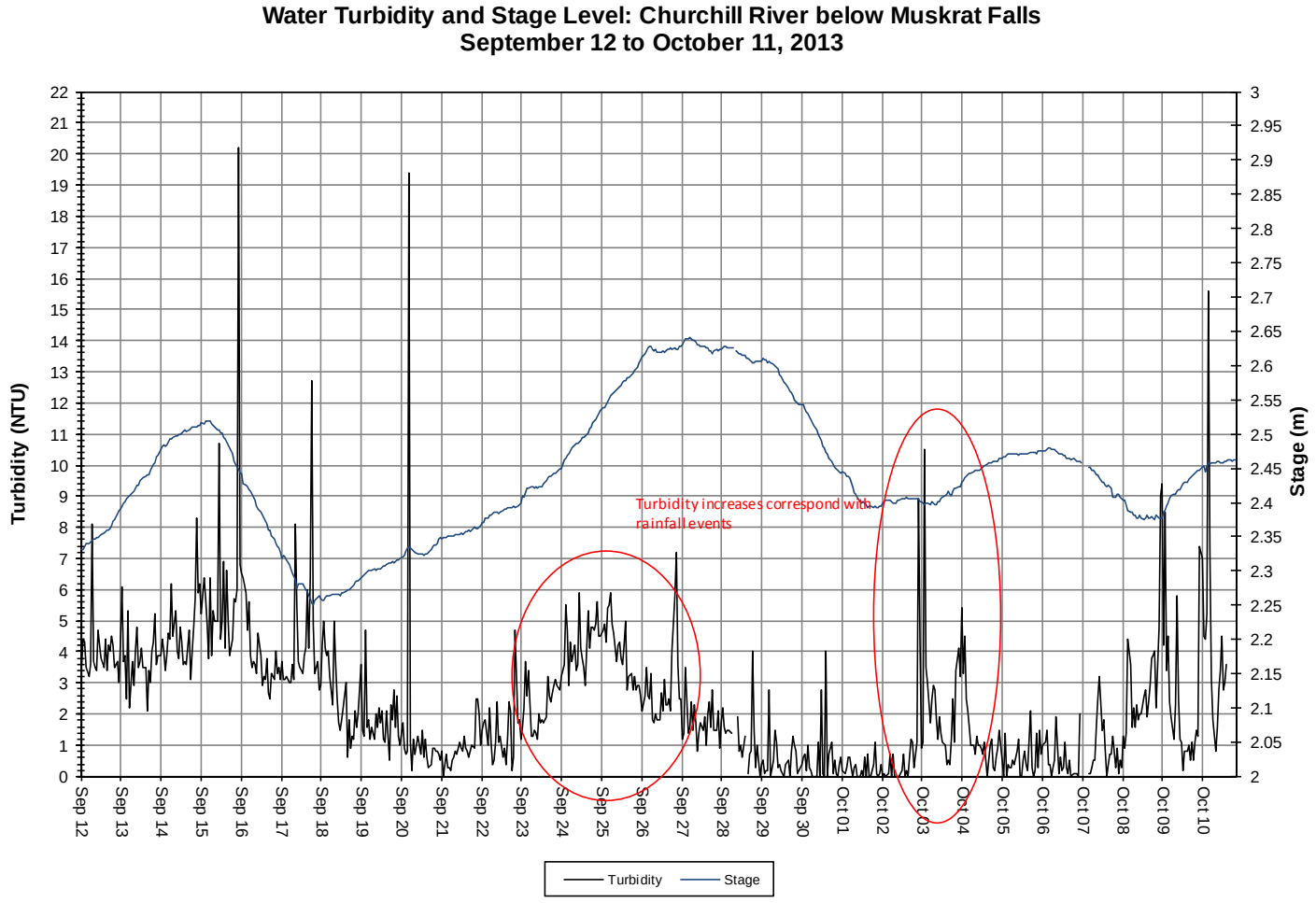


Figure 28a: Turbidity and stage level at Churchill River below Muskrat Falls

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 30). Stage is fluctuating throughout the deployment period. Precipitation occurs on >50% of the days in the deployment period however amounts are generally low except for two +18mm events on September 23-24. Stage ranges between 2.25m and 2.64m, a difference of 0.39m.

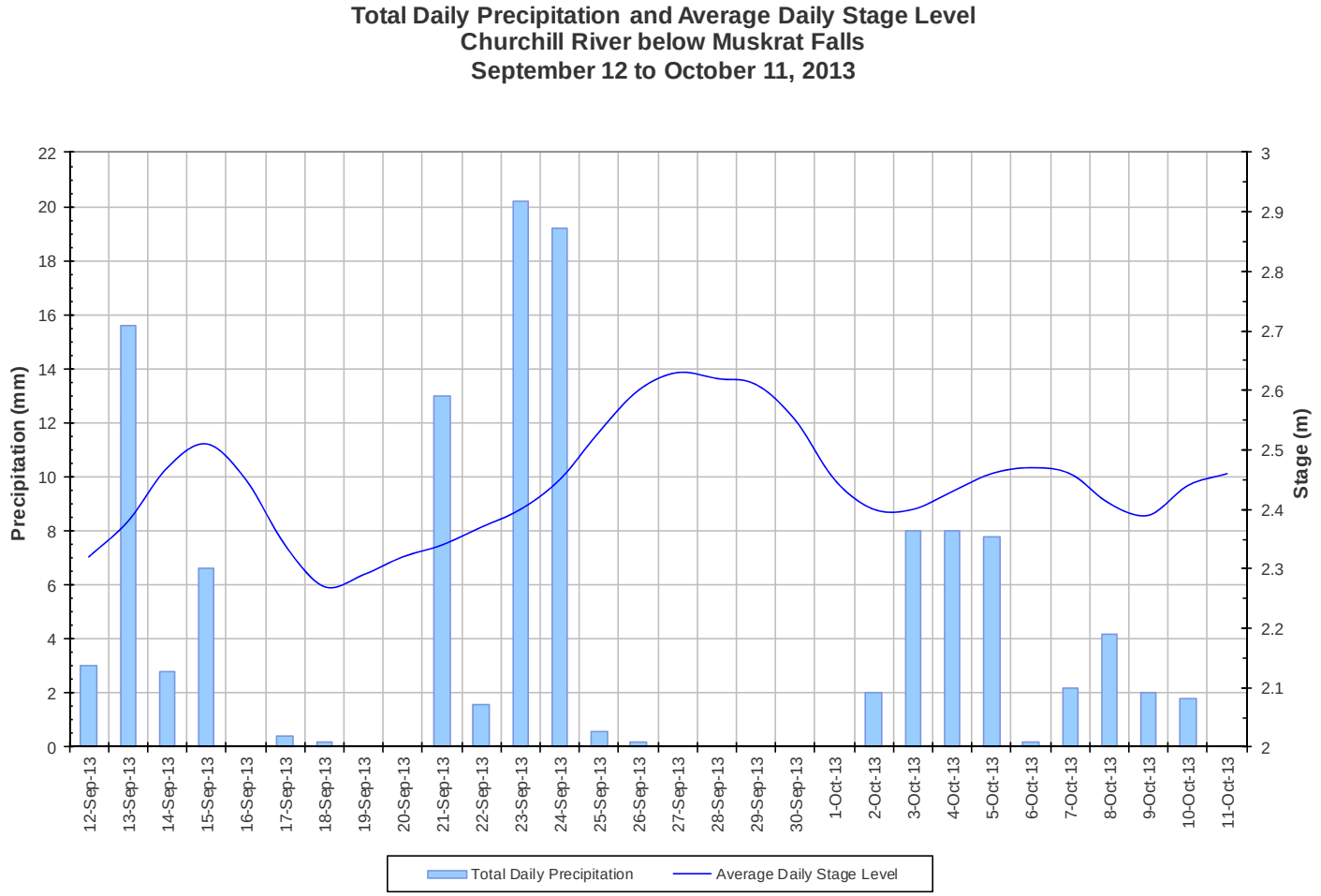


Figure 30: Daily precipitation and average daily stage level at Churchill River below Muskrat Falls (weather data recorded at Goose Bay)

Churchill River at English Point

- This station experienced a transmission error from September 19 to October 11. Log file data from the instrument internal memory was retrieved on October 11 at removal and used to supplement the transmitted data available from the Automatic Data Retrieval System. The instrument continued to experience a power supply issue which affected the internal data collection. From September 20 to October 2, data was recorded to one decimal place and a note on the log file indicates the instrument was 'late turning on'. From October 2-11, data is recorded at regular times and at the correct resolution. Stage data and daily averages for this time remain unavailable.

- Water temperature ranges from 7.42°C to 13.50°C during the deployment period (Figure 31).
- Water temperature is decreasing throughout the deployment period. This trend is expected given the cooling ambient air temperatures in the fall season (Figure 32). Water temperature fluctuates diurnally.

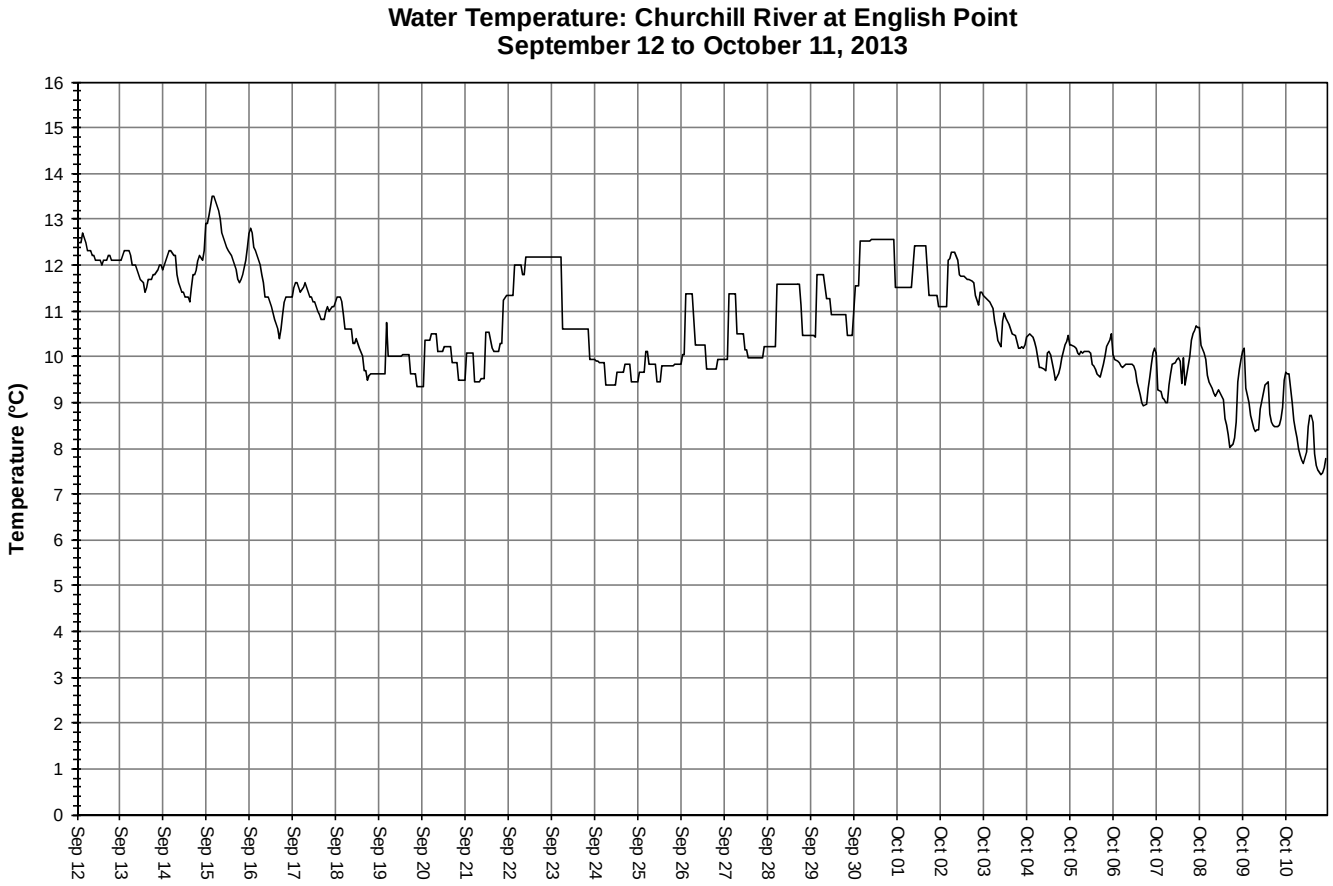


Figure 31: Water temperature at Churchill River at English Point

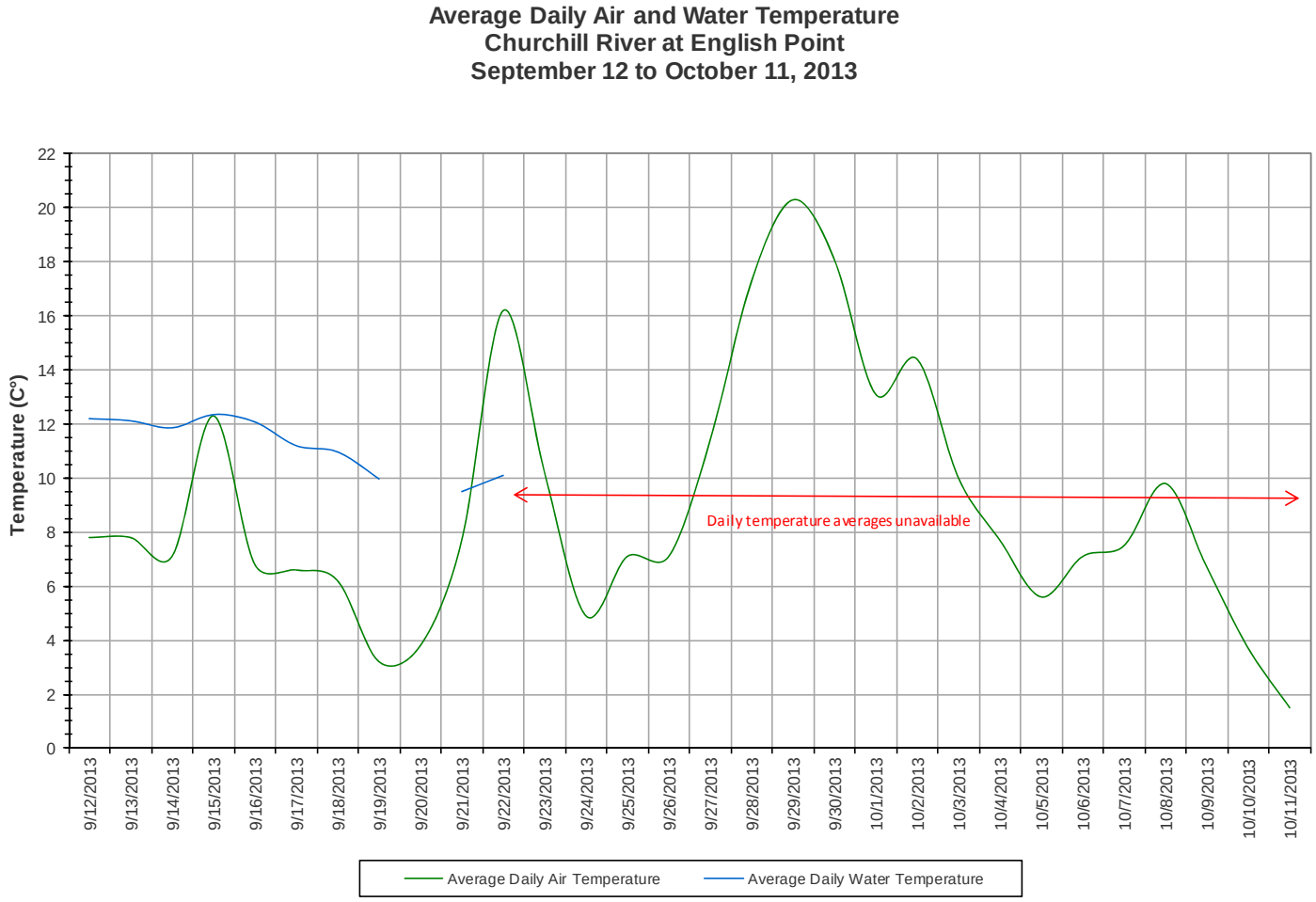


Figure 32: Average daily air and water temperature at Churchill River at English Point

(weather data recorded at Goose Bay)

- pH ranges between 5.69 and 7.56 pH units (Figure 33).
- From October 2-11, pH data collected in the log file appears inaccurate and is likely caused by a power supply problem to the instrument internal memory. This data has been removed from the data set.
- All values during the deployment period between September 12 and October 2 are within the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 33).

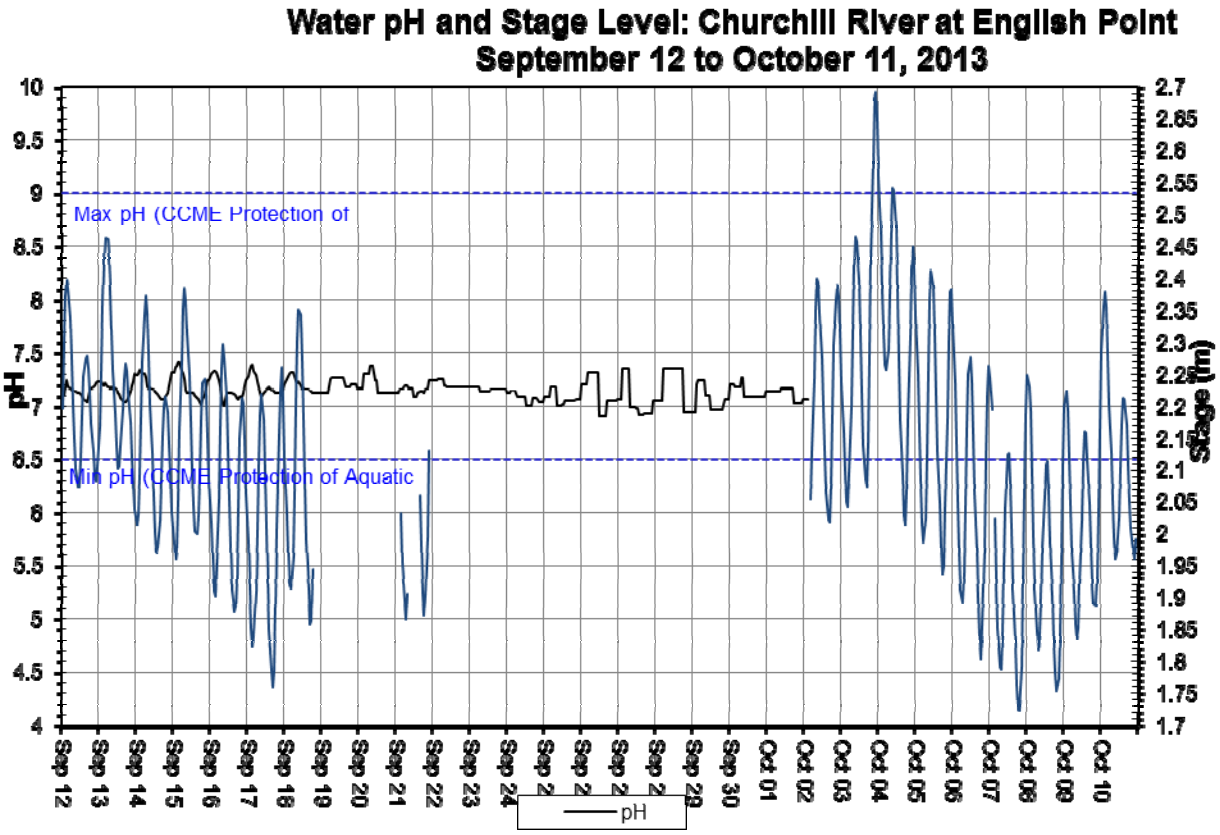


Figure 33: pH and stage level at Churchill River at English Point

- Specific conductance typically ranges between 21.0µS/cm and 51.0µS/cm during the deployment period, averaging 32.2µS/cm (Figure 34).
- Specific conductivity fluctuates considerably at this location due to the tidal influences of the Atlantic Ocean. As the tide comes in, the specific conductivity increases as the dissolved solids and salinity increase, and vice versa as the tide goes out. This increase and decrease in specific conductivity and stage occurs twice daily. This pattern is generally consistent throughout the deployment period.

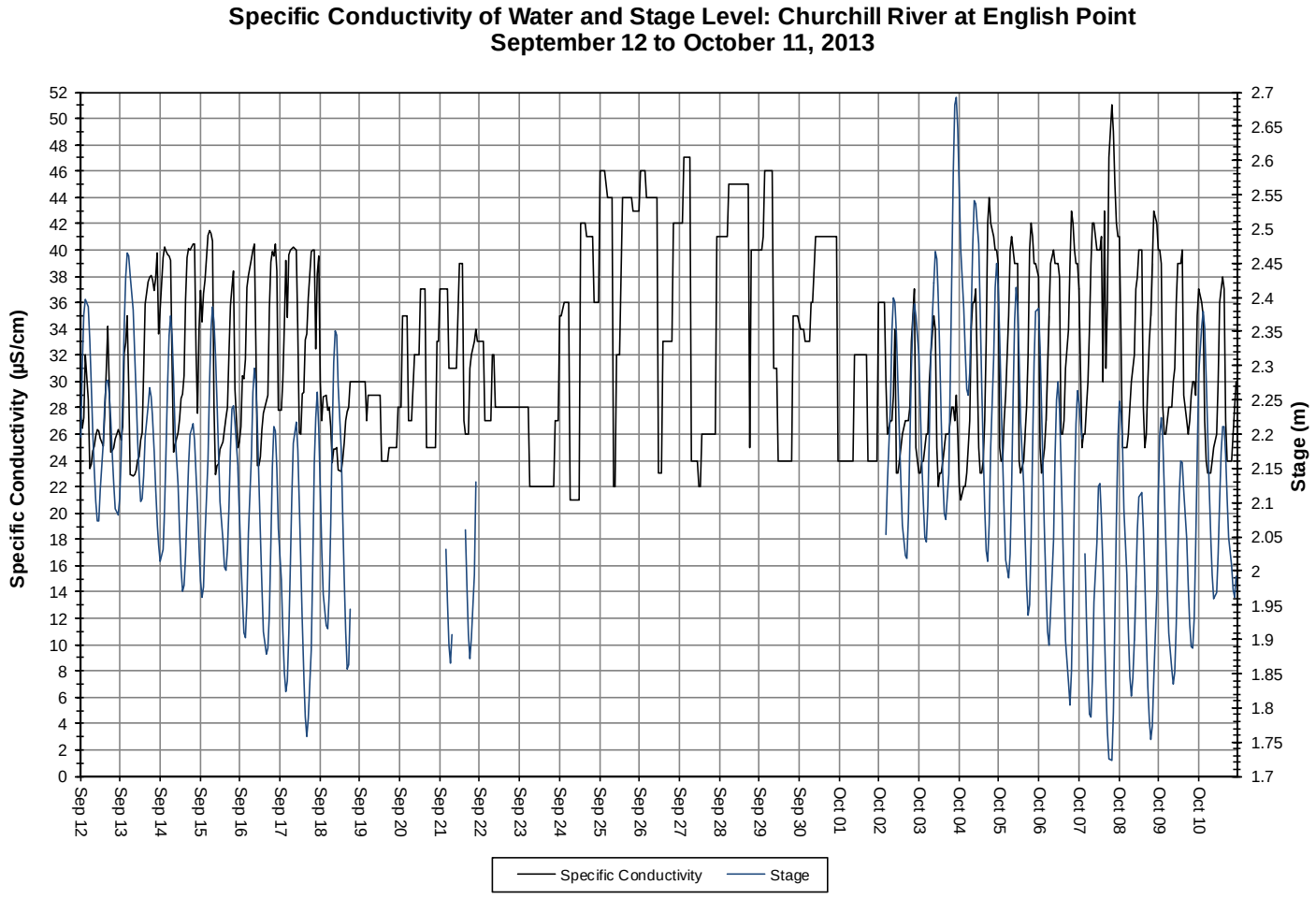


Figure 34: Specific conductivity and stage level at Churchill River at English Point

- Dissolved oxygen content ranges between 9.41mg/l and 11.64mg/l. The saturation of dissolved oxygen ranges from 85.9% to 106.8% (Figure 35).
- All values were above the minimum CCME Guidelines for the Protection of Cold Water Biota at Other Life Stage of 6.5mg/l. All data values with the exception of one hour on September 17 are above the minimum CCME Guideline for the Protection of Aquatic Life at Early Life Stages of 9.5mg/l. On September 17, dissolved oxygen content drop to 9.41mg/l for a period of one hour. The guidelines are indicated in blue on Figure 35.
- Dissolved oxygen content is increasing slightly throughout the deployment period. This trend is expected given the cooling air and water temperatures (Figure 32).

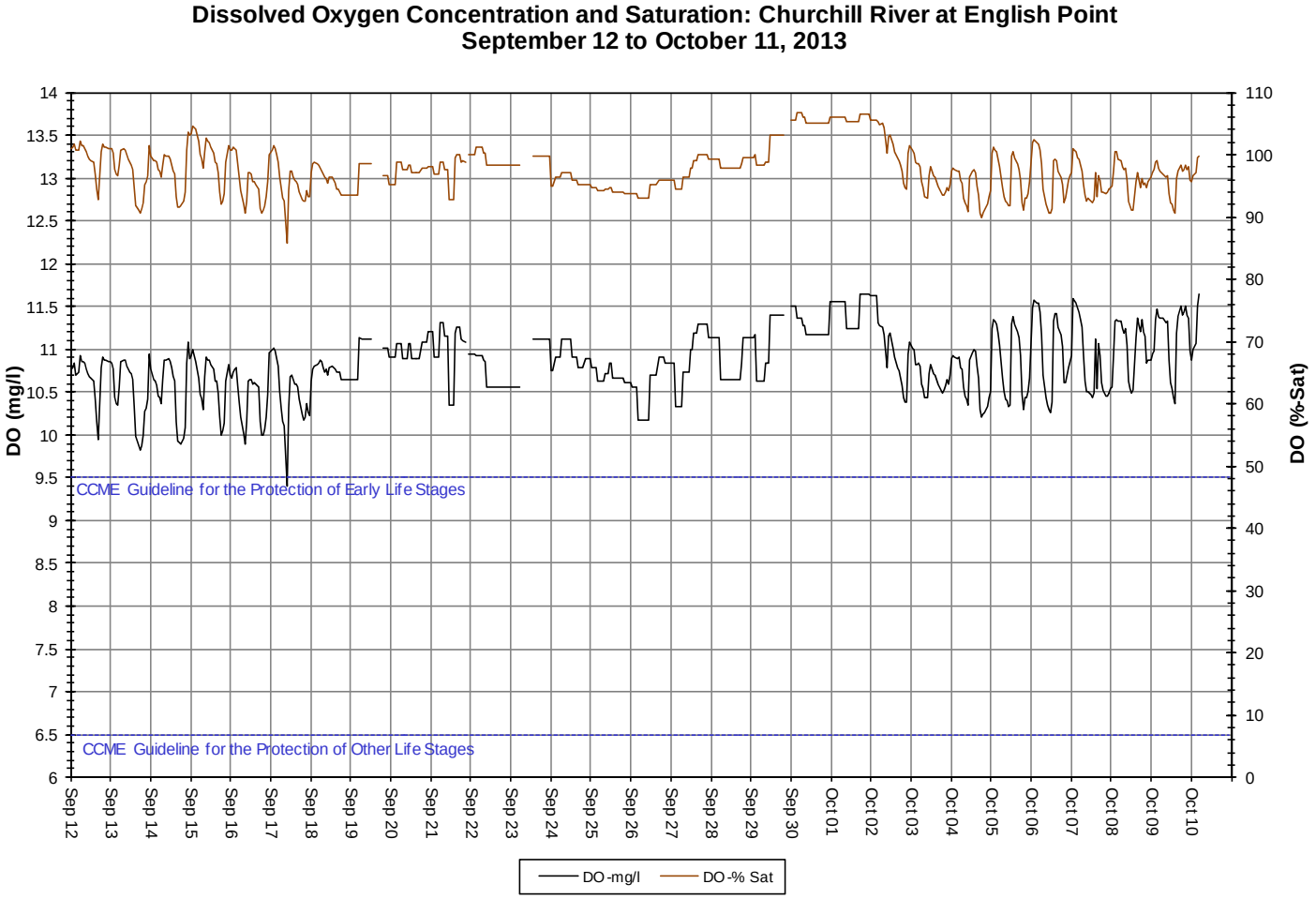


Figure 35: Dissolved oxygen and percent saturation at Churchill River at English Point

- The turbidity sensor on the instrument deployed at English Point experienced almost immediate failure following deployment on September 12. The data collected is inaccurate and has been removed from the data set.
- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 37). Stage is fluctuating throughout the deployment period. Precipitation occurs on >50% of the days in the deployment period however amounts are generally low except for two +18mm events on September 23-24. Stage ranges between 1.76m and 2.46m, a difference of 0.70m.

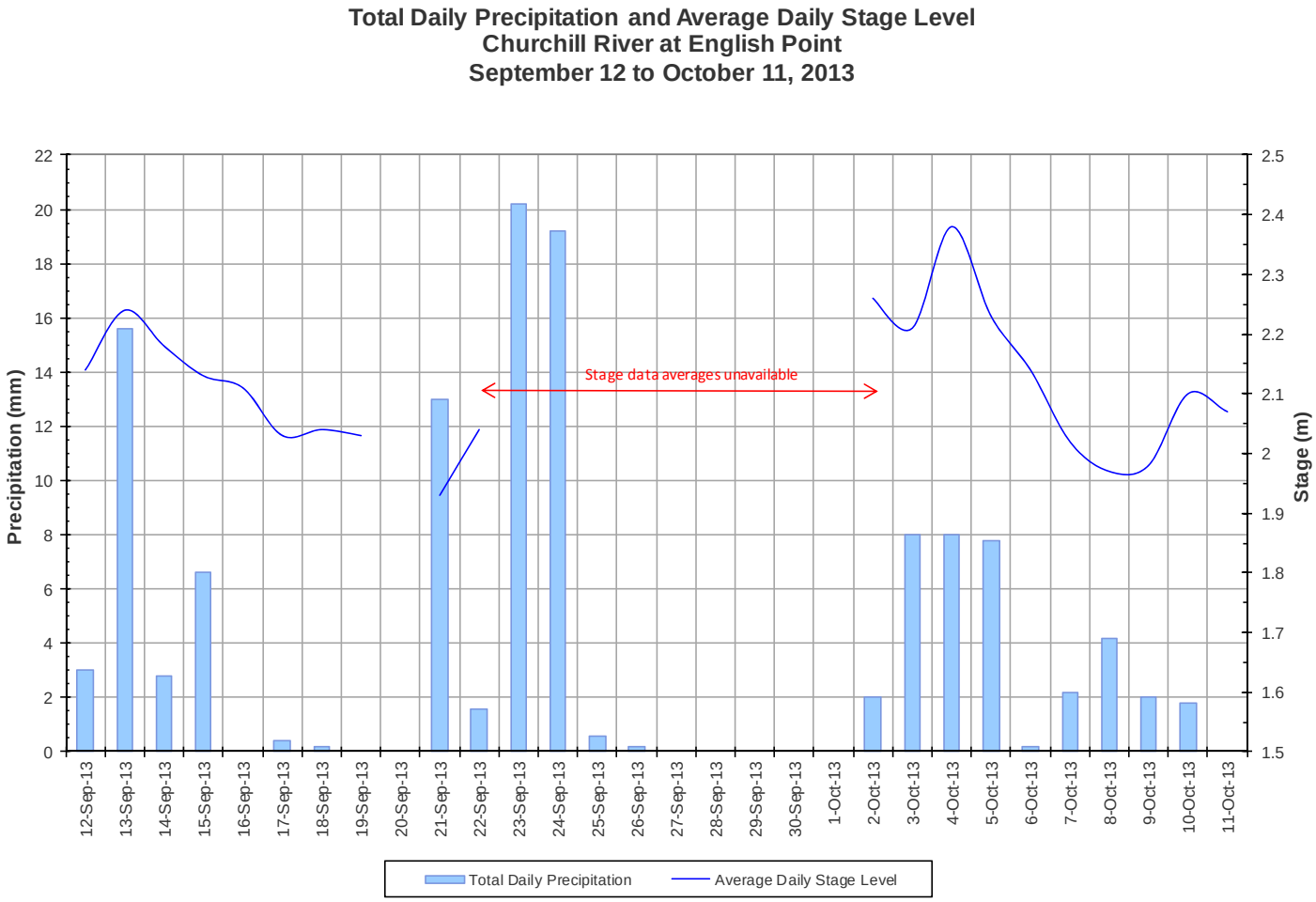


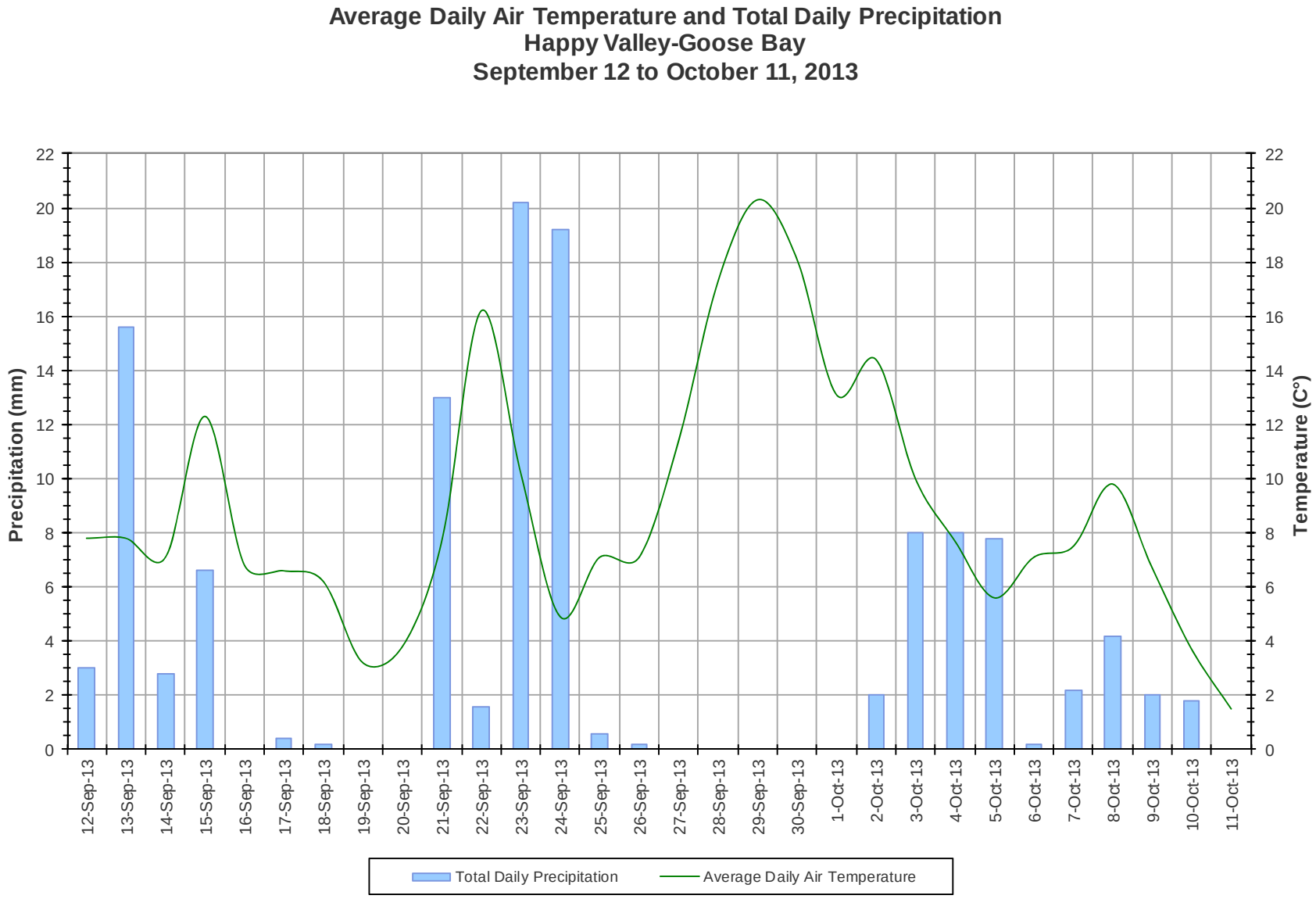
Figure 37: Daily precipitation and average daily stage level at Churchill River at English Point

(weather data recorded at Goose Bay)

Conclusions

- Instruments at five water quality monitoring stations on the Lower Churchill River were deployed from September 12/14 to October 10/11, 2013.
- Stage levels fluctuated at all stations throughout the deployment period. Water level changes at the each of the stations ranged between 0.24m and 0.74m.
- Water temperature was decreasing at all stations throughout the deployment period due to the cooling ambient air temperatures in the region during the fall season. Water temperature typically ranged between 7.20°C and 13.50°C.
- pH is generally neutral and stable at stations along the Lower Churchill River ranging between 6.64 and 7.56 pH units. At English Point, pH data collected after a power supply problem occurred on October 2 has been removed from the data set. With the exception of the inaccurate data at English Point, pH values at all stations were within the recommended CCME Guidelines for the Protection of Aquatic Life.
- Specific conductivity was relatively stable at all stations regardless of the fluctuating stage levels. While this trend is not normally experienced, for this deployment period, the trend was similar throughout the network with the exception of the station at English Point which is influenced by the tides in Lake Melville. There was a slight decrease in specific conductivity which corresponded with a stage level increase visible at the stations upstream of English Point. Specific conductivity averaged between 19.3µS/cm and 20.9µS/cm at the stations below Metchin River, below Grizzle Rapids and above and below Muskrat Falls. Specific conductivity values at the station at English Point averaged higher at 32.2µS/cm.
- Dissolved oxygen content was increasing throughout the deployment period as it is inversely related to water temperature. Values ranged between 9.41mg/l and 12.13mg/l. All values were above the CCME Guideline for the Protection of Aquatic Life for Cold Water Biota at Other Life Stages at 6.5mg/l. All values were above the CCME Guideline for the Protection of Aquatic Life at Early Life Stages of 9.5mg/l at stations upstream from English Point. At English Point, dissolved oxygen content dipped below this guideline for a period of one hour on September 17. The station below Muskrat Falls consistently has high dissolved oxygen content due to the location of the Muskrat Falls, 6km upstream.
- Turbidity data at the stations below Metchin River and below Grizzle Rapids remained mostly at 0NTU throughout the deployment period which is typical of these stations. Turbidity values at the stations above and below Muskrat Falls were typical for the stations, reporting 0.9NTU and 1.8NTU background values. Turbidity values at the station at English Point were unavailable due to sensor malfunction. The data has been removed from the data set.

Appendix 1 – Weather Data – Environment Canada Historical Weather and Climate Database



Average Daily Air Temperature and Total Daily Precipitation
Churchill Falls
September 12 to October 11, 2013