Real-Time Water Quality Deployment Report

Voisey's Bay Network

July 19 to
August 15, 2012

Newfoundland Labrador

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

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General

- Department of Environment and Conservation 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; Upper Reid Brook, Tributary to Lower Reid Brook, Lower Reid Brook and Camp Pond Brook.
- On July 19, 2012, Vale Environment staff deployed real-time water quality monitoring instruments at the four real time stations in the Voisey's Bay network for a period of 27 days. Instruments were removed for cleaning and calibration on August 15.

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 (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 deployed from July 19 to August 15, 2012 are summarized in Table 2.

Table 2: Comparison rankings for Voisey's Bay Network stations, July 19– August 15, 2012

Station Voisey's Bay	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Upper Reid Brook	Jul 19, 2012	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	Aug 15, 2012	Removal	Excellent	Good	Excellent	Good	Excellent
Tributary to Lower Reid Brook	Jul 19, 2012	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	Aug 15, 2012	Removal	Excellent	Excellent	Excellent	Good	Excellent
Lower Reid Brook	Jul 19, 2012	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	Aug 15, 2012	Removal	Good	Good	Excellent	Excellent	Excellent
Camp Pond Brook	Jul 19, 2012	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	Aug 15, 2012	Removal	Excellent	Good	Excellent	Excellent	Excellent

- At the station at Upper Reid Brook, all parameters ranked 'excellent' at deployment. At removal, temperature, specific conductivity and turbidity ranked 'excellent' and pH and dissolved oxygen ranked 'good'.
- At the station on the tributary to Lower Reid Brook, all parameters ranked 'excellent' at deployment. At removal, temperature, pH, specific conductivity and turbidity ranked 'excellent' and dissolved oxygen ranked 'good'.
- At the station on Lower Reid Brook, all parameters ranked 'excellent' at deployment. At removal, specific conductivity, dissolved oxygen and turbidity ranked 'excellent' and temperature and pH ranked 'good'.
- At the station on Camp Pond Brook, all parameters ranked 'excellent' at deployment. At removal, temperature, specific conductivity, dissolved oxygen and turbidity ranked 'excellent' and pH ranked 'good'.

Data Interpretation

- The following graphs and discussion illustrate significant water quality-related events from July 19 to August 15 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.

Upper Reid Brook (Outlet from Reid Pond)

- Water temperature ranges from 10.77 ^{o}C to 16.67^{o}C during the deployment period (Figure 1).
- Water temperature is increasing slightly throughout the first half of the deployment period. This trend is expected given the warm ambient air temperatures in the summer season (Figure 2).
- Water temperature fluctuates diurnally. Average water temperature is 14.69°C for the deployment period.
- There are a couple of days when water temperature drops significantly in the first week of the deployment. These decreases in water temperature on July 22 and 24 correspond with cool air temperatures recorded in the area (Figure 2).

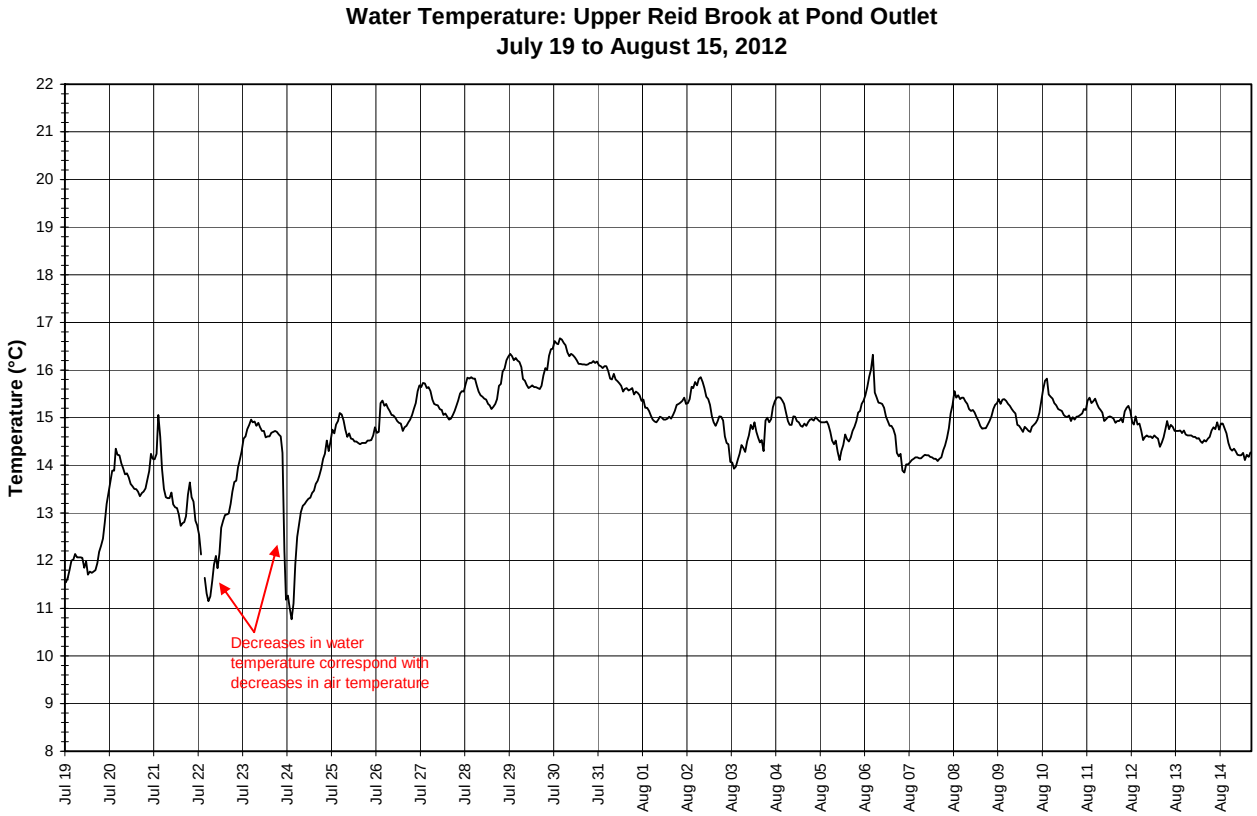

Figure 1: Water temperature at Upper Reid Brook

- Average daily air and water temperatures are fluctuating throughout the deployment period (Figure 2). Increases and decreases in air temperature are reflected in water temperatures. Air temperatures generally increase and decrease faster while water temperatures increase and decrease more slowly over time.

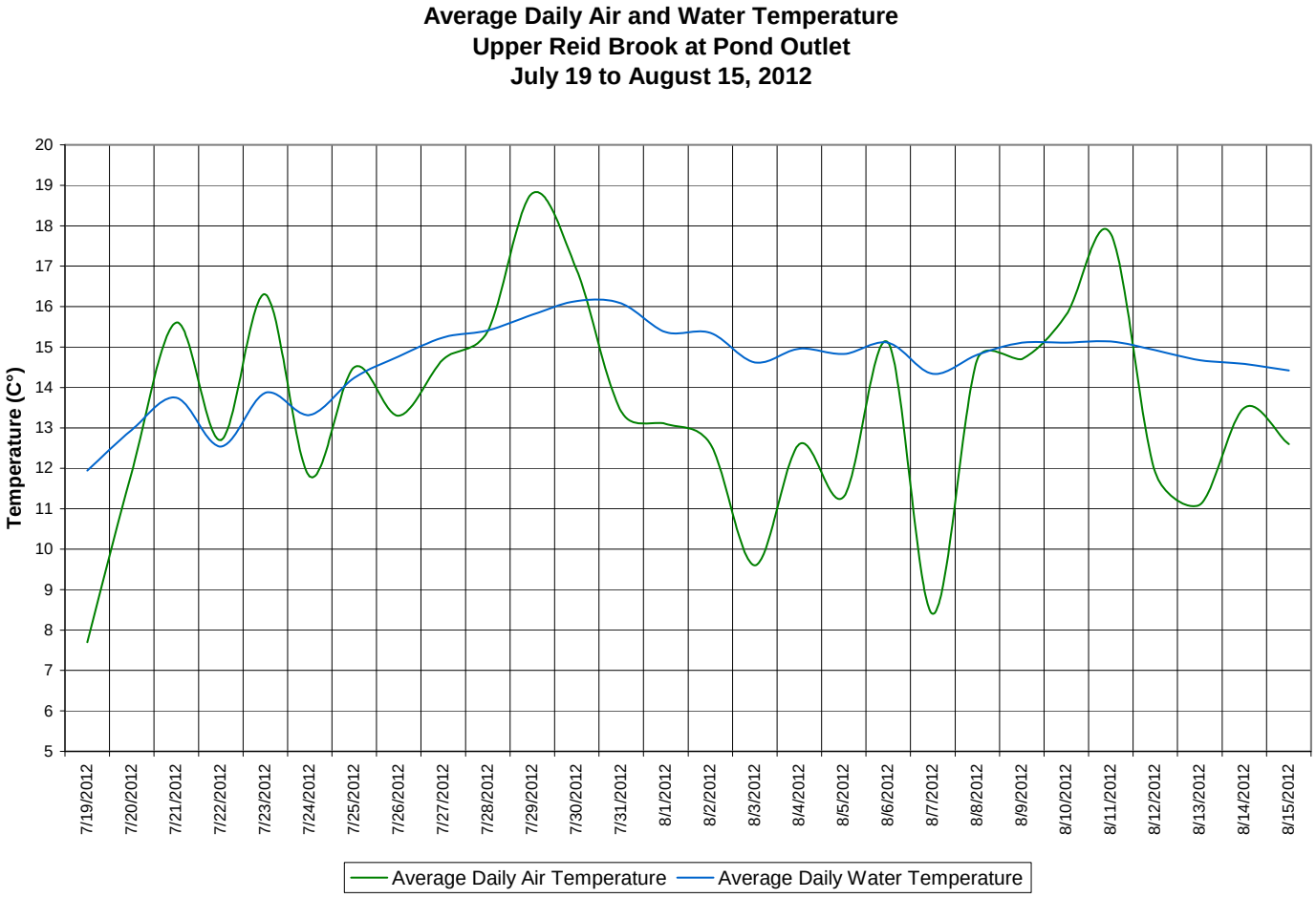

Figure 2: Average daily air and water temperatures at Upper Reid Brook

(weather data recorded at Nain)

- pH ranges between 6.97 and 7.22 pH units (Figure 3) and is stable throughout the deployment period.
- All values are within the recommended range as suggested by the CCME Guidelines for the Protection of Aquatic Life (> 6.5 and <9.5 pH units). Guidelines are indicated in blue on Figure 3.

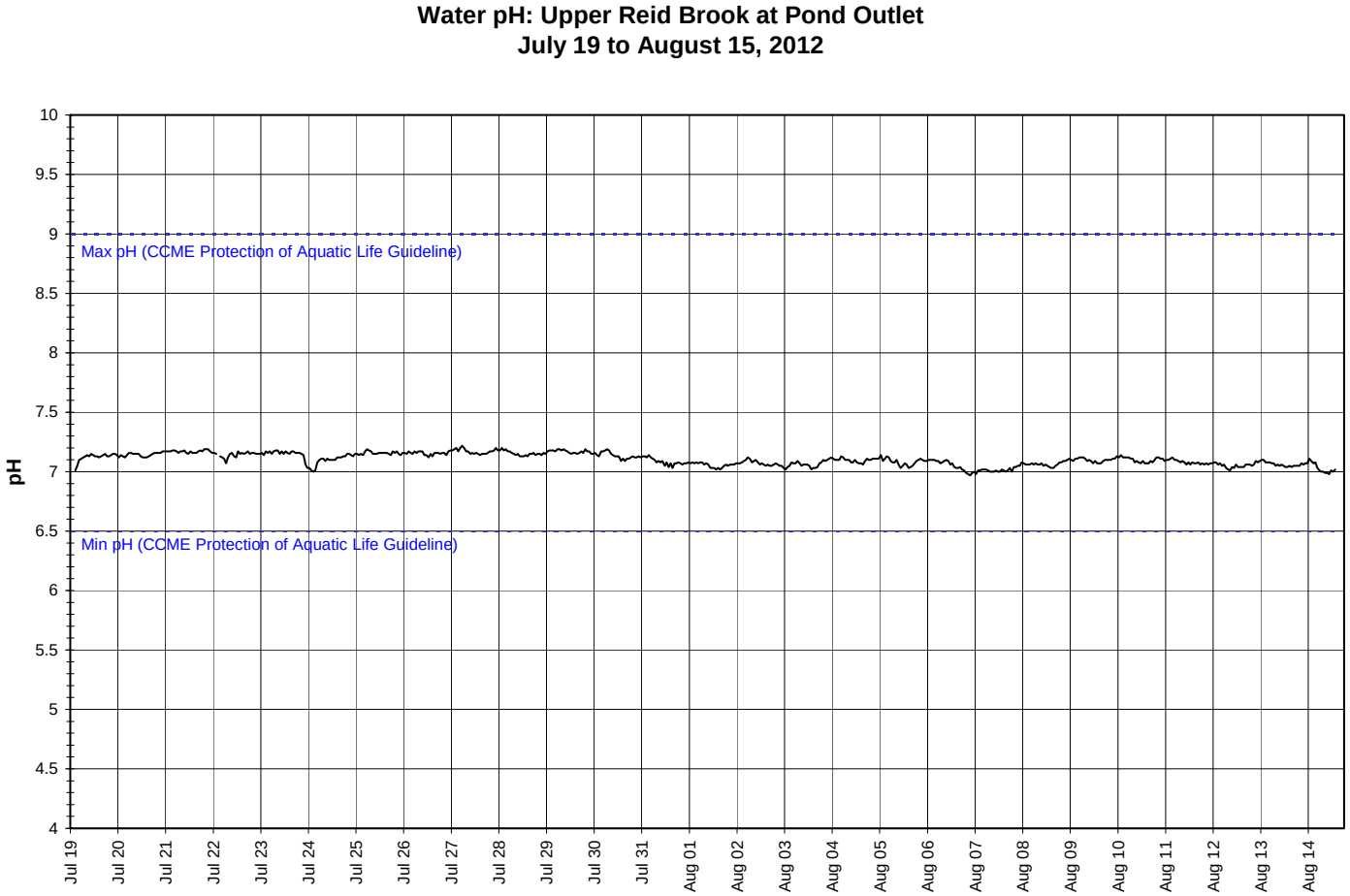

Figure 3: pH at Upper Reid Brook

- Specific conductivity values range from 10.3µS/cm to 11.0µS/cm during the deployment period (Figure 4).
- Specific conductivity remains very low and extremely stable throughout the deployment period with minimal fluctuation (±0.7µS/cm) regardless of the changing water level. This trend is expected as the flow from this station is directly from a stable lake environment.

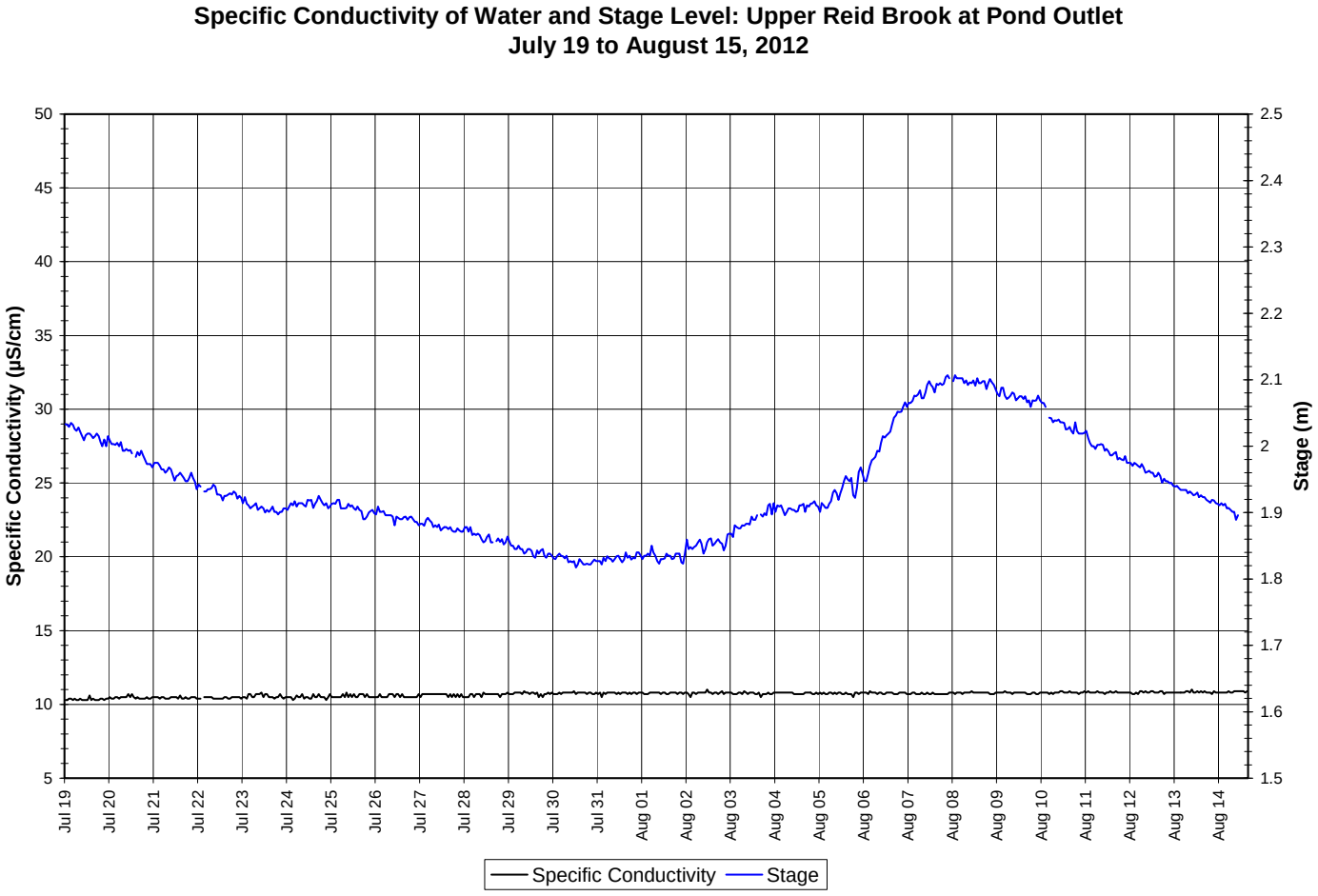

Figure 4: Specific conductivity and stage level at Upper Reid Brook

- Dissolved oxygen content ranges between 9.88mg/L and 11.26mg/L. The saturation of dissolved oxygen ranges from 96.9% to 103.9% (Figure 5).
- All values are above both of the minimum CCME Guidelines for the Protection of Cold Water Biota at Other Life Stages (6.5mg/l) and Early Life Stages (9.5mg/l). The guidelines are indicated in blue on Figure 5. The average dissolved oxygen value was 10.20mg/l.
- Dissolved oxygen content is decreasing slightly throughout the deployment period. This trend is expected given the slight increase in water temperature. There are a couple of sharp increases in the first week of the deployment which correspond with cool air temperatures (Figure 2) and sharp decreases in water temperature (Figure 1).

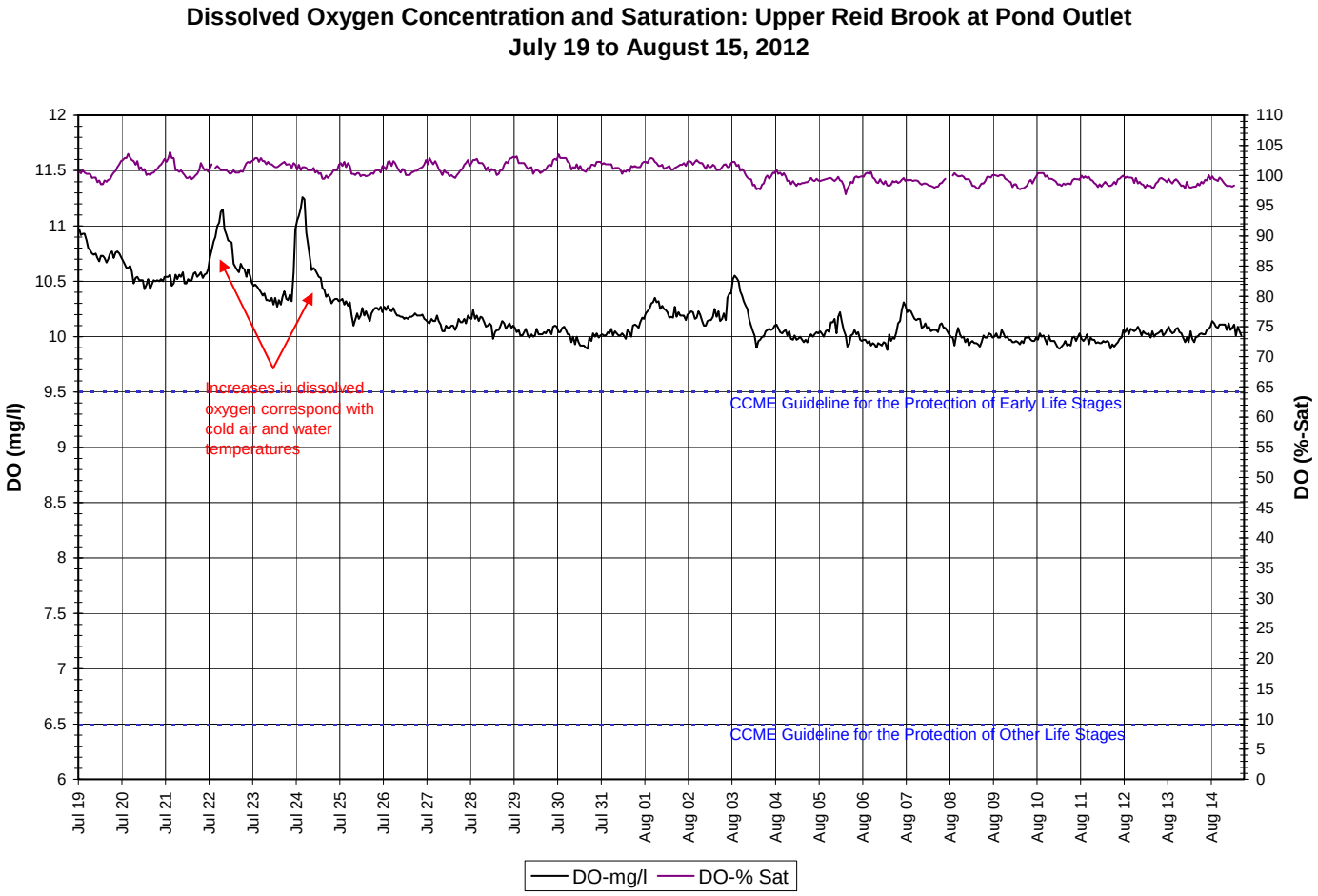

Figure 5: Dissolved oxygen and percent saturation at Upper Reid Brook

- Turbidity at this station remained at 0NTU for the entire deployment period (Figure 6). This is not unusual for this station as the water flowing from the lake is typically very clean, clear and cold.

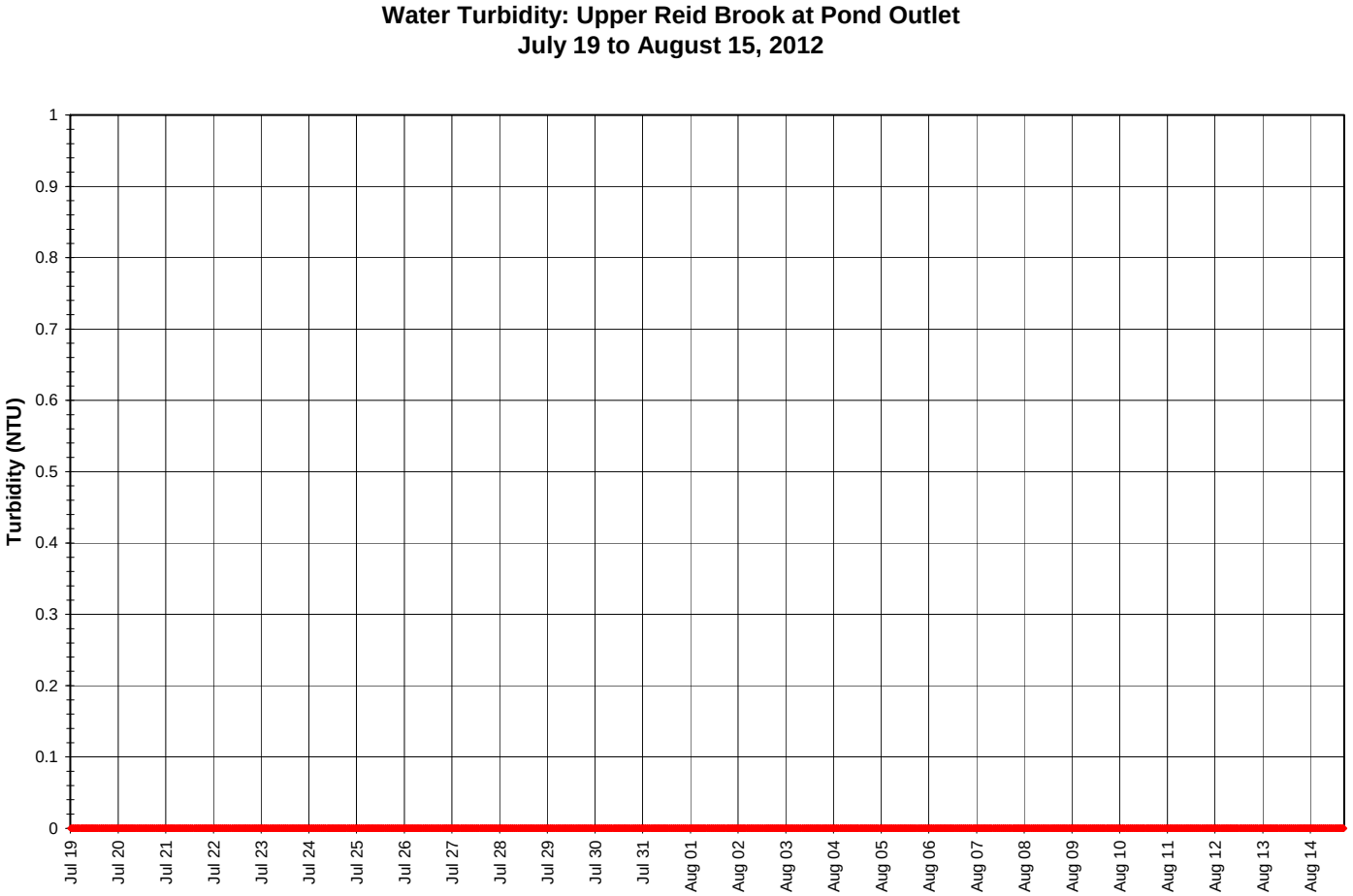

Figure 6: Turbidity at Upper Reid Brook

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 7). Stage is generally decreasing for the first two weeks of the deployment period. Stage level is increasing in the third week of the deployment before decreasing again in the final week. Precipitation events are infrequent but moderate in magnitude.

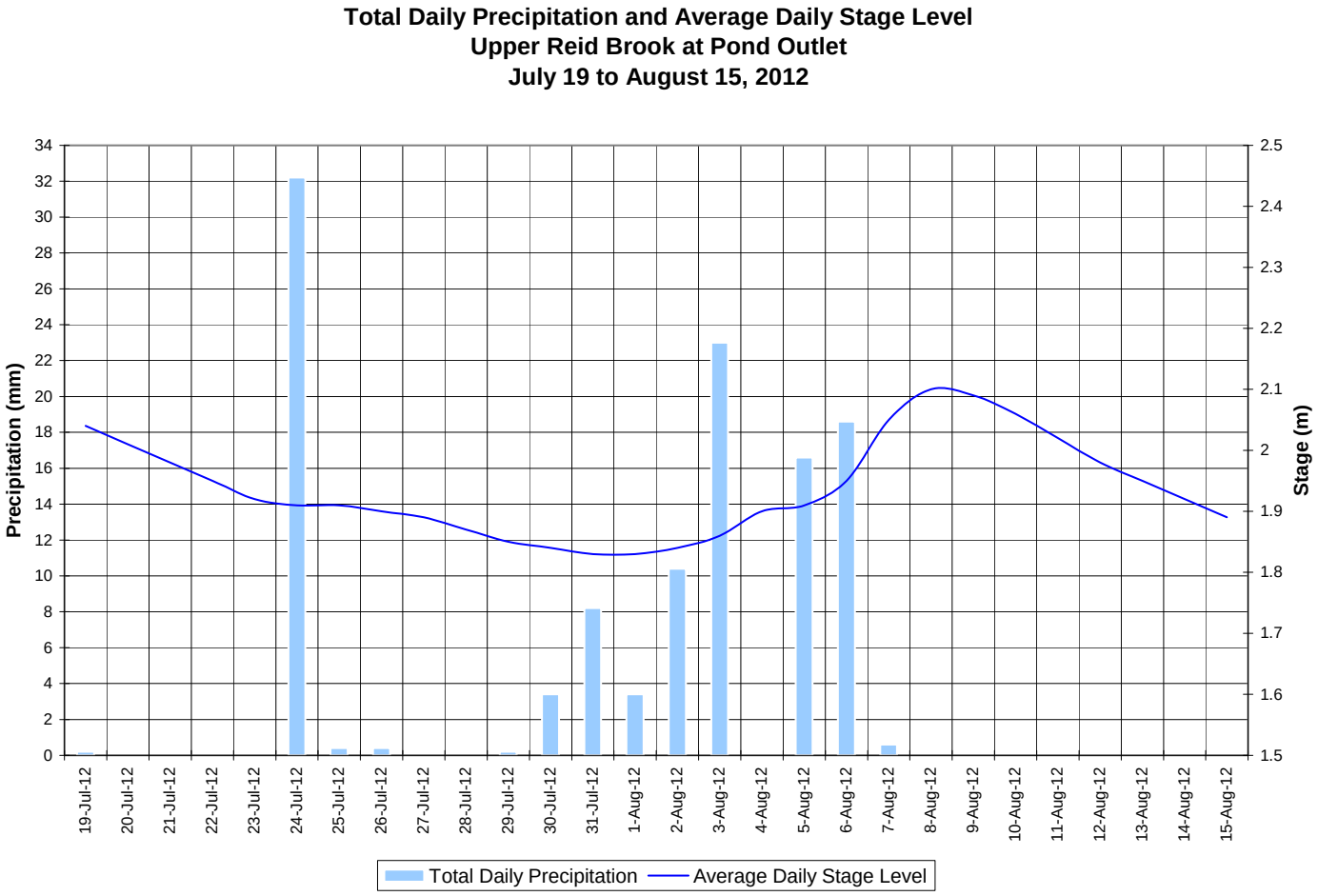

Figure 7: Daily precipitation and average daily stage level at Upper Reid Brook

(weather data recorded at Nain)

Tributary to Lower Reid Brook

- Water temperature ranges from 8.40 °C to 16.00°C during the deployment period (Figure 8).
- Water temperature is increasing slightly throughout the beginning of the deployment period. Water temperature decreases mid deployment and remains mostly stable for the rest of the month.
- Water temperature fluctuates diurnally. Average water temperature is 13.38°C for the deployment period.
- There are sharp decreases in water temperature on July 23-24 and August 2-3. These decreases correspond with cool air temperatures and significant rainfall events. These decreases are also noticeable at stations on Lower Reid Brook and Camp Pond Brook.

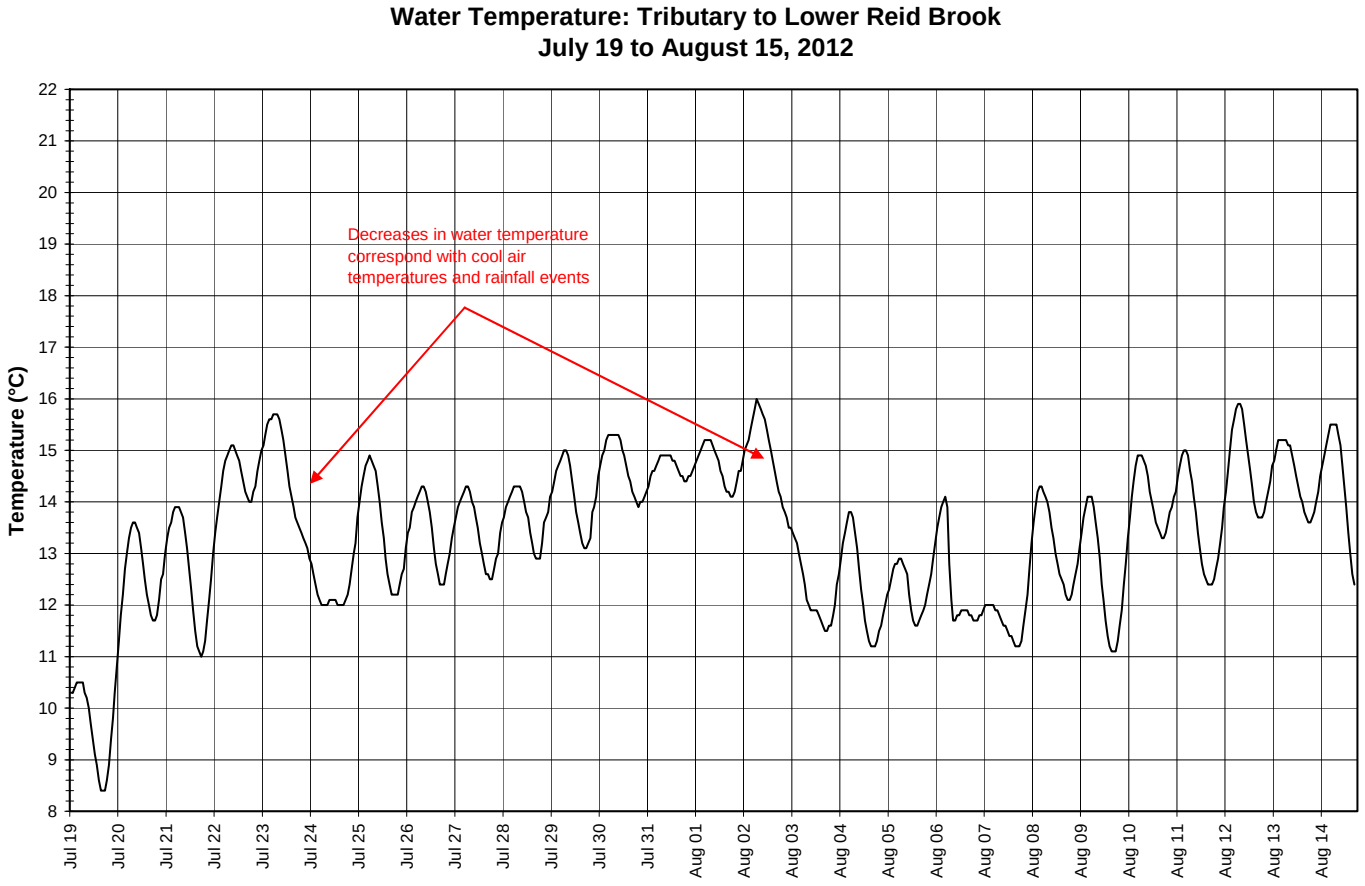

Figure 8: Water temperature at Tributary to Lower Reid Brook

- Average daily air and water temperatures are fluctuating throughout the deployment period (Figure 9). Increases and decreases in air temperature are reflected in water temperatures. Air temperatures generally increase and decrease faster while water temperatures increase and decrease more slowly over time.

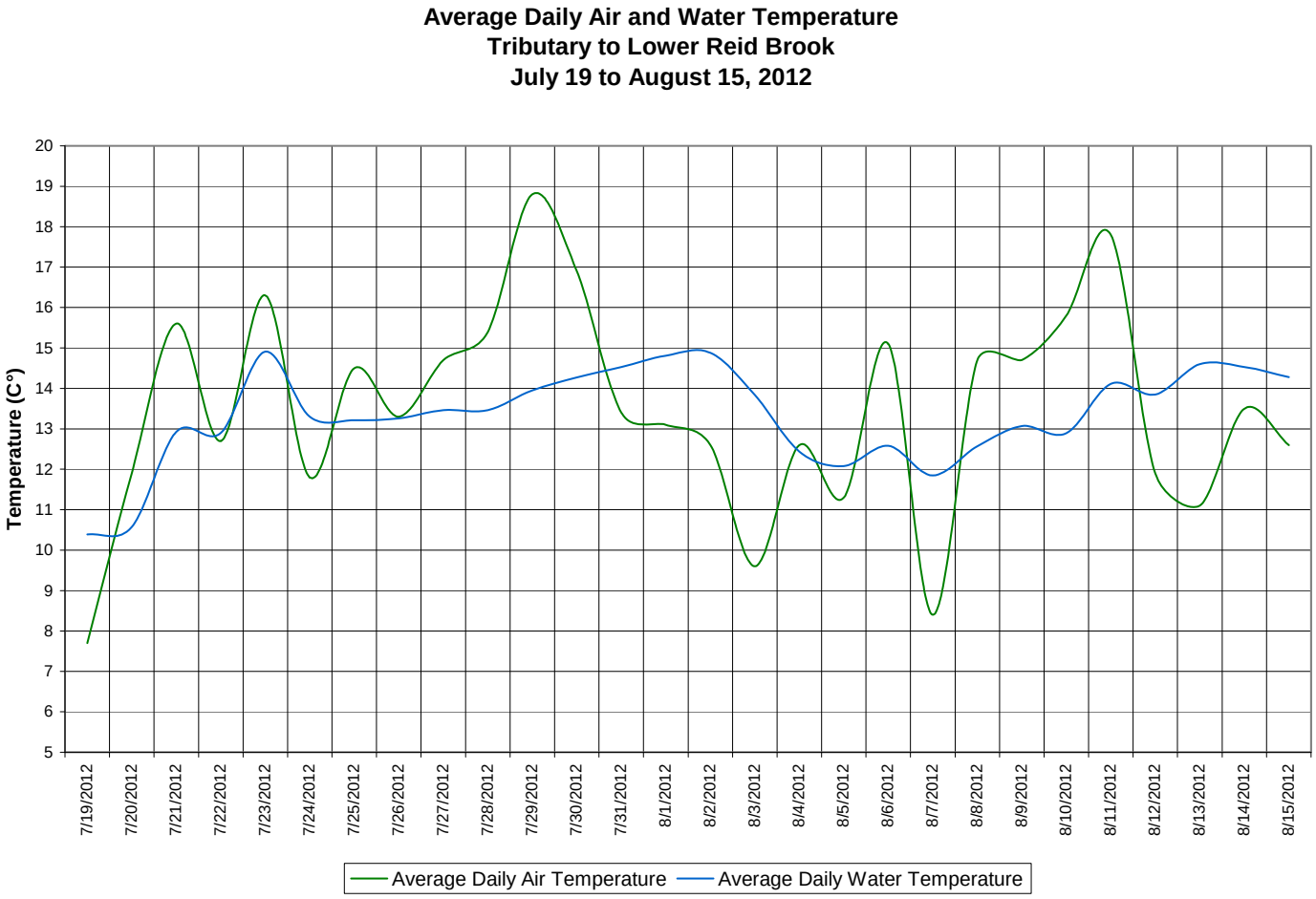

Figure 9: Average daily air and water temperatures at Tributary to Lower Reid Brook (weather data recorded at Nain)

- pH ranges between 6.06 and 7.17 pH units (Figure 10).
- Stage is included on Figure 10 to show the relationship between water level and pH. Stage increases on July 24 and August 6, causing pH to decrease sharply. These increases in stage level correspond with rainfall events.
- Most values are within the recommended range for pH as suggested by the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 10). During the stage increase and decrease in pH on August 6, pH values drop below the minimum CCME Guideline but increase again the following day.

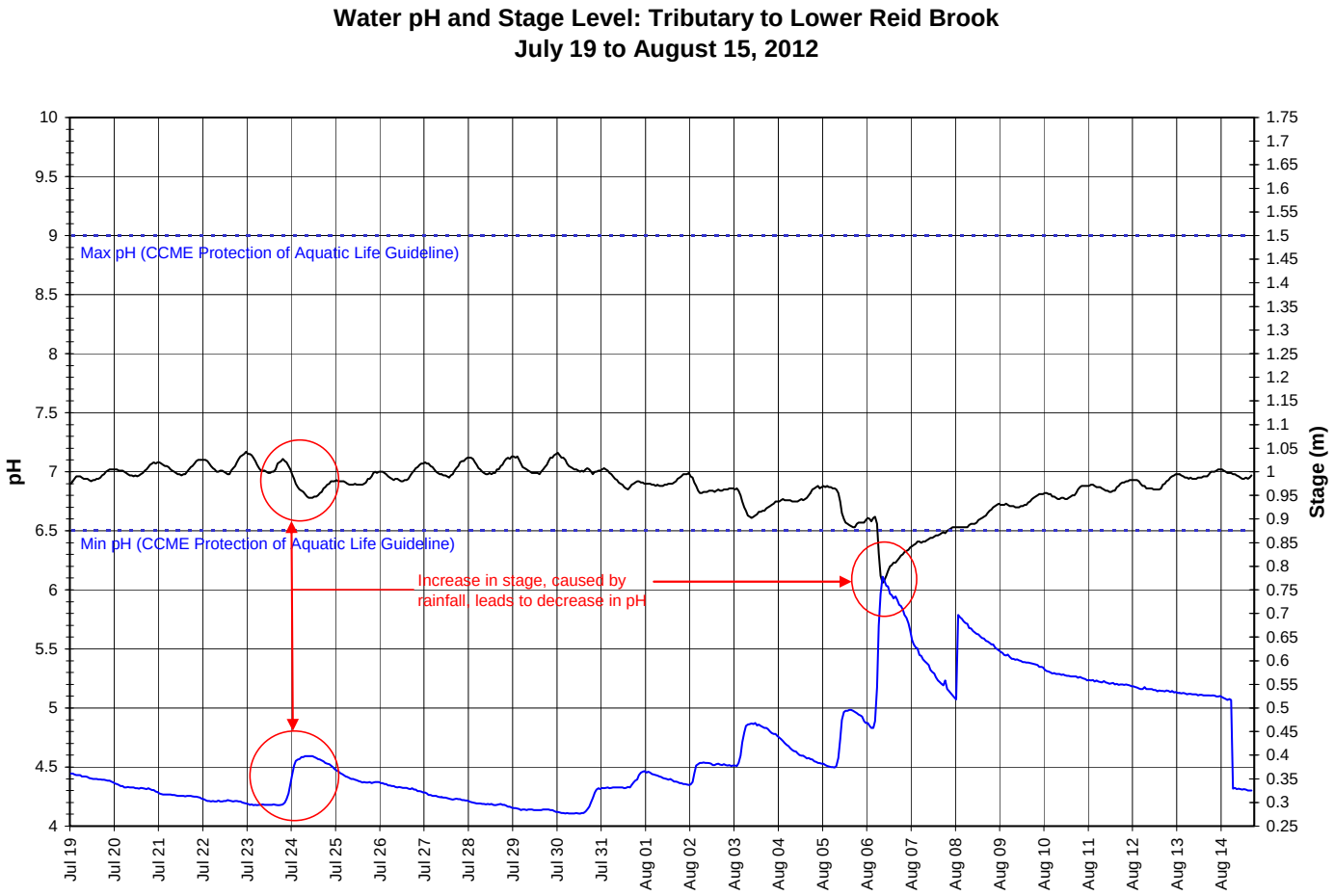

Figure 10: pH and stage level at Tributary to Lower Reid Brook

- Specific conductivity ranges between 17.8µS/cm and 31.4µS/cm and fluctuates throughout the deployment period (Figure 11).
- Stage is included in Figure 11 to illustrate the inverse relationship between conductivity and water level. Stage increases and decreases sharply throughout the deployment period. Specific conductivity changes with the varying water level (indicated by red arrows in Figure 11). As stage increases, specific conductivity generally decreases due to the dilution of dissolved solids in the water column. Inversely, as stage decreases, specific conductivity increases as the concentration of dissolved solids increases.

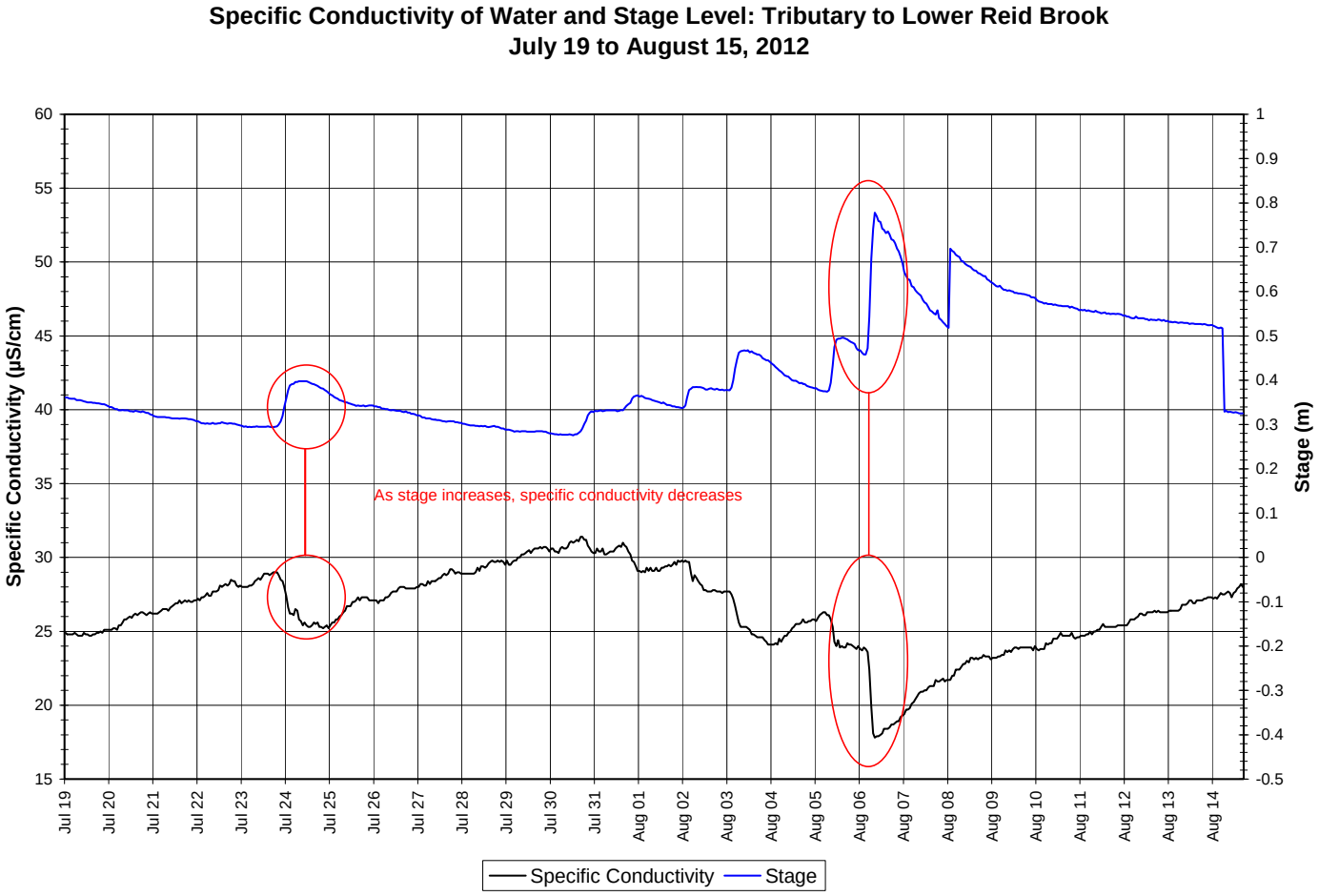

Figure 11: Specific conductivity and stage level at Tributary to Lower Reid Brook

- Dissolved oxygen content ranges between 9.35g/L and 11.34mg/L. The saturation of dissolved oxygen ranges from 92.3% to 98.7% (Figure 12).
- All values are above the minimum CCME Guideline for the Protection of Cold Water Biota at Other Life Stages (6.5mg/l) and most values are above the guideline for Early Life Stages (9.5mg/l). The guidelines are indicated in blue on Figure 12. Average dissolved oxygen value was 10.02mg/l.
- Dissolved oxygen content is decreasing slightly throughout the deployment period. This trend is expected given the slight increase in water temperatures during the summer season (Figure 8 & 9). Dissolved oxygen content and percent saturation fluctuate diurnally.

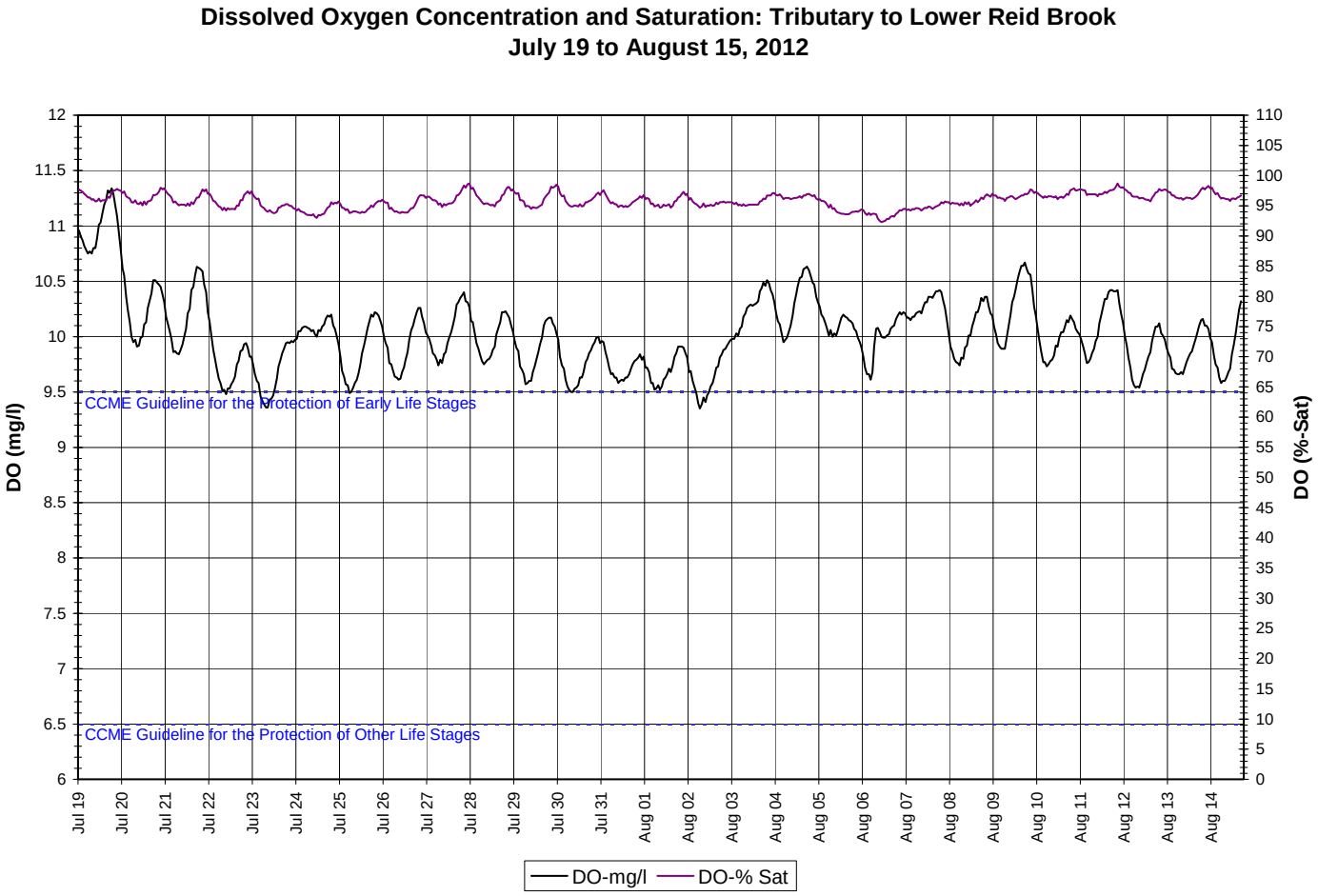

Figure 12: Dissolved oxygen and percent saturation at Tributary to Lower Reid Brook

- Turbidity ranges between 0 and 76.8 NTU throughout the deployment period (Figure 13). A median value of 0NTU indicates there is no natural background turbidity value for this deployment period.
- Short-lived turbidity increases are common at this station. Stage is graphed on Figure 13 as the increases in turbidity most times correspond with increases in stage caused by a rainfall event. There are a number of these examples indicated on Figure 13 on July 24, August 3-4, and August 5-7.

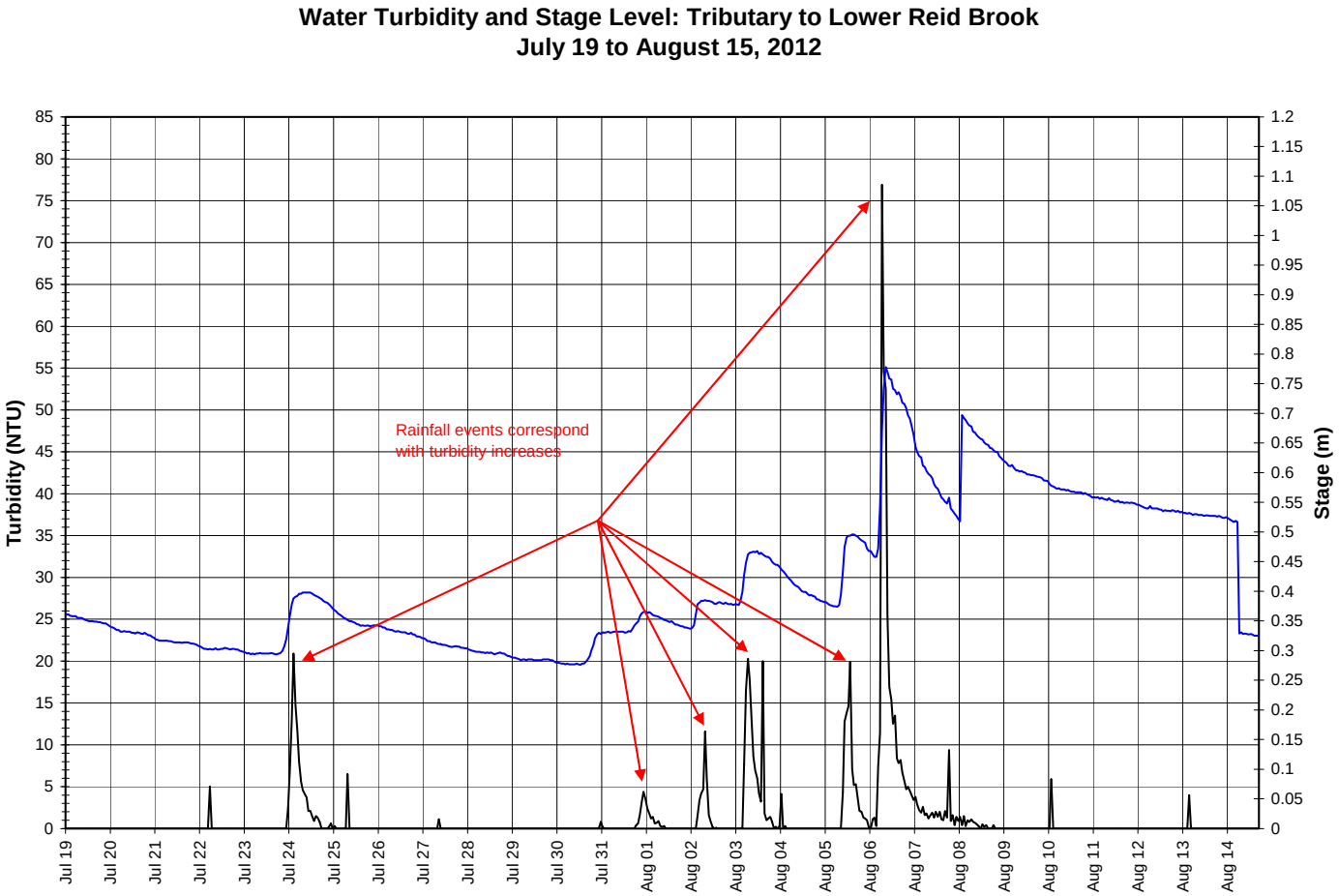

Figure 13: Turbidity and stage level at Tributary to Lower Reid Brook

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 14). Stage is generally stable for the first two weeks of the deployment period. Stage increases in the third week of the deployment period and then decreases in the final week. Precipitation events are infrequent but moderate in magnitude.

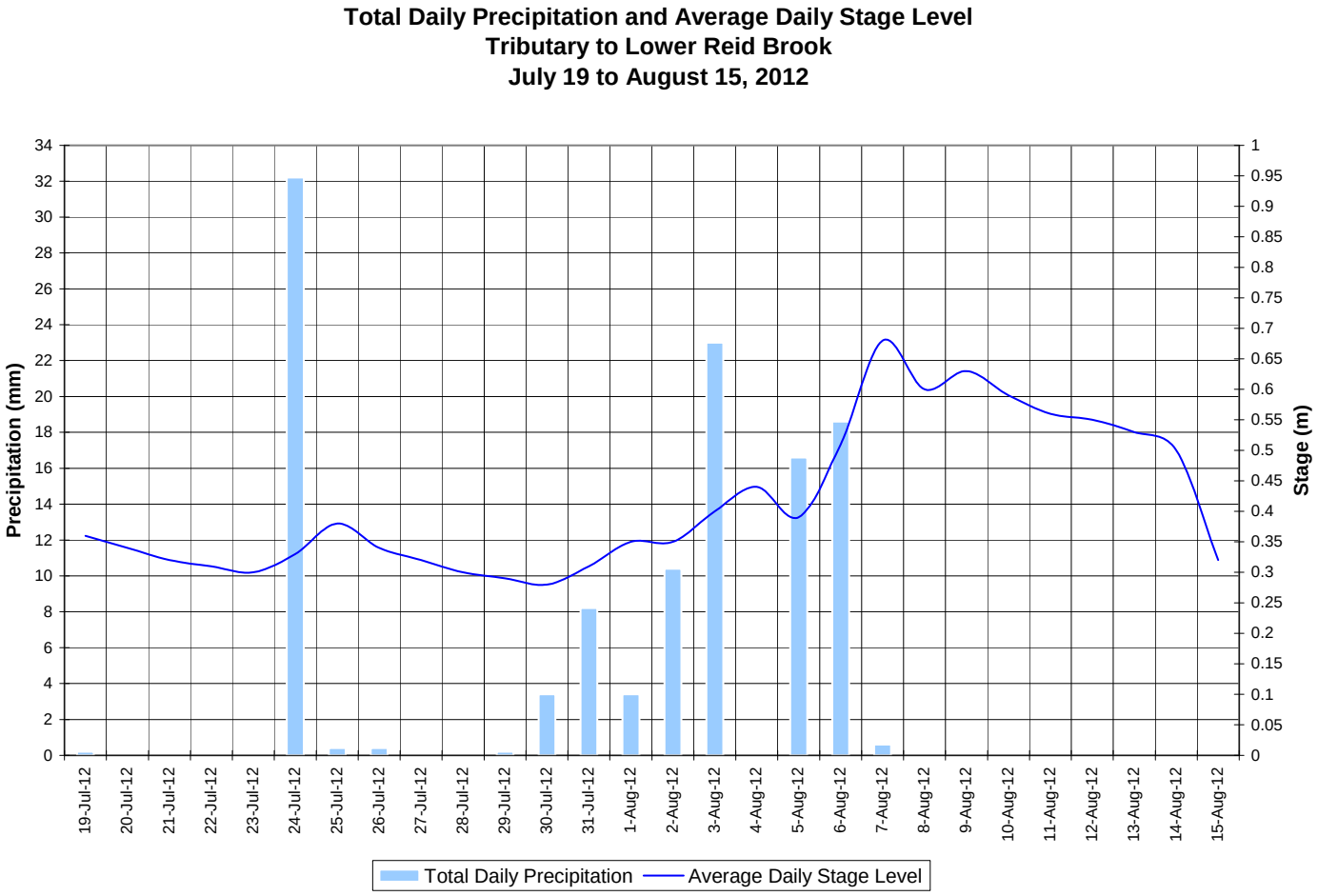

Figure 14: Average Daily Stage and Daily Precipitation at Tributary to Lower Reid Brook

Lower Reid Brook

- Water temperature ranges from 8.73 °C to 16.73°C during the deployment period (Figure 15).
- Water temperature is increasing slightly throughout the first half of the deployment period. This trend is expected given the warm ambient air temperatures in the summer season (Figure 16).
- Water temperature fluctuates diurnally. Average water temperature is 13.89°C for the deployment period.
- There are sharp decreases in water temperature on July 23-24 and August 2-3. These decreases correspond with cool air temperatures and significant rainfall events. These decreases are also noticeable at stations Tributary to Lower Reid Brook and Camp Pond Brook.

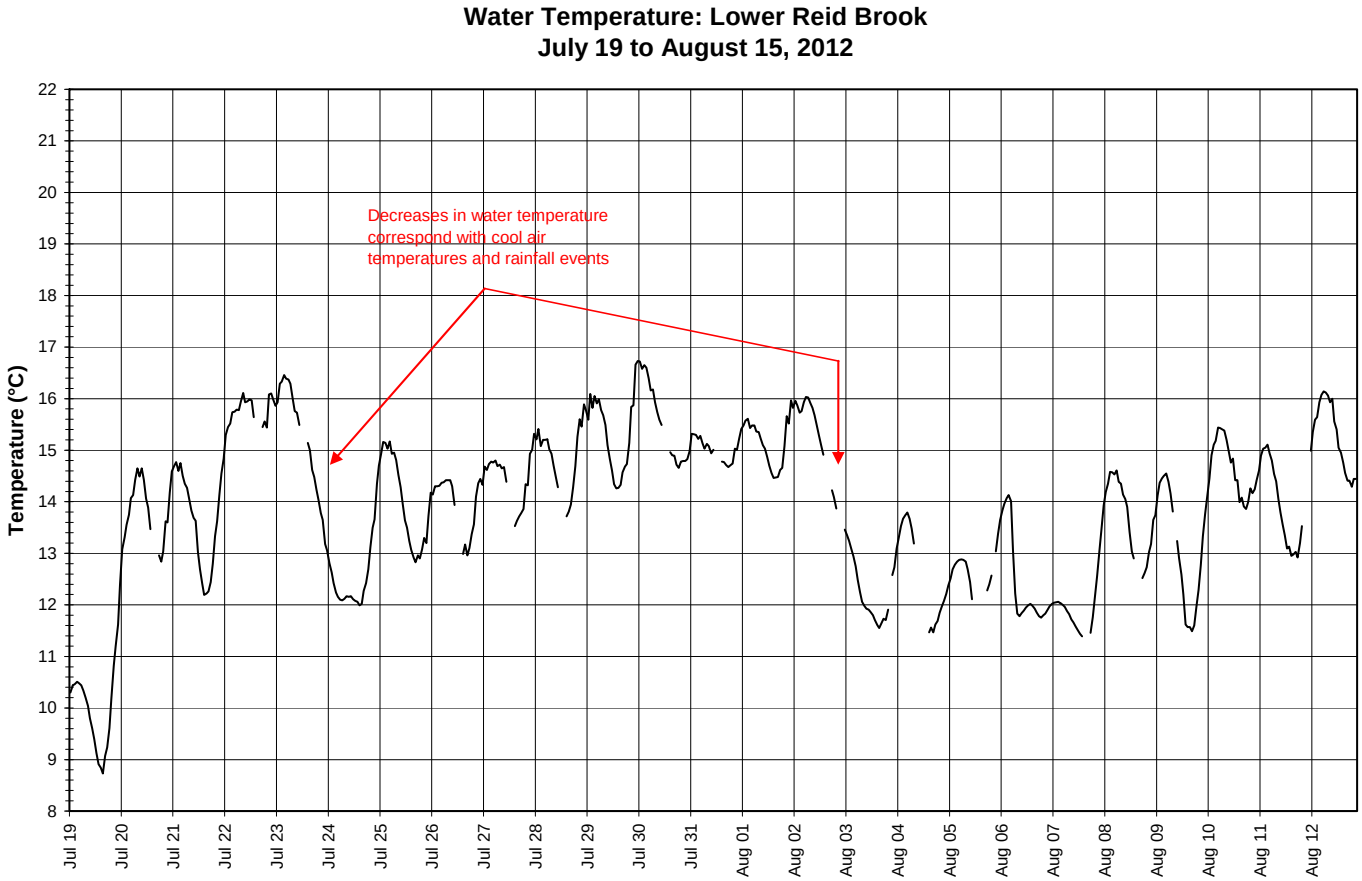

Figure 15: Water temperature at Lower Reid Brook

- Average daily air and water temperatures are increasing and decreasing throughout the deployment period (Figure 16). Increases and decreases in air temperature are reflected in water temperatures. Air temperatures generally increase and decrease faster while water temperatures increase and decrease more slowly over time.

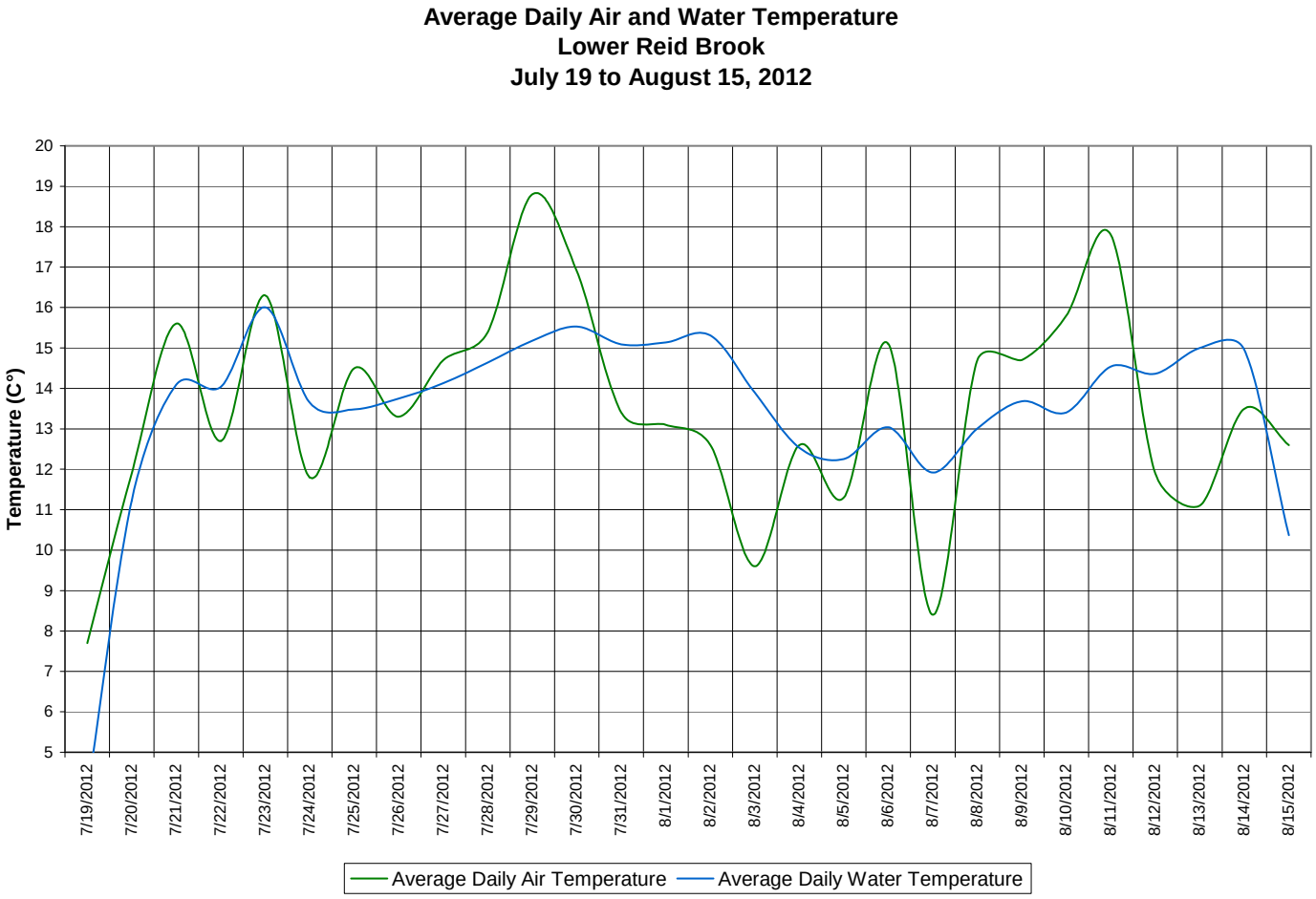

Figure 16: Average daily air and water temperatures at Lower Reid Brook

(weather data recorded at Nain)

- pH ranges between 6.51 and 7.47 pH units (Figure 17).
- Stage is included on Figure 17 to show the relationship between water level and pH. Stage increases on August 6 cause pH to decrease for a period of 1 day. This increase in stage corresponds with a rainfall event.
- All values are within the recommended range for pH as suggested by the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 17).

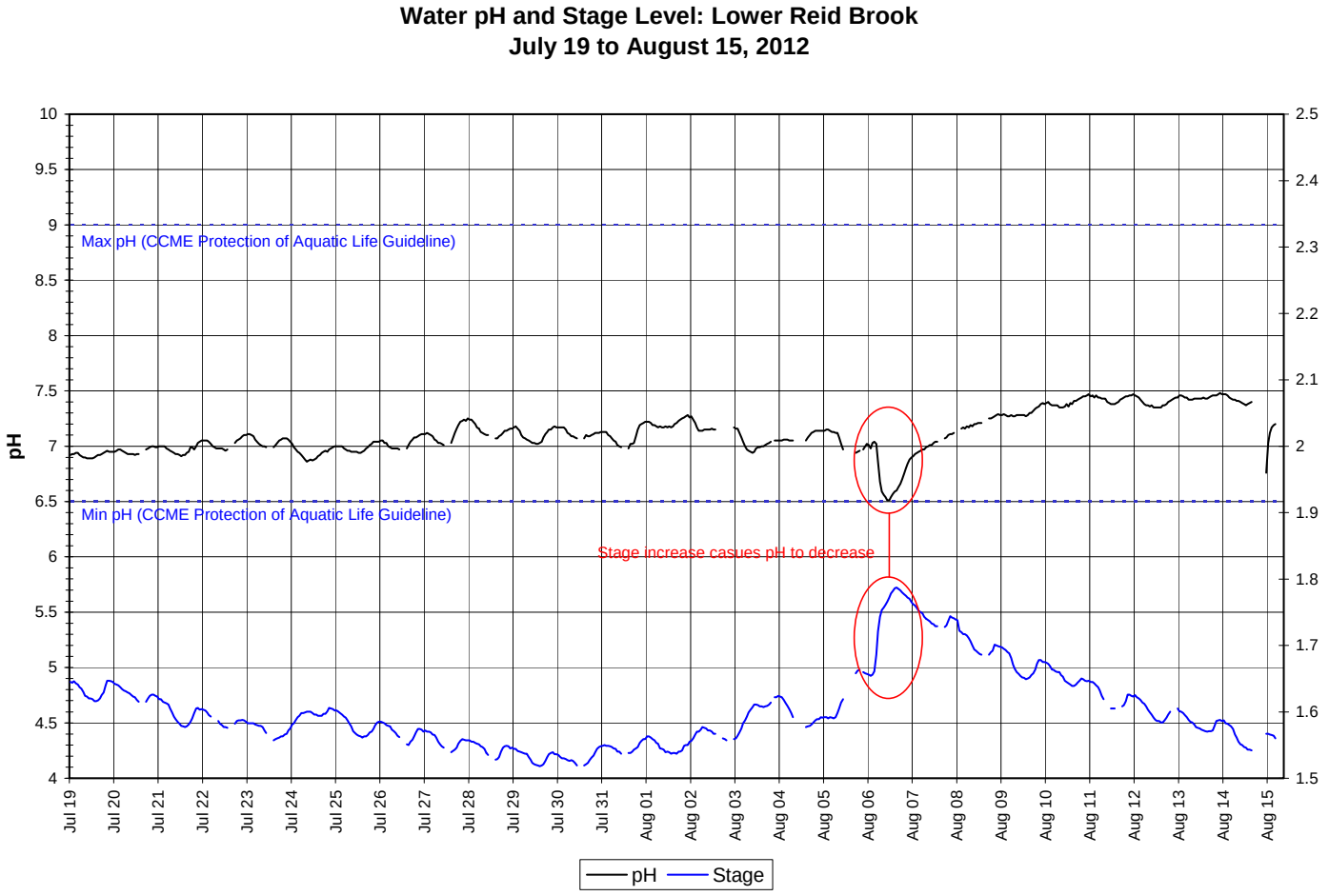

Figure 17: pH and stage level at Lower Reid Brook

- Specific conductivity ranges between 18.0µS/cm and 29.0µS/cm (Figure 18).
- Stage is included in Figure 18 to illustrate the inverse relationship between conductivity and water level. Stage is decreasing slightly throughout the first half of the deployment period while specific conductivity is increasing. On August 6, stage increases due to a rainfall event and specific conductivity decreases sharply. Generally, as stage increases, specific conductivity generally decreases due to the dilution of dissolved solids in the water column. Inversely, as stage decreases, specific conductivity increases as the concentration of dissolved solids increases.

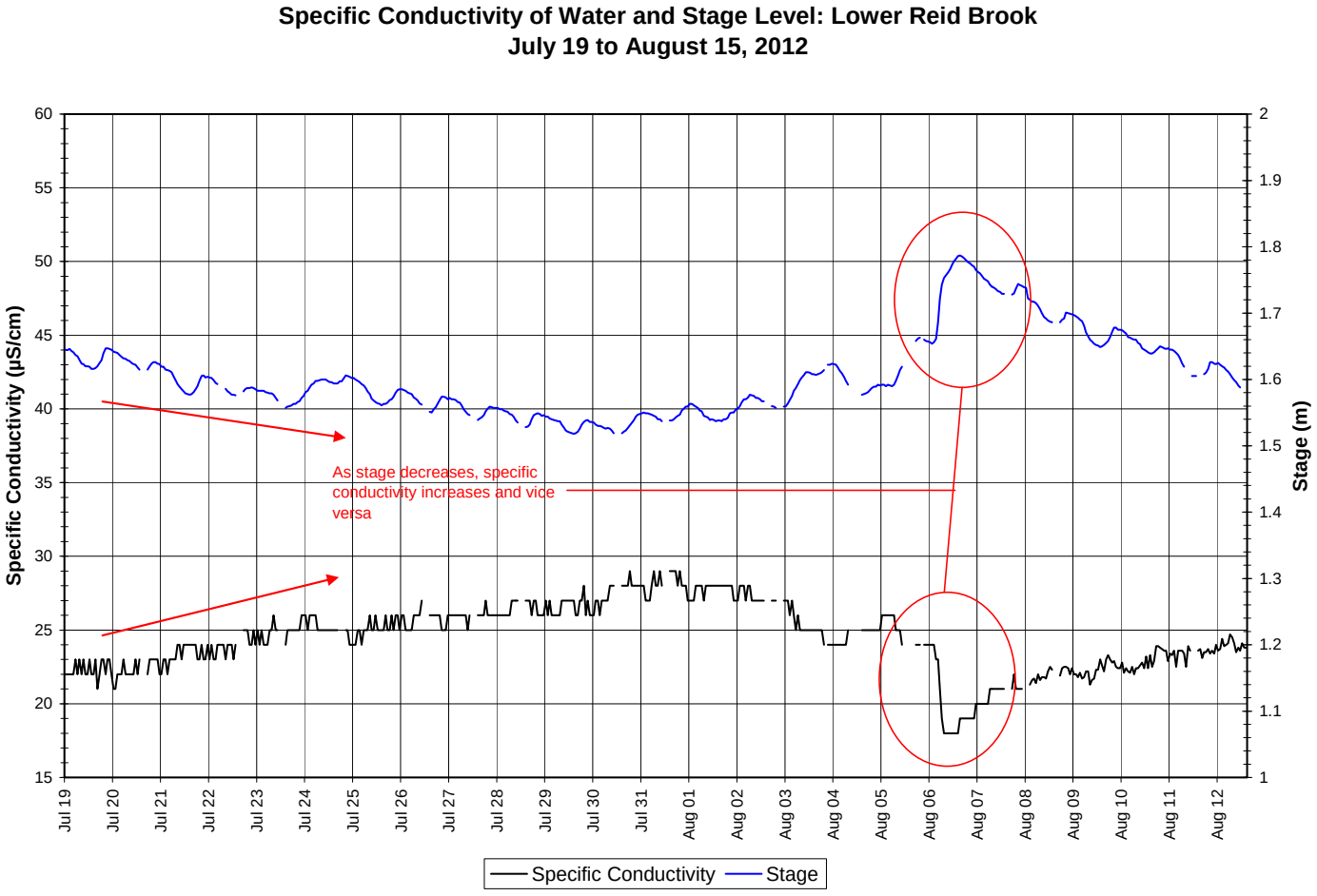

Figure 18: Specific conductivity and stage level at Lower Reid Brook

- Dissolved oxygen content ranges between 9.36g/L and 11.31mg/L. The saturation of dissolved oxygen ranges from 94.4% to 101.5% (Figure 19).
- All values are above the minimum CCME Guideline for the Protection of Cold Water Biota at Other Life Stages (6.5mg/l) and most values are above the guideline for Early Life Stages (9.5 mg/l). The guidelines are indicated in blue on Figure 19. Average dissolved oxygen content is 10.09mg/l for the deployment period.
- Dissolved oxygen content is fluctuating but relatively stable throughout the deployment period.

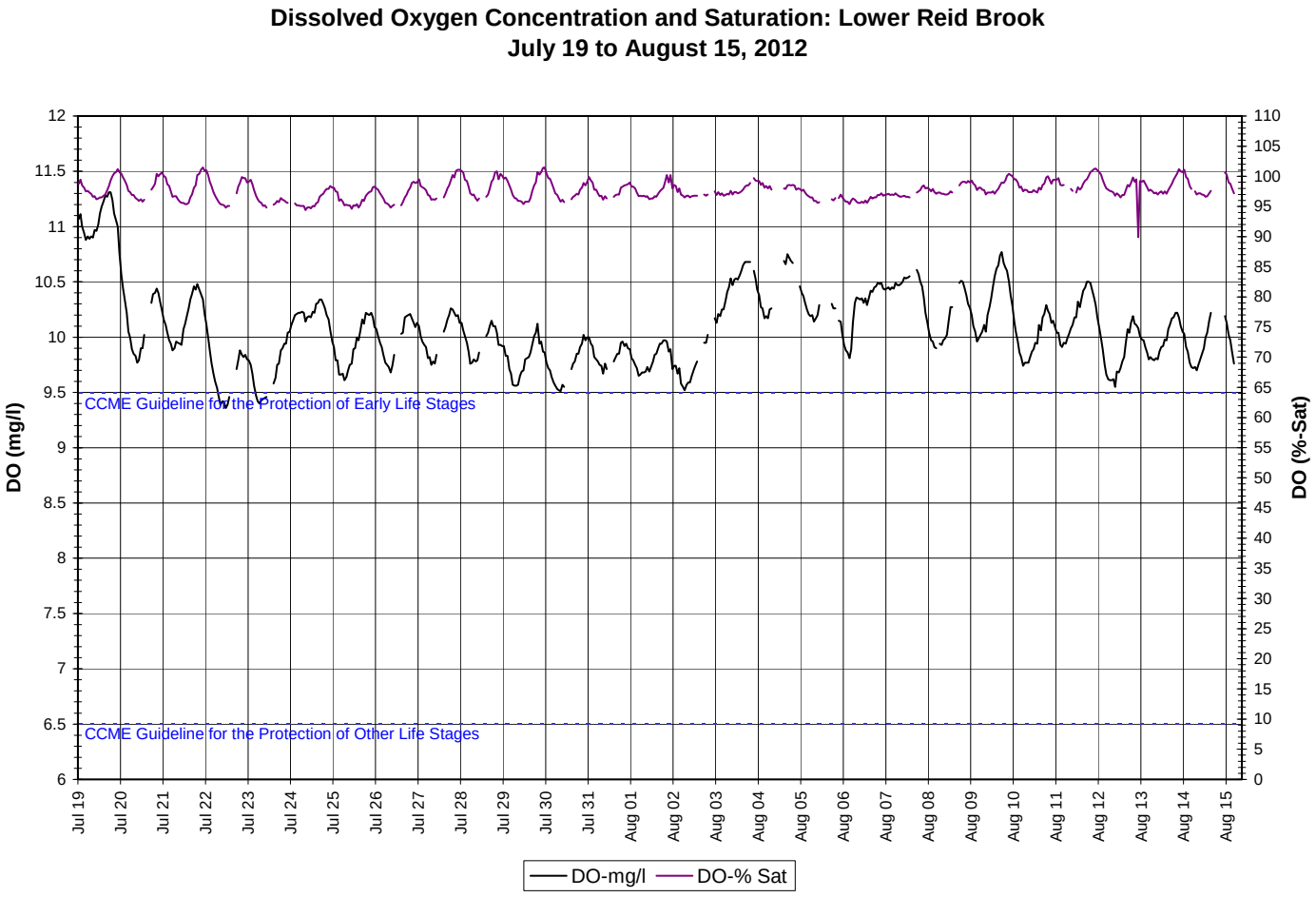

Figure 19: Dissolved oxygen and percent saturation at Lower Reid Brook

- Turbidity ranges between 0 and 81.9NTU throughout the deployment period (Figure 20). A median value of 0.0 indicates there is no natural background turbidity data for this deployment period.
- Turbidity remains 0NTU for much of the deployment period with a few short-lived increases. On July 24, and August 2, 3, and 5-7 turbidity increases to as high at 81.9NTU. These increases correspond with rainfall events and/or increases in stage.

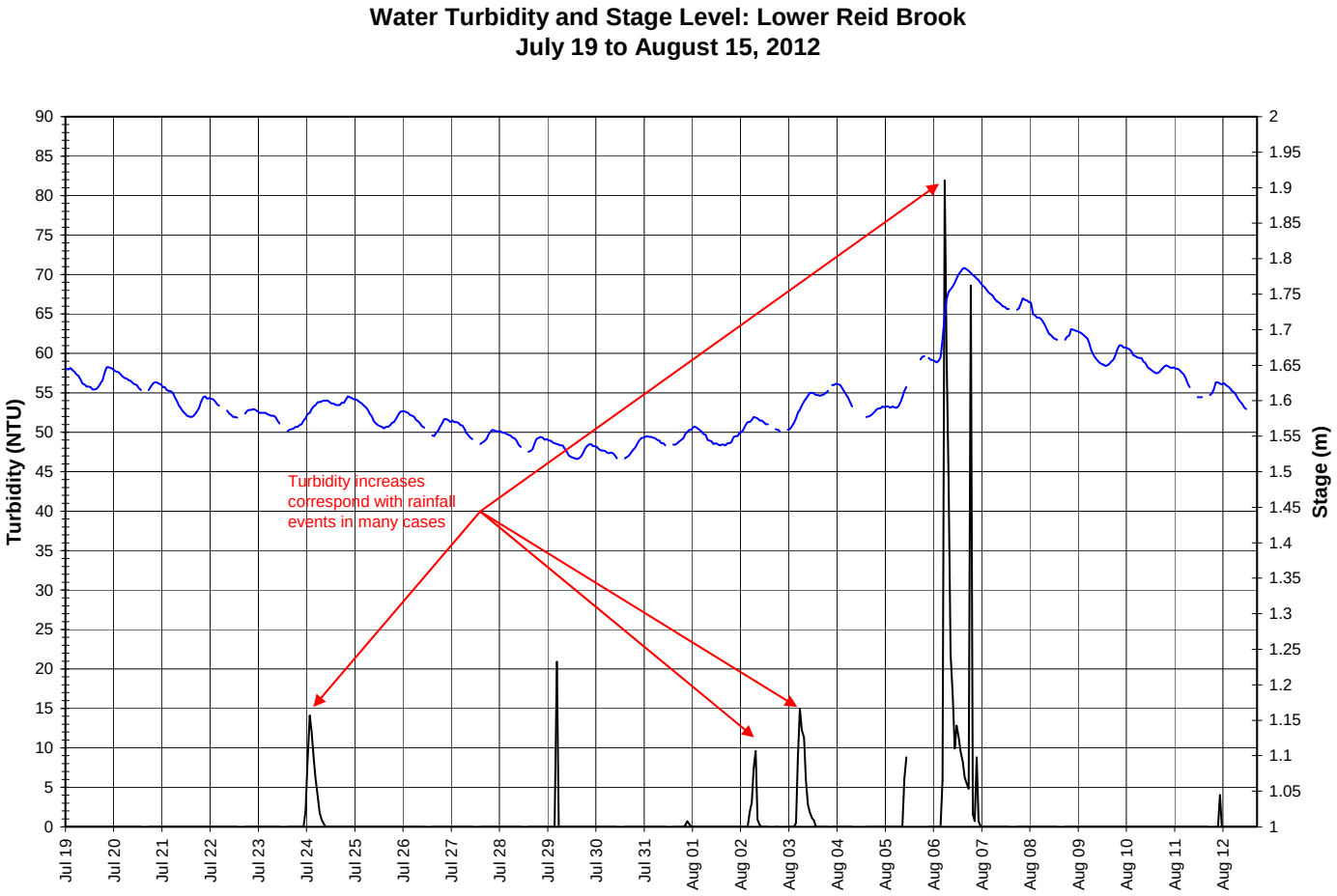

Figure 20: Turbidity and stage level at Lower Reid Brook

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 21). Stage is generally stable for much of the deployment period and then increases and decreases in the last ten days of the deployment. Precipitation events are infrequent but moderate in magnitude.

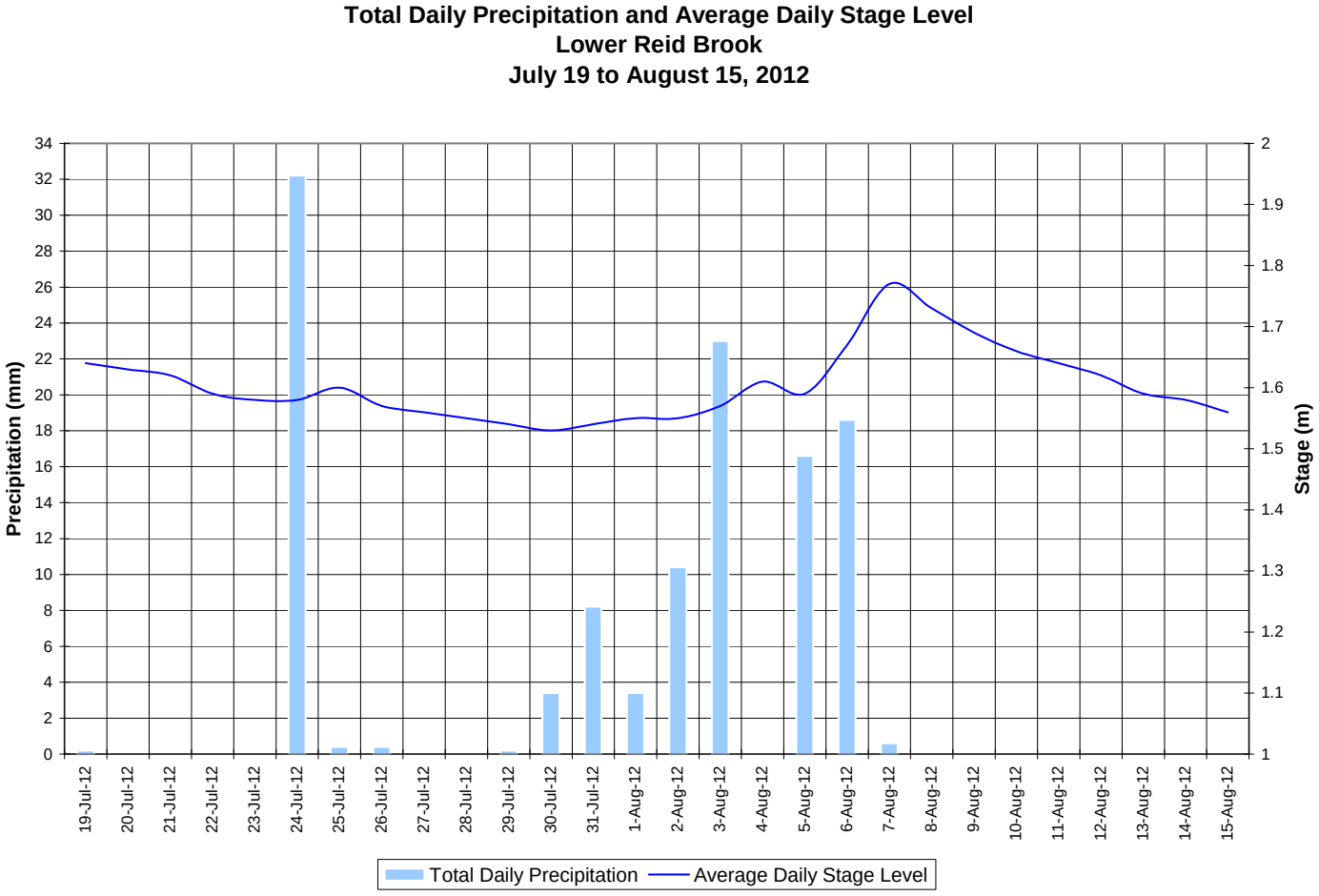

Figure 21: Daily precipitation and average daily stage level at Lower Reid Brook

(weather data recorded at Nain)

Camp Pond Brook

- Data collected from this station was sporadic throughout the deployment period. Transmissions often cut out for 3 to 12 hour periods. Environment Canada was on site to try and rectify the problem on August 6. Data from the instruments internal log file is used in most cases for Figures 22-27 and for discussions.

- Water temperature ranges from 11.87 °C to 20.01°C during the deployment period (Figure 22).
- Water temperature is generally increasing throughout the first half of the deployment period. This trend is expected given the warm ambient air temperatures in the summer season (Figure 23).
- Water temperature fluctuates diurnally. Average water temperature is 16.67°C for the deployment period.
- There are sharp decreases in water temperature on July 23-24 and August 2-3. These decreases correspond with cool air temperatures and significant rainfall events. These decreases are also noticeable at stations on Lower Reid Brook and Tributary to Lower Reid Brook.

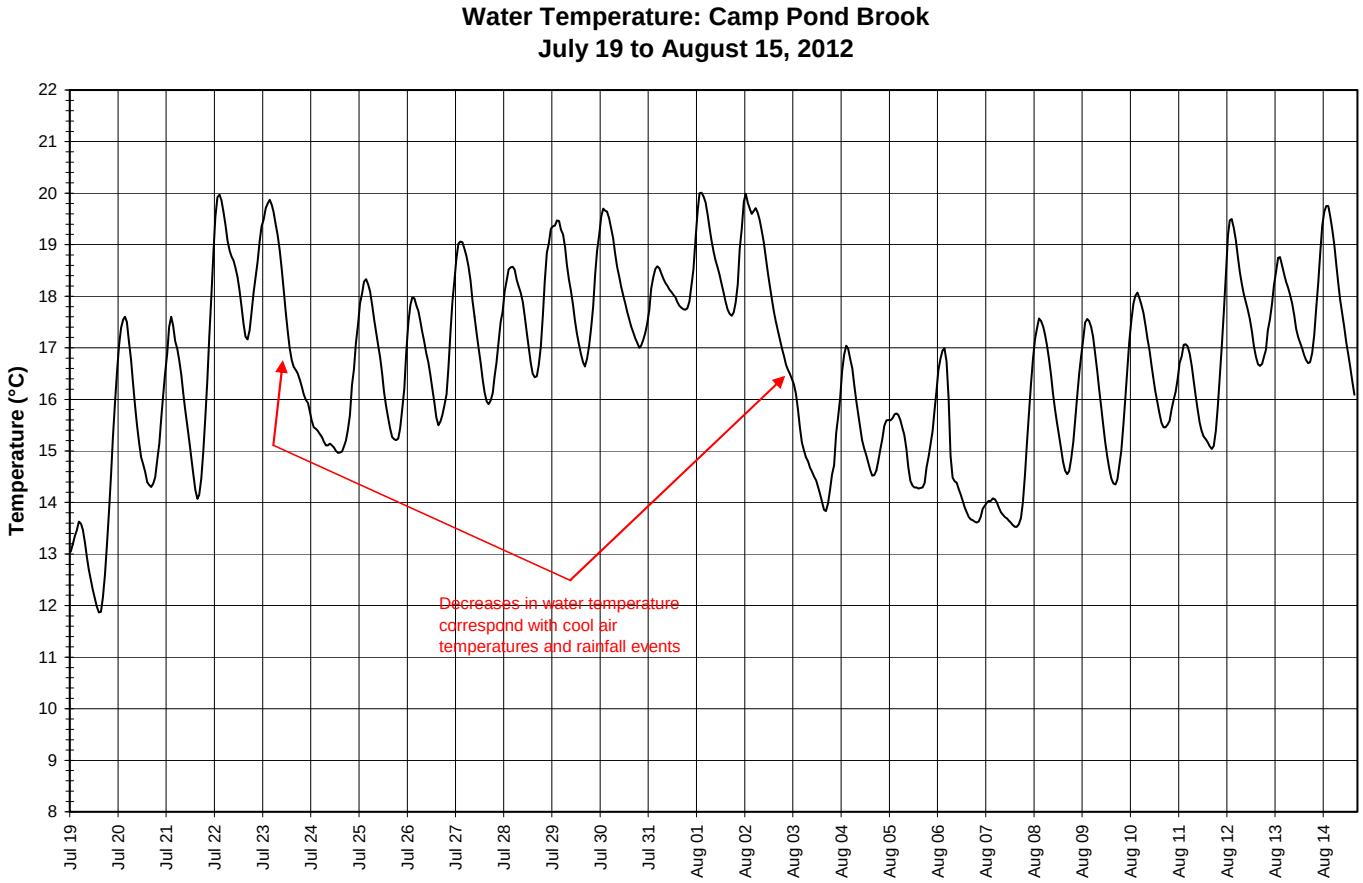

Figure 22: Water temperature at Camp Pond Brook

- Average daily air and water temperatures are generally increasing throughout the first two weeks of the deployment period (Figure 23). Fluctuations in average daily air temperatures are reflected by slight changes in water temperature. Air temperatures generally increase and decrease faster while water temperatures increase and decrease more slowly over time.

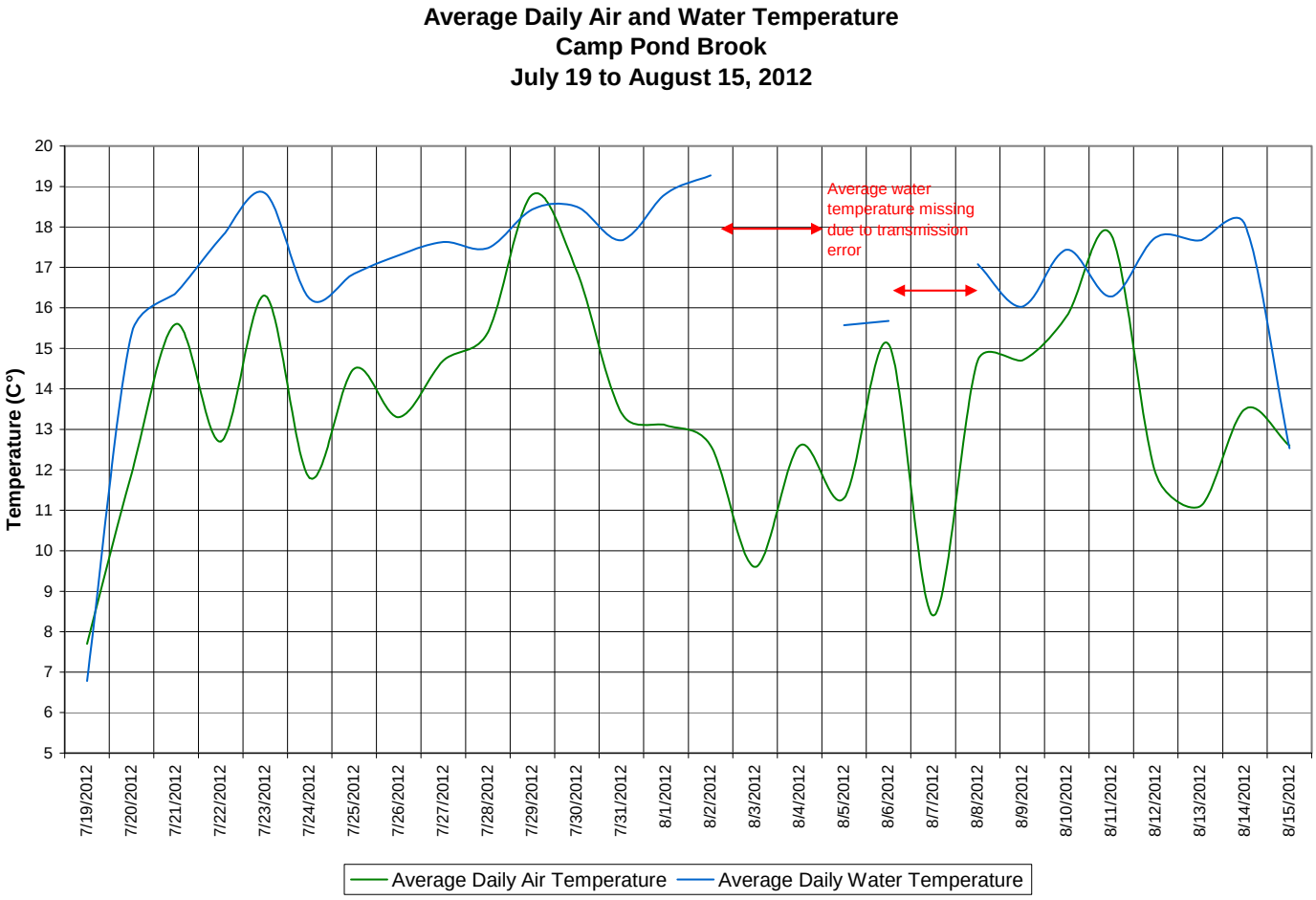

Figure 23: Average daily air and water temperatures at Camp Pond Brook

(weather data recorded at Nain)

- pH ranges between 6.89 and 7.44 pH units (Figure 24).
- pH values are stable with daily fluctuations throughout the deployment period.
- There is a slight decrease in pH on August 6-7 during a rainfall event. Stage data is sporadic during this event.
- All values are within the recommended range for pH as suggested by the CCME Guidelines for the Protection of Aquatic Life (indicated in blue on Figure 24).

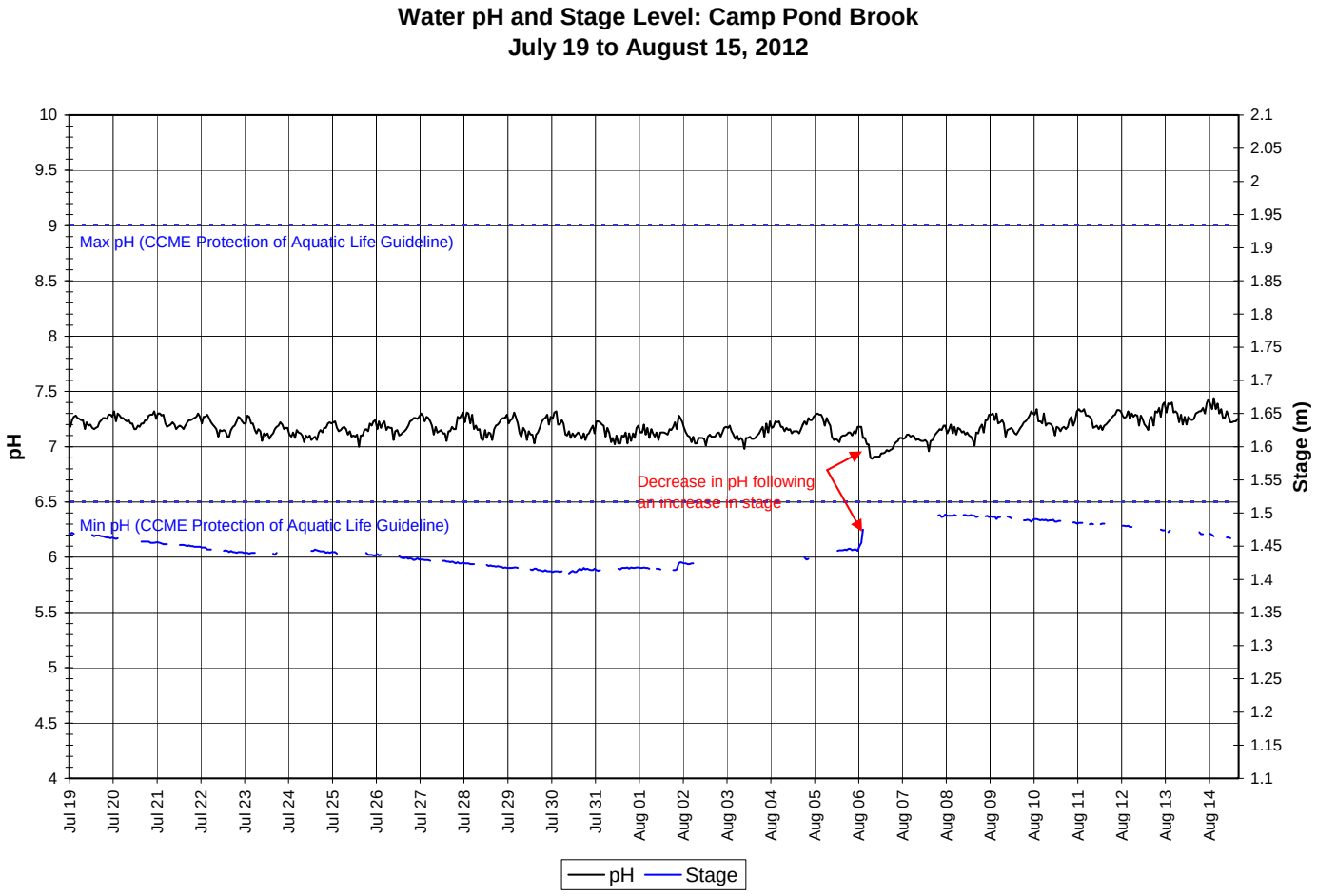

Figure 24: pH and stage level at Camp Pond Brook

- Specific conductivity ranges from 32.0µS/cm to 54.0µS/cm during the deployment period (Figure 25).
- Stage is included in Figure 25 to illustrate the inverse relationship between conductivity and water level. Stage data is sporadic and many increases and decreases are not captured. From patterns at the surrounding stations and rainfall data, it is assumed that this station also experienced stage level increases on July 24 and August 2-3, 5-6. Typically, stage level increase causes decreases the specific conductivity of the water by diluting the concentrations of dissolved solids present in the water column, however, in these instances, there is an increase in specific conductivity during when stage is expected to have risen (indicated by red arrows in Figure 25). This pattern has been experienced at this station in the past.

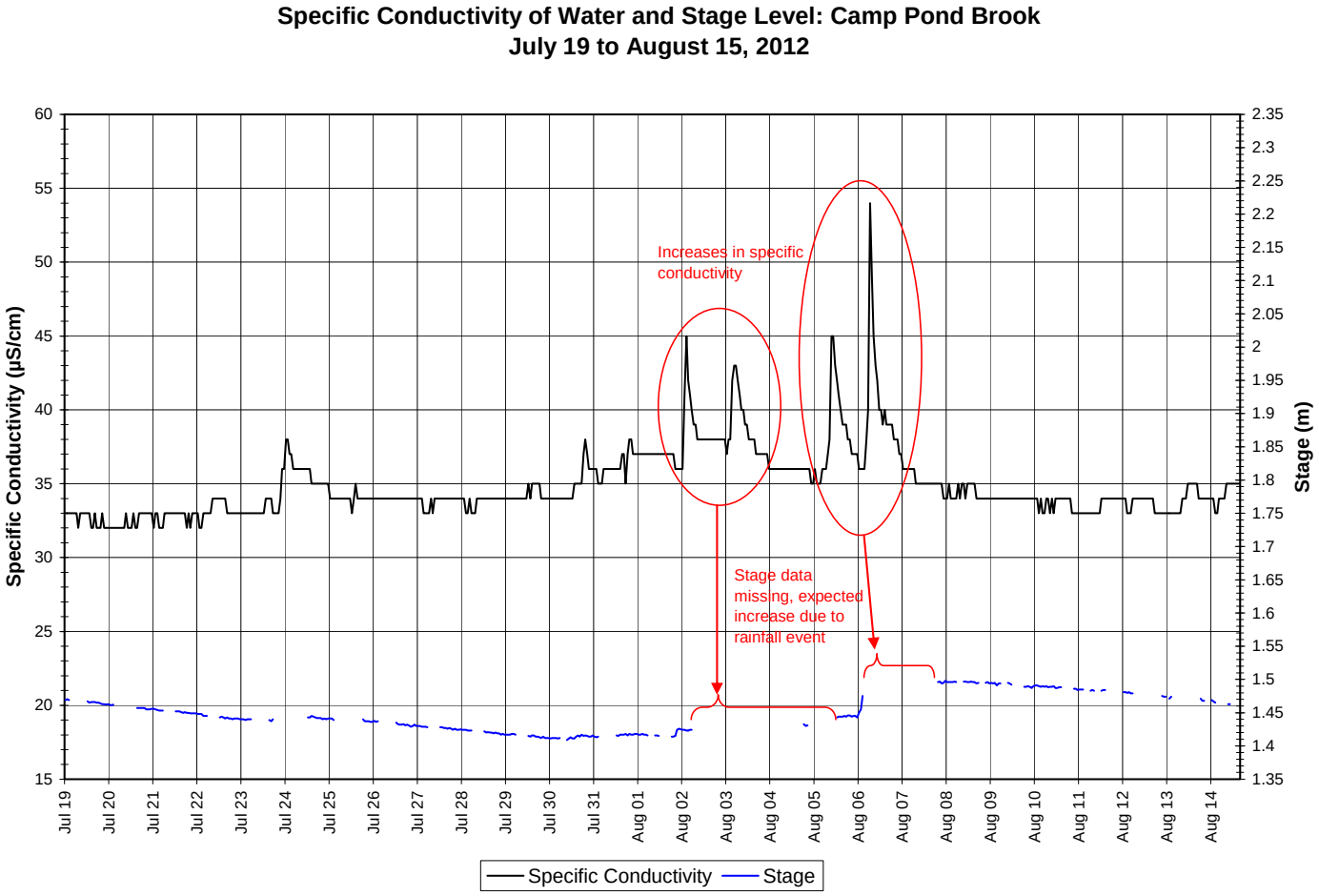

Figure 25: Specific conductivity and stage level at Camp Pond Brook

- Dissolved oxygen content ranges between 8.61mg/L and 10.31mg/L. The saturation of dissolved oxygen ranges from 90.4% to 101.7% (Figure 26).
- All values are above the minimum CCME Guideline for the Protection of Cold Water Biota at Other Life Stages (6.5mg/l) and most values are just below the minimum guideline for Early Life Stages (9.5mg/l). Guidelines are indicated in blue on Figure 26. Average dissolved oxygen content is 9.33mg/l.
- Dissolved oxygen content is decreasing slightly throughout the deployment period. This trend is expected in response to the warm air and water temperatures (Figure 22 & 23).
- Dissolved oxygen content increases August 2-3 during a rainfall event and cool air temperatures.

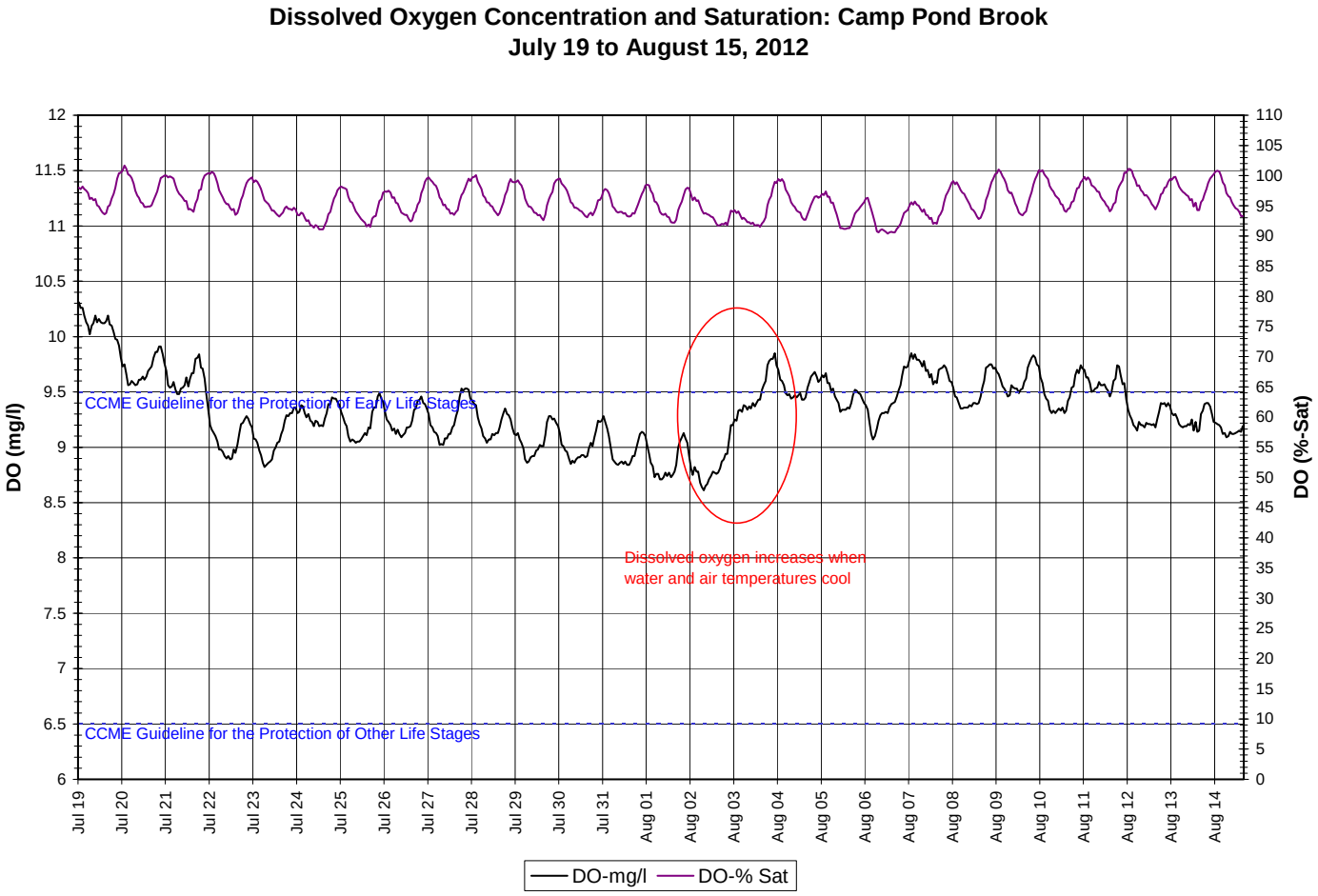

Figure 26: Dissolved oxygen and percent saturation at Camp Pond Brook

- Turbidity generally ranges between 0.0NTU to 122.50NTU (Figure 27). A median value of 0.0NTU indicates there is no consistent natural background turbidity value at this station for this deployment period.
- There are only a few instances when turbidity increases above 0NTU and each for very short periods of time. Small turbidity increases on July 24 and August 2 and 6 each correspond with rainfall events and increases in stage. The increase on August 6 lasts almost 12 hours and reaches a high turbidity value of 122.5NTU.

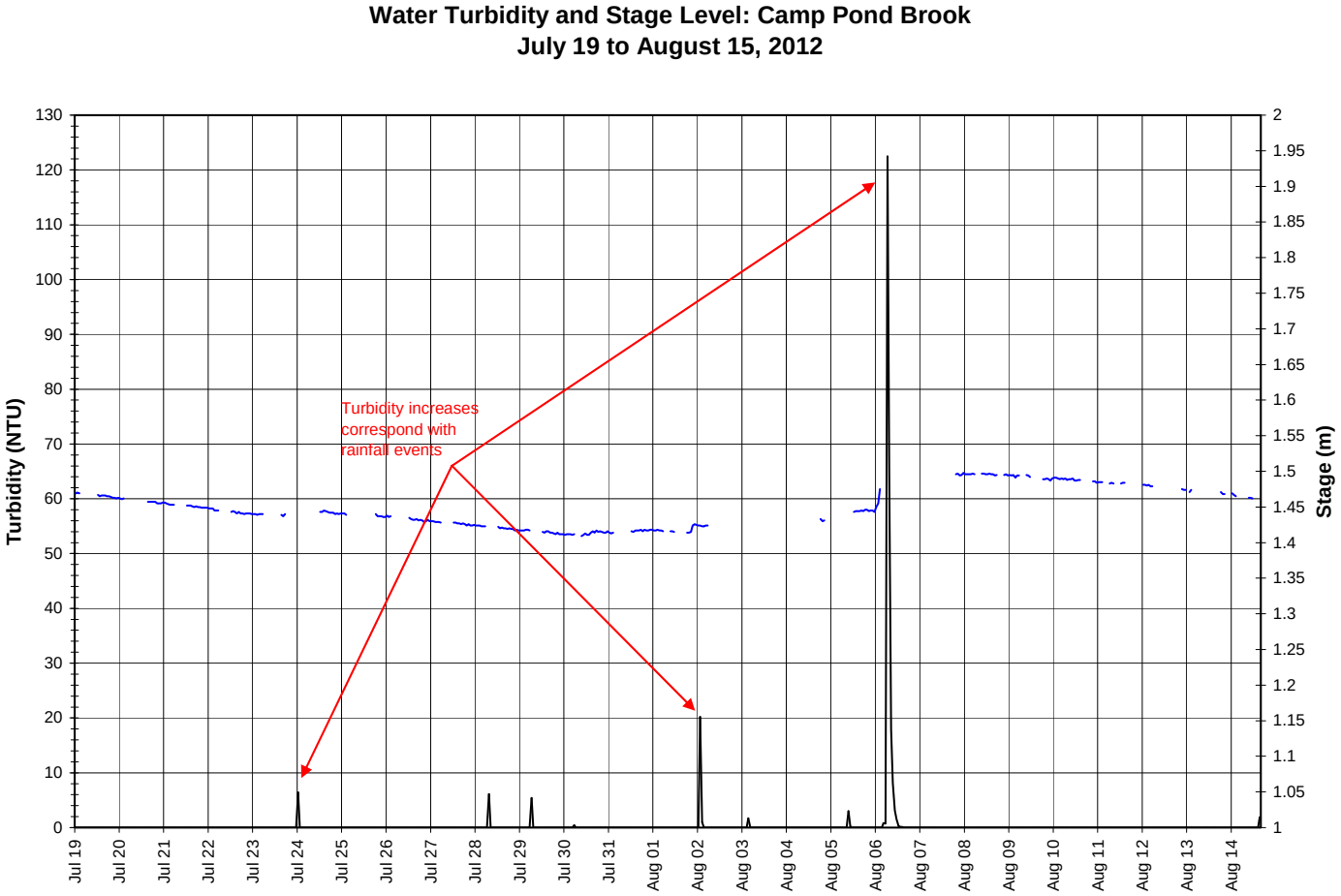

Figure 27: Turbidity and stage level at Camp Pond Brook

- Stage and precipitation are graphed below to show the relationship between rainfall and water level (Figure 28). Stage is generally stable throughout the deployment period. Precipitation events are infrequent but moderate in magnitude.

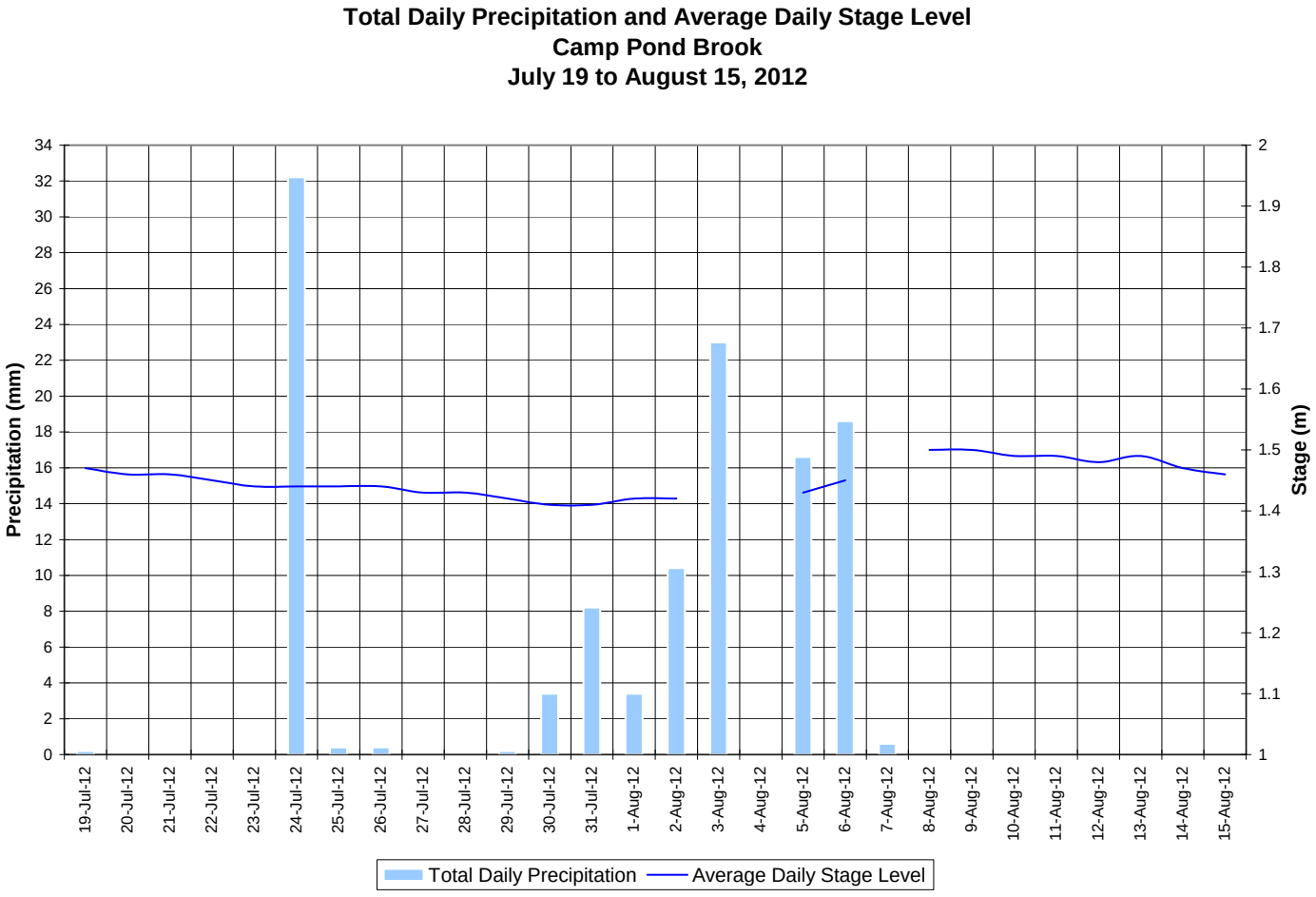

Figure 28: Daily precipitation and average daily stage level at Camp Pond Brook

(weather data recorded at Nain)

Conclusions

- Instruments at water quality monitoring stations in the Voisey's Bay Network were deployed from July 19 to August 15, 2012.

Summary by Station

- At Upper Reid Brook, water temperature fluctuated throughout the deployment period. pH was neutral, specific conductivity was low and were both very stable. Dissolved oxygen increased and decreased slightly in response to the changing air and water temperatures. Turbidity remained at 0NTU. Stage levels decreased for first the half of the deployment before increasing for a week and then decreasing again.
- At Tributary to Lower Reid Brook, temperature and dissolved oxygen fluctuated diurnally and in response to changing weather conditions. pH and specific conductivity fluctuated in response to changing water levels. Turbidity was mainly 0NTU except for a few short lived increases that corresponded with rainfall events. Stage levels are stable for the first half of the deployment and increase in the third week. In the final week, stage levels begin to decrease again.
- At Lower Reid Brook, temperature and dissolved oxygen also fluctuated diurnally as well as in response to changing weather conditions. pH and specific conductivity fluctuated in response to changing water levels. Turbidity remained mostly at 0NTU except for a few increases that corresponded with rainfall events. Stage levels were also similar to those at the station on the tributary to Lower Reid Brook, where generally water levels were stable for the first half of the deployment period before increasing in the third week. In the final days of this deployment period, stage levels began to drop off again.
- At Camp Pond Brook, water temperatures increased slightly while dissolved oxygen values decreased slightly in the first half of the deployment period. pH and specific conductivity values were mostly stable but some times fluctuated with changing water levels and rainfall events. Specific conductivity did not portray a typical inverse relationship with stage level. Instead of seeing specific conductivity decrease with increasing stage, specific conductivity increased when stage increased. Turbidity events were rare, short and low in magnitude. Stage levels increased and decreased throughout the deployment period. Some stage data is missing due to numerous short transmission errors.

Summary by Parameter

- Temperature averaged between 13.4°C (Tributary) and 16.7°C (Camp Pond Brook) at the 4 stations in the Voisey's Bay Network. Temperature fluctuated at all stations throughout the deployment period with a few notable decreases especially around August 2-3 when cool air temperatures and a significant rainfall event were recorded in the area. Water temperature is most stable at the Upper Reid Brook station because of the lake environment from which the water flows.
- pH values averaged between 6.87 (Tributary) and 7.18 (Camp Pond Brook) pH units across the network. Most values recorded were within the recommended range as stated by the CCME Guideline for the Protection of Aquatic Life. At stations at Tributary to Lower Reid Brook, Lower Reid Brook, and Camp Pond

Brook, increases in stage level (by rainfall events) caused noticeable decreases in pH. pH is very stable at the station on Upper Reid Brook.

- At Tributary to Lower Reid Brook, Lower Reid Brook and Camp Pond Brook stations, specific conductivity averaged between 24.5µS/cm (Lower Reid Brook) and 34.9µS/cm (Camp Pond Brook). Values at Upper Reid Brook were considerably lower averaging 10.7µS/cm. These lower values are expected from this pristine station at the outflow from Reid Pond. Values at this station tend not to fluctuate a lot even with changing stage levels. At Tributary to Lower Reid and Lower Reid Stations, specific conductivity displayed a clear inverse relationship with stage level, with values decreasing when stage level increased. At Camp Pond Brook, specific conductivity increased sharply when the stage level increased which is a trend normally seen at this station.
- Dissolved oxygen levels averaged between 10.02 and 10.20mg/l at station on Upper Reid Brook, Tributary to Lower Reid Brook and Lower Reid Brook. Most values recorded at these stations were above both the minimum CCME Guideline for the Protection of Aquatic Life at Other Life Stages (6.5mg/l and for Early Life Stages (9.5mg/l). Dissolved oxygen content averaged 9.33mg/l at the station on Camp Pond Brook. All values were above the minimum CCME Guideline for the Protection of Aquatic Life at Other Life Stages (6.5mg/l) and just slightly below the guideline for Early Life Stages (9.5mg/l). Dissolved oxygen content fluctuated diurnally and in response to changing water temperatures at all stations throughout the deployment period.
- Turbidity values remained at 0NTU for the entire deployment period at the station at Upper Reid Brook. At stations on the Tributary to Lower Reid Brook, Lower Reid Brook and Camp Pond Brook, turbidity generally remained at 0NTU with the exception of a few increases that were short in duration and relatively low in magnitude. Each of these increases usually corresponded well with rainfall events recorded in the area.
- Stage generally remained stable or decreased slightly in the first half of the deployment period at all stations. In the third week of the deployment period, stage tended in increase slightly at all stations and then decrease or level off again in the final days of the deployment. Total stage fluctuation ranged anywhere from 50cm (Tributary) to just 9cm (Camp Pond Brook) over the deployment period. Precipitation events were infrequent but moderate in magnitude.

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Appendix 1: Weather Data – Environment Canada Historical Climate Database