Real-Time Water Quality Deployment Report

Rattling Brook Network

May 11, 2012 to July 3, 2012

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

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2012-05-11 to 2012-07-03

General

- Department of Environment and Conservation staff monitors the real-time web pages consistently.
- This deployment report describes water quality events from May 11th to July 3rd, 2012 – a period of 52 days (note: Big Pond's instrument was switched out on May 10th, giving a deployment period of 53 days).

Maintenance and Calibration of Instrument

- 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.
  - Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.
  - At the end of a deployment period, a freshly cleaned and calibrated QAQC Sonde is placed *in situ*, adjacent to the Field Sonde. Values are compared between all parameters and differences are ranked for placement in Table 1.

Table 1: Qualitative QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook Big Pond	May 10, 2012	Deployment	Good	Good	Excellent	Excellent	Excellent
	July 3, 2012	Removal	Excellent	Poor*	Fair	NA	Poor†
Rattling Brook below Bridge	May 11, 2012	Deployment	Excellent	Good	Good	Excellent	Excellent
	July 3, 2012	Removal	Excellent	Excellent	Fair	Excellent	Good
Rattling Brook below Plant Discharge	May 11, 2012	Deployment	Good	Good	Good	Excellent	Good
	July 3, 2012	Removal	Fair	Excellent	Marginal	Excellent	Excellent

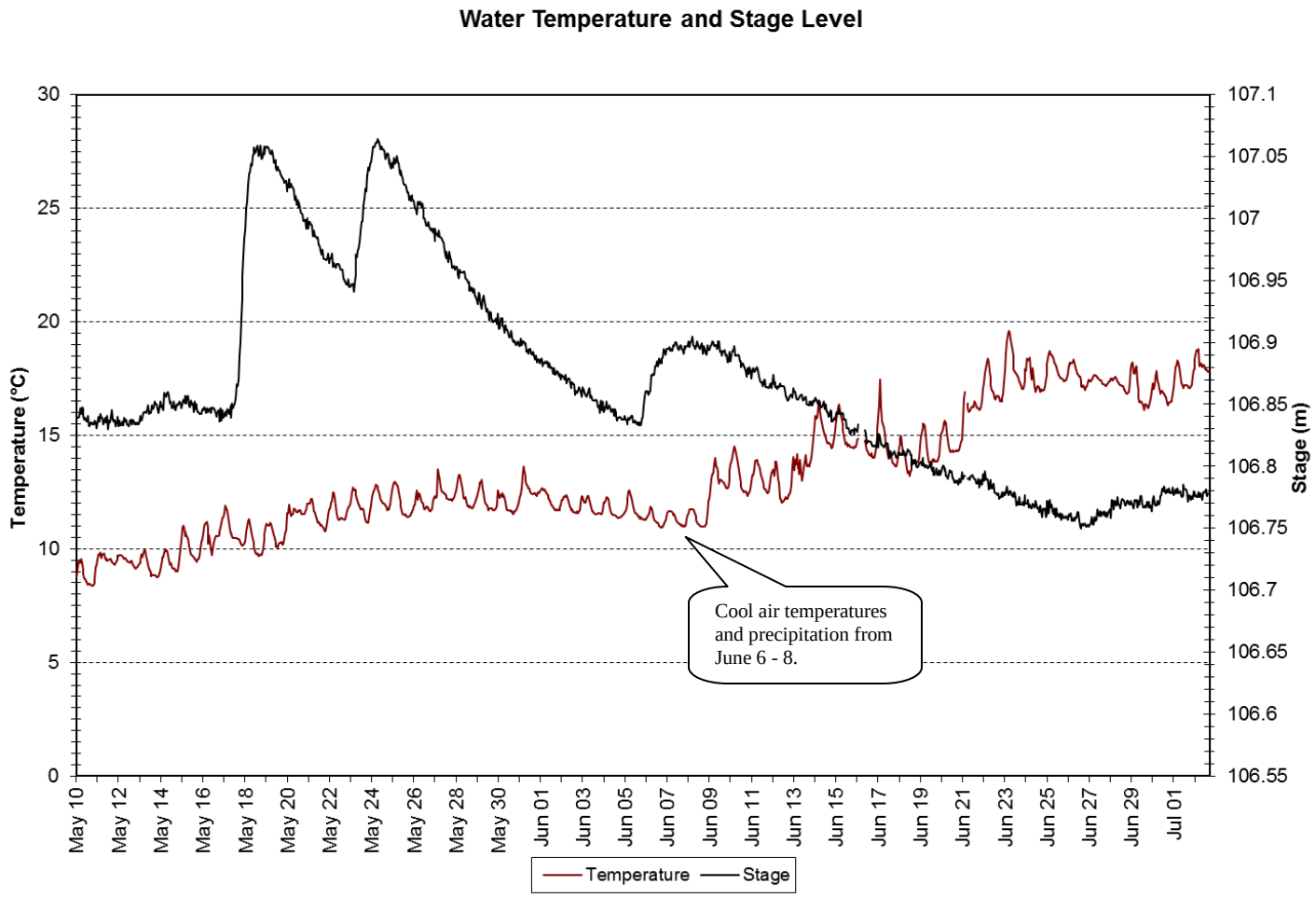
* Field Sonde read 6.98 while QAQC Sonde read 5.94.

† Probable fouling as the Field Sonde read 15.5 NTU while the QAQC sonde read 0.6 NTU. This error may be caused by silt stirred up during field maintenance since there does not appear to be error on the Big Pond turbidity graph included below.

Data Interpretation

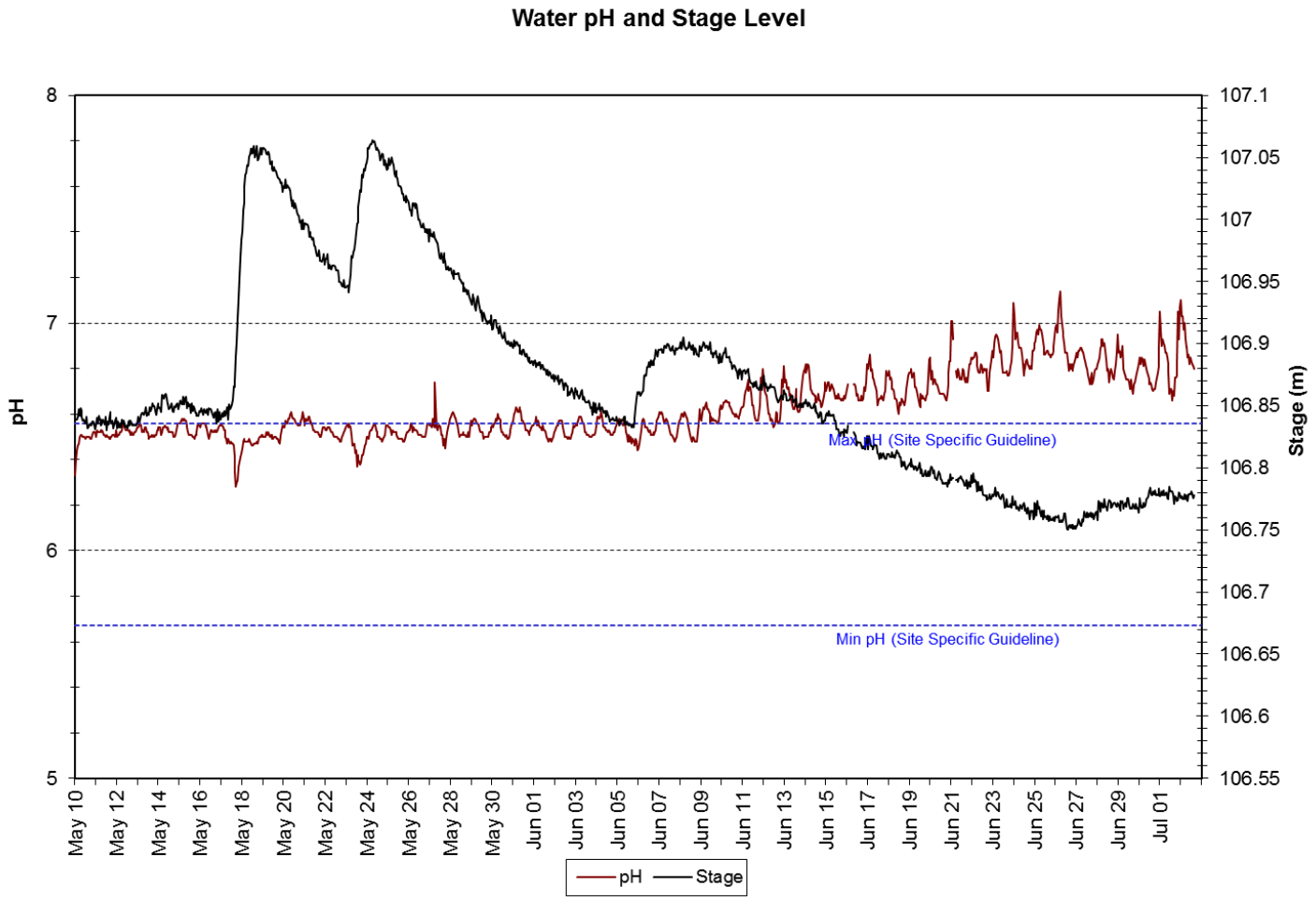
Rattling Brook Big Pond

Figure 1: Water Temperature at Rattling Brook Big Pond from May 10, 2012 to July 3, 2012



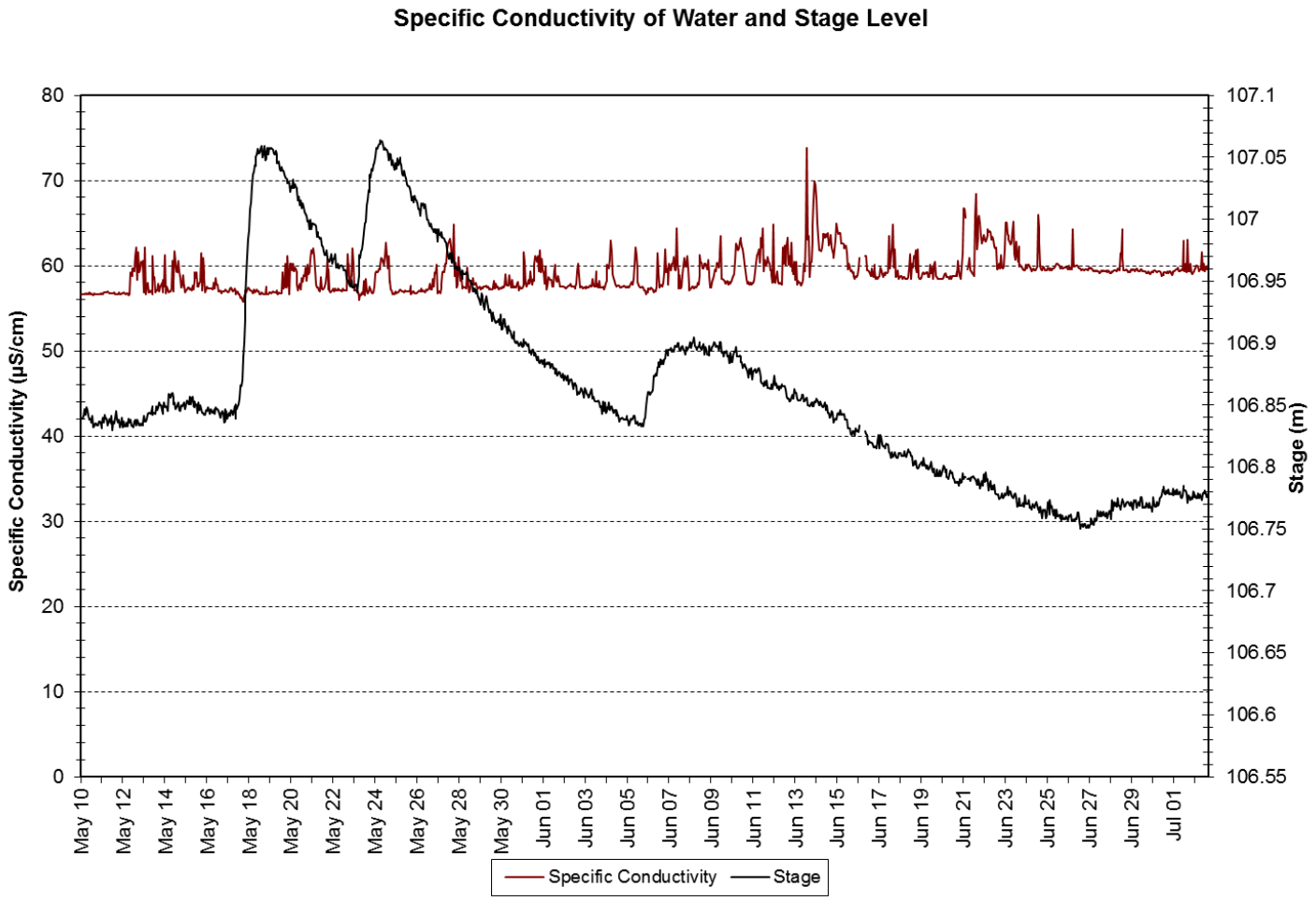
- Water temperature steadily increased from 8.39°C to 19.61°C from early May to July with a median value of 12.36°C. A slight decline in temperature was observed in early June with precipitation and daytime mean temperatures reaching 6 – 8°C.

Figure 2: pH at Rattling Brook Big Pond from May 10, 2012 to July 3, 2012



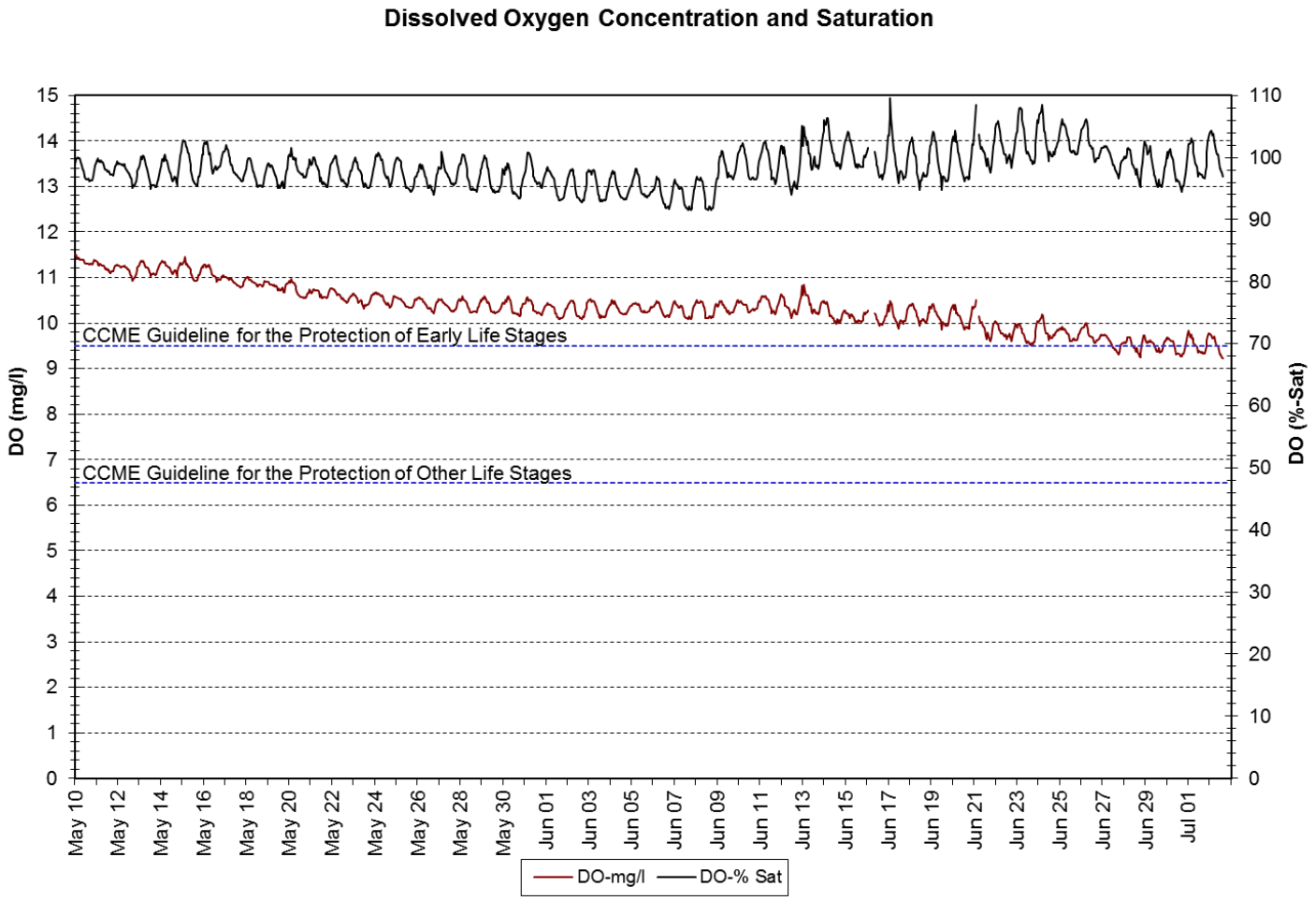
- pH was seen to increase from a low of 6.28 to a high of 7.14 (median value: 6.57). Most values were found to be at or slightly above the Site Specific Guideline of 6.56.
- As the deployment progresses, diel cycling is seen to increase as pH swings upward by day and falls overnight.

Figure 3: Specific Conductivity at Rattling Brook Big Pond from May 10, 2012 to July 3, 2012



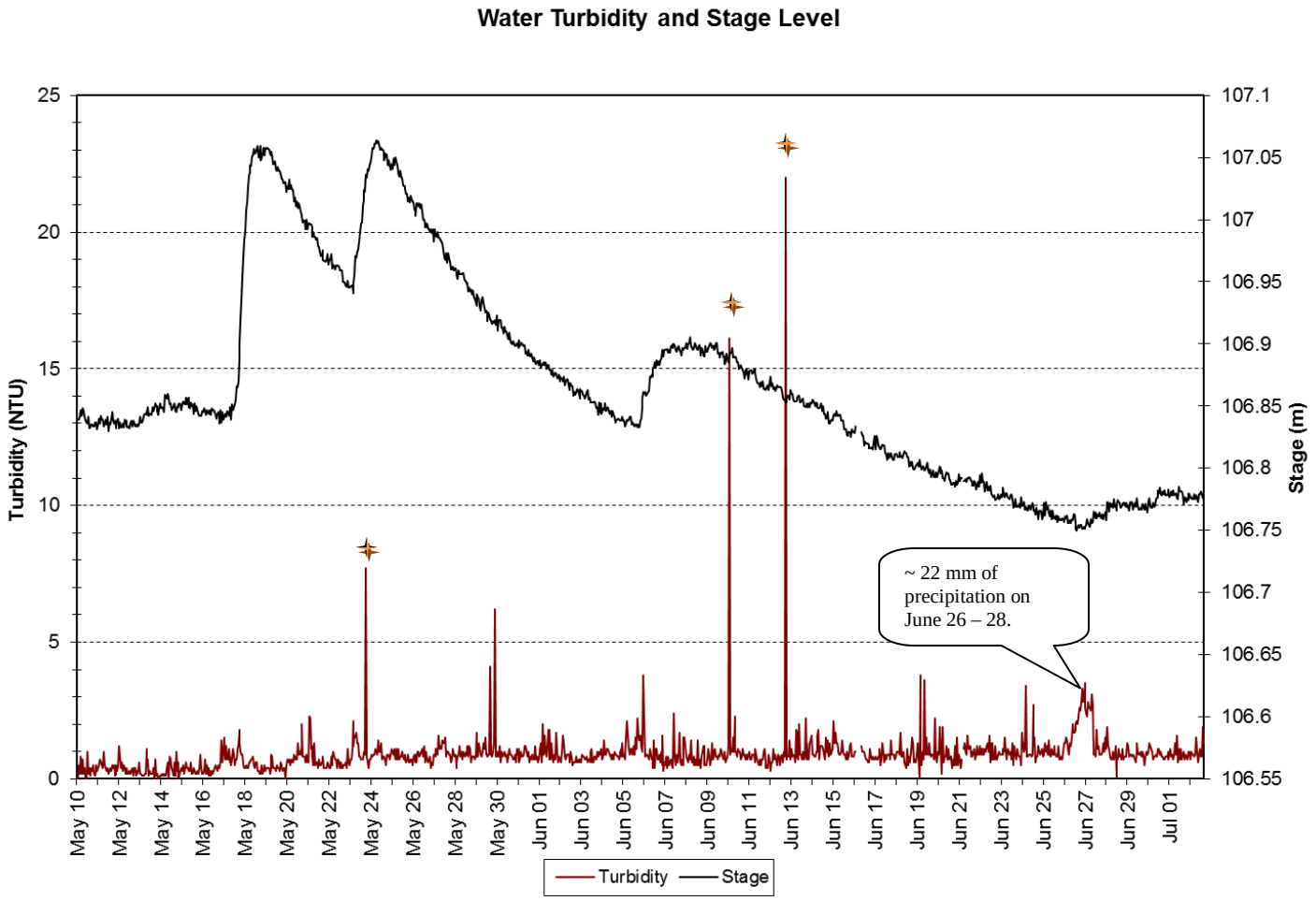
- A slight increase in conductivity is apparent from May 10th to July 3rd. Values fell between 55.8 µS/cm to 73.8 µS/cm (median value: 58.8 µS/cm). The slow rise of conductivity may be the result of low water levels and a lack of precipitation allowing for a slight concentration of dissolved salts in Big Pond.

Figure 4: Dissolved Oxygen at Rattling Brook Big Pond from May 10, 2012 to July 3, 2012



- It is expected that dissolved oxygen concentrations will decline with an increasing water temperature. In this case, DO concentrations steadily decline from a high of 11.51 mg/l seen in early May to a minimum of 9.22 mg/l seen in early July.

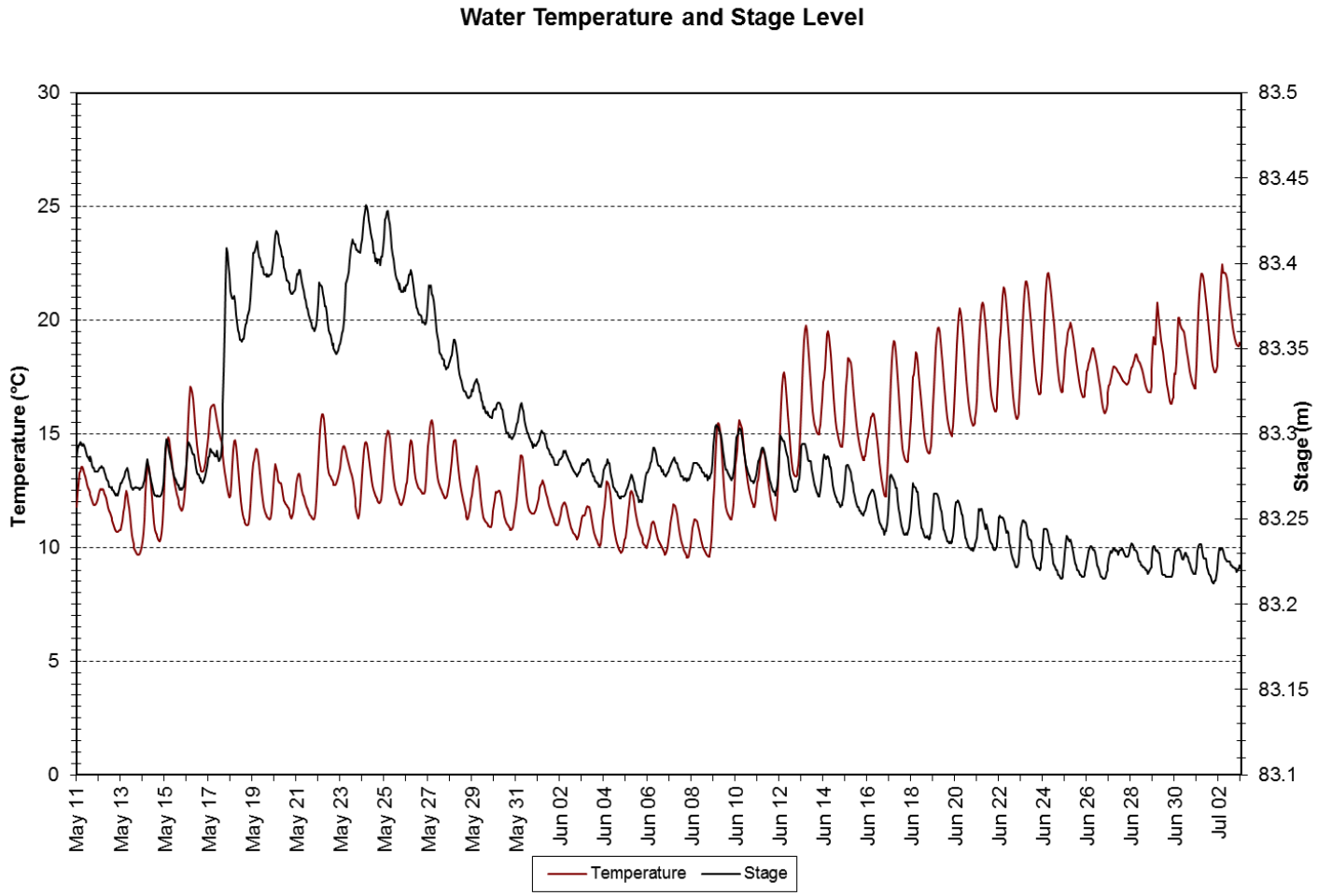
Figure 5: Turbidity at Rattling Brook Big Pond from May 10, 2012 to July 3, 2012



- No major turbidity events were observed over the course of this deployment period, except for a few spurious spikes that may be related to temporary, localised silt movement (see inset stars in figure above).
- A small turbidity event was observed on June 26 during a period of rainfall over two days.
- Values ranged from 0.0 NTU to a maximum of 22.0 NTU (median value: 0.8 NTU).

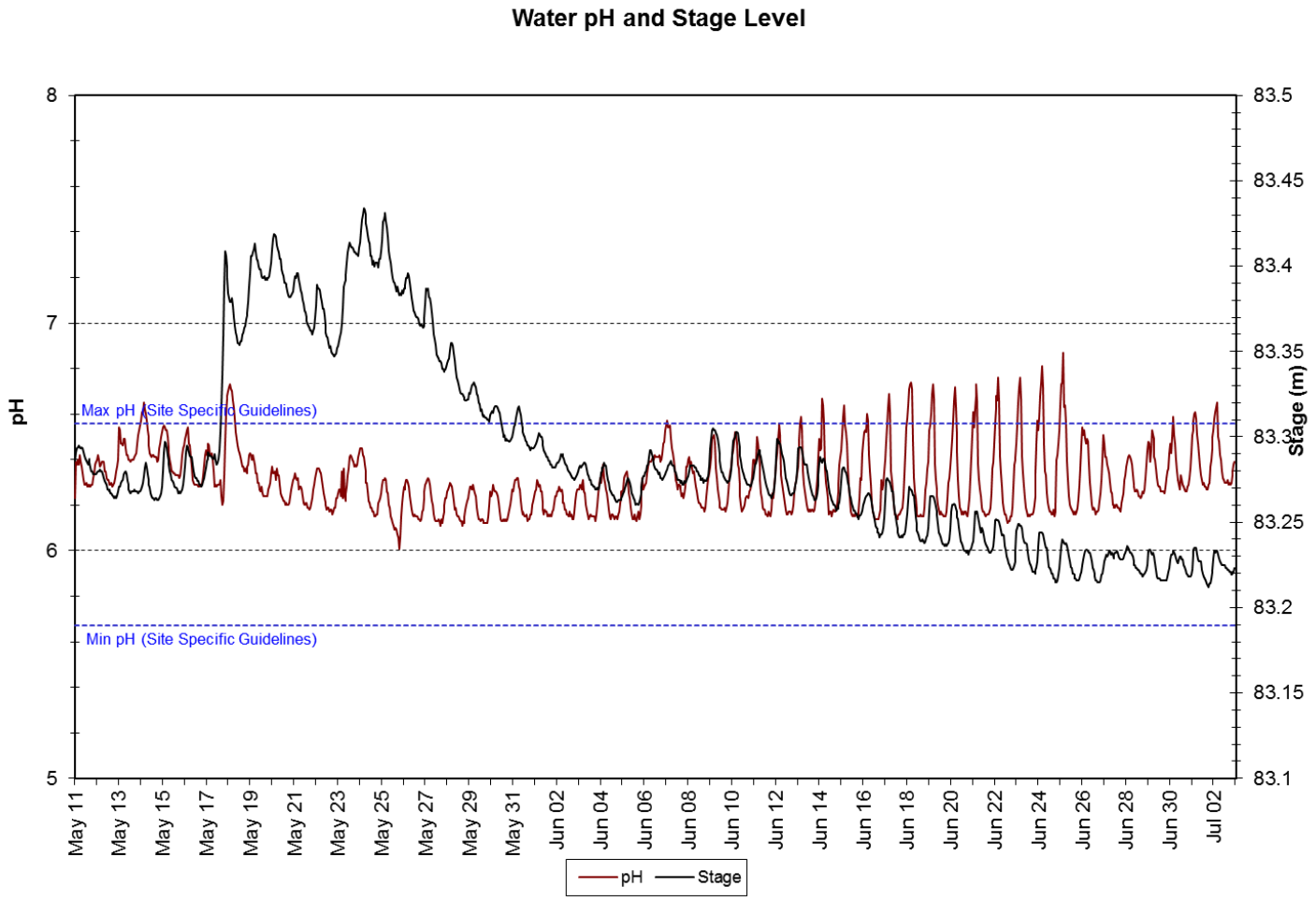
Rattling Brook below Bridge

Figure 6: Water Temperature at Rattling Brook below Bridge from May 11, 2012 to July 3, 2012



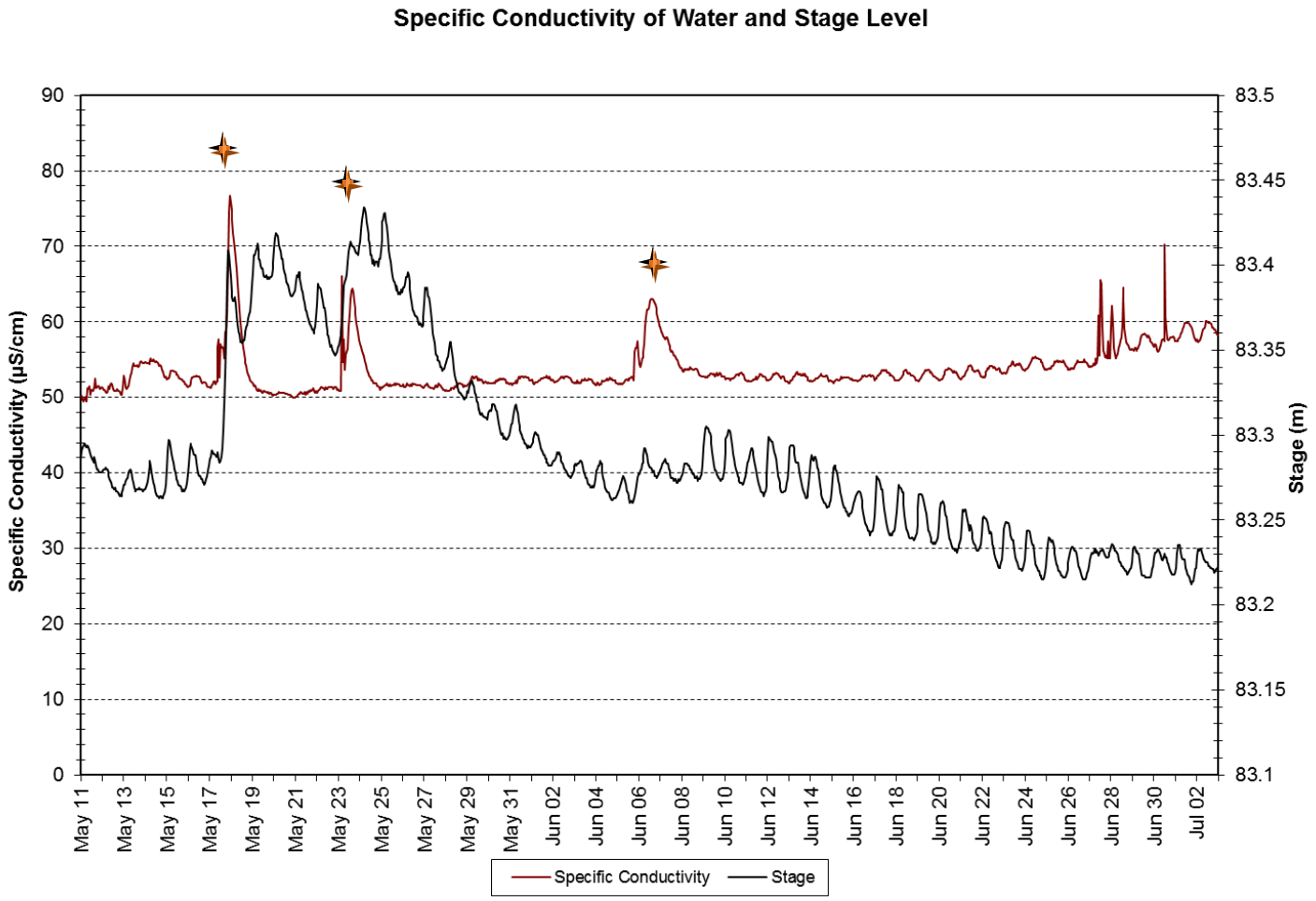
- Diel cycles of temperature are clear throughout the deployment period. Such temperature cycles are expected as high daytime temperatures influence the river channel followed by a cooling period overnight.
- Water temperature was mostly flat from deployment until early June when a steady upward trend continued until removal. Temperatures ranged from 9.55^{o}C to 22.44^{o}C (median value: 13.60).

Figure 7: pH at Rattling Brook below Bridge from May 11, 2012 to July 3, 2012



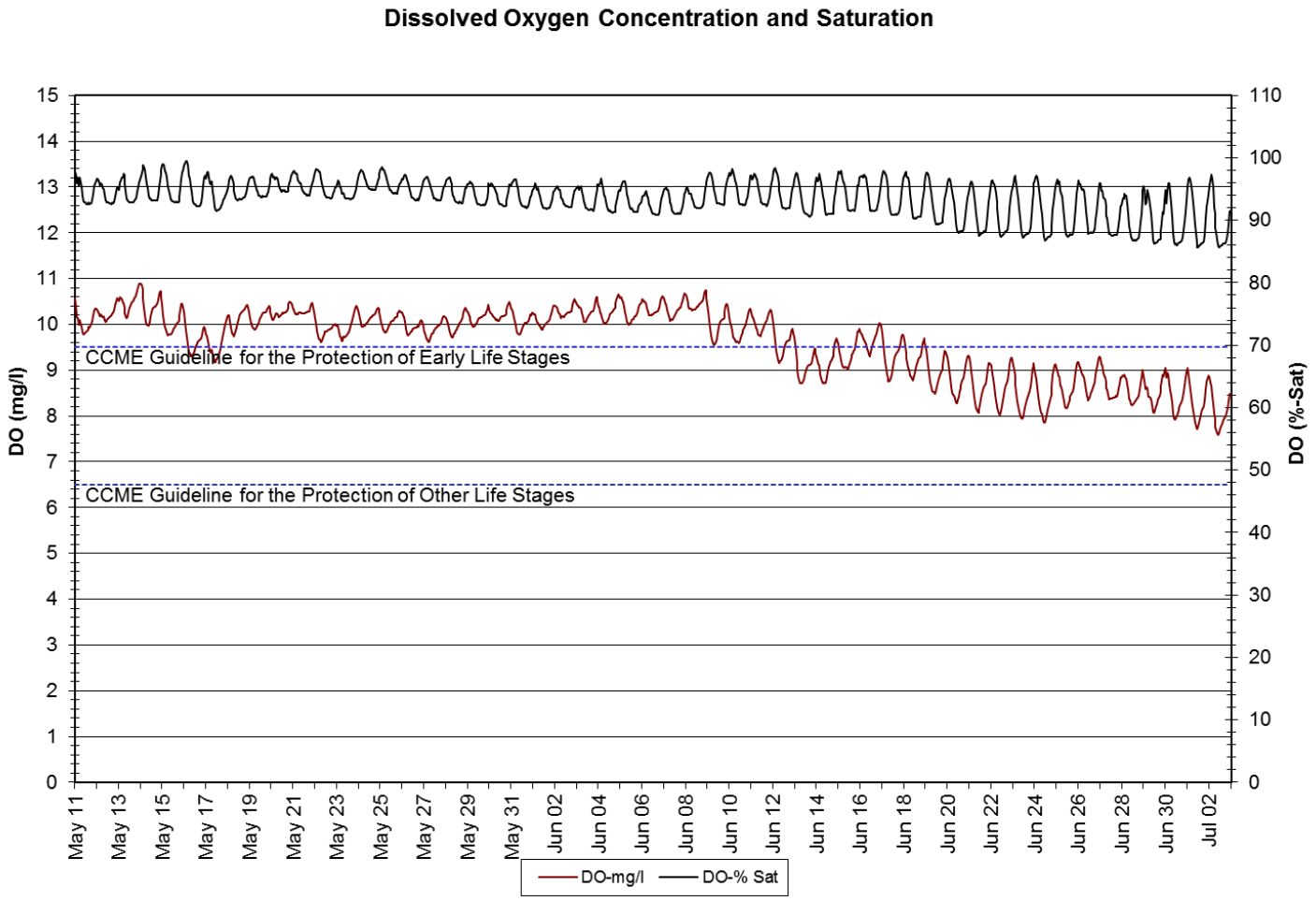
- pH values mostly fell within the Site Specific Guidelines for the Rattling Brook system. Although pH diel cycles grow progressively larger throughout the deployment period, there is little change in average pH.
- Values fell between 6.01 to 6.87 (median value: 6.29).

Figure 8: Specific Conductivity at Rattling Brook below Bridge from May 11, 2012 to July 3, 2012



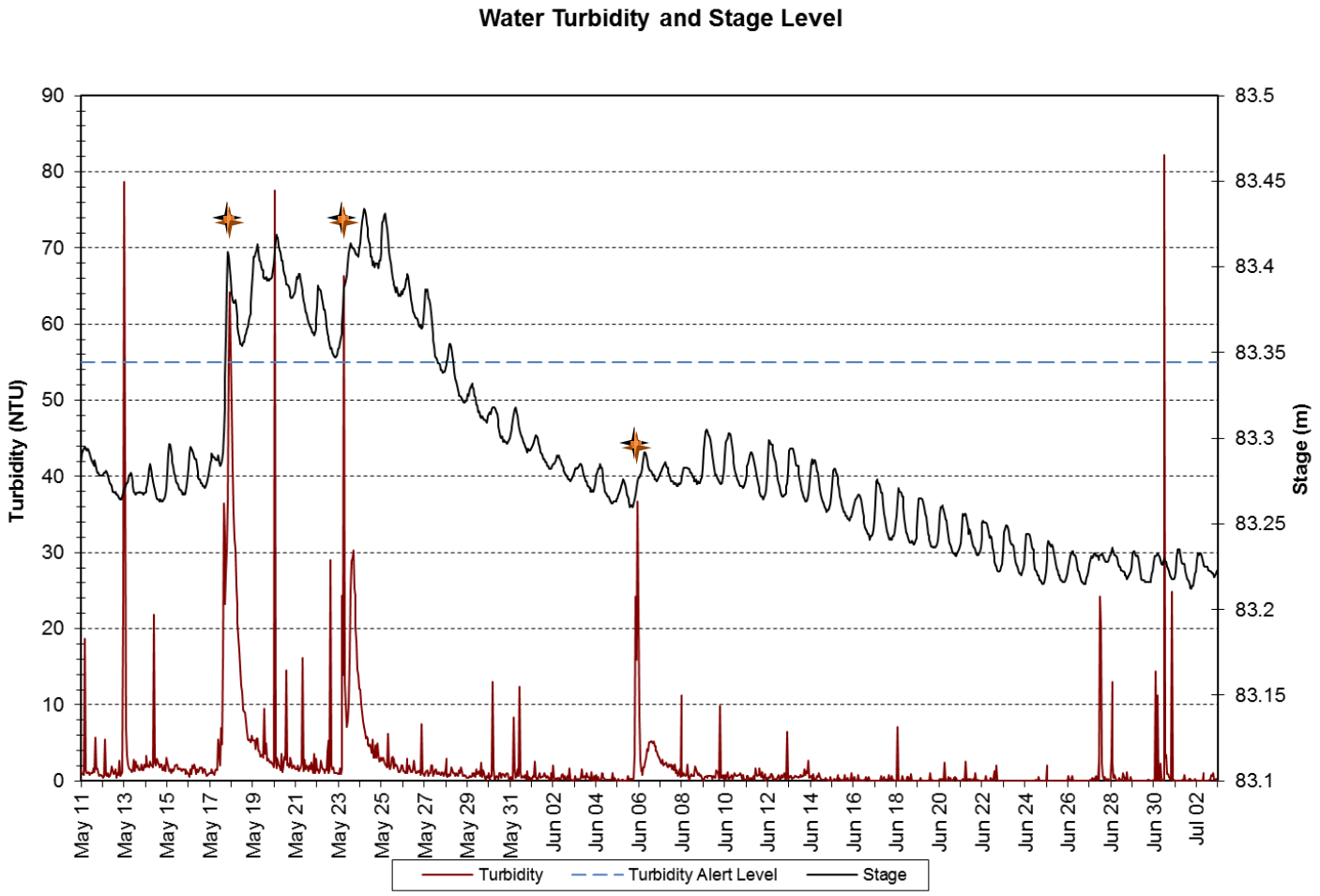
- As seen at Big Pond station, conductivity showed a similar increase at Bridge station. From May 11th to July 3rd, conductivity fell between 49.4 µS/cm to 76.7 µS/cm with a median value of 52.7 µS/cm.
- Major perturbations in specific conductivity are frequently associated with changes in stage level, indicating an influx of dissolved solids flushed through the river system by runoff (see inset stars, above).

Figure 9: Dissolved Oxygen at Rattling Brook below Bridge from May 11, 2012 to July 3, 2012



- As temperature was steady and plateaued from early May to early June, so was the concentration of dissolved oxygen. From June onward, DO fell as temperature increased. Additionally, diel cycles became more pronounced as a result of respiration from aquatic vegetation. Oxygen concentrations are lowest over night when oxygen consumption outpaces production from photosynthesis.
- Values during the deployment period fell between 7.59 mg/l to 10.89 mg/l with a median value of 9.86 mg/l. In early June, dissolved oxygen began to fall below the CCME Guideline of 9.5 mg/l for the Protection of Early Life Stage aquatic life.

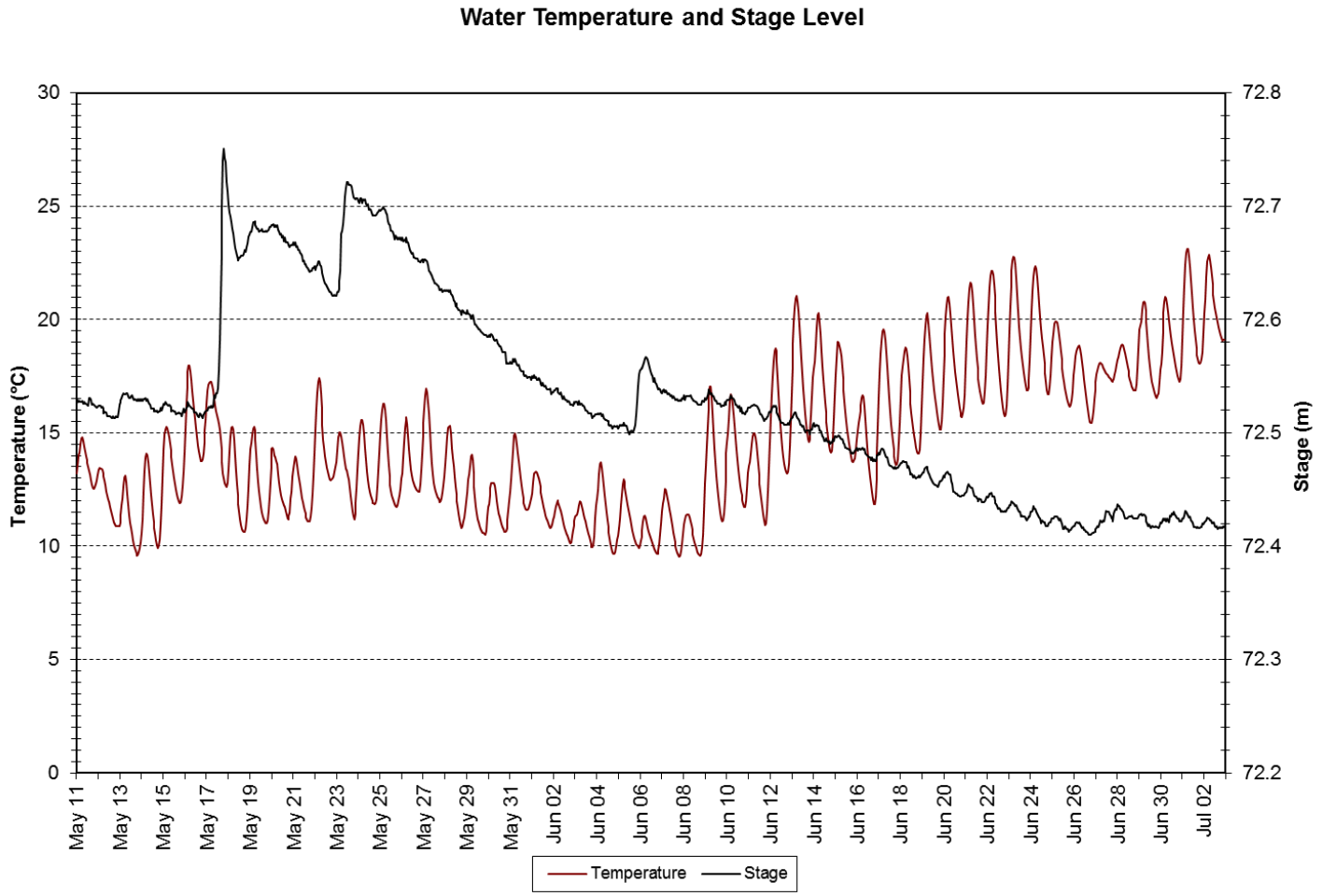
Figure 10: Turbidity at Rattling Brook below Bridge from May 11, 2012 to July 3, 2012



- Turbidity values were mostly low during from May 11th to July 3rd with only seven instances of turbidity exceeding the alert level of 55 NTU. Generally, turbidity was seen to fluctuate with changes in stage level; indicating siltation from runoff (see inset stars, above).
- Values fell between 0.0 and 82.2 NTU with a median value of 0.6 NTU.

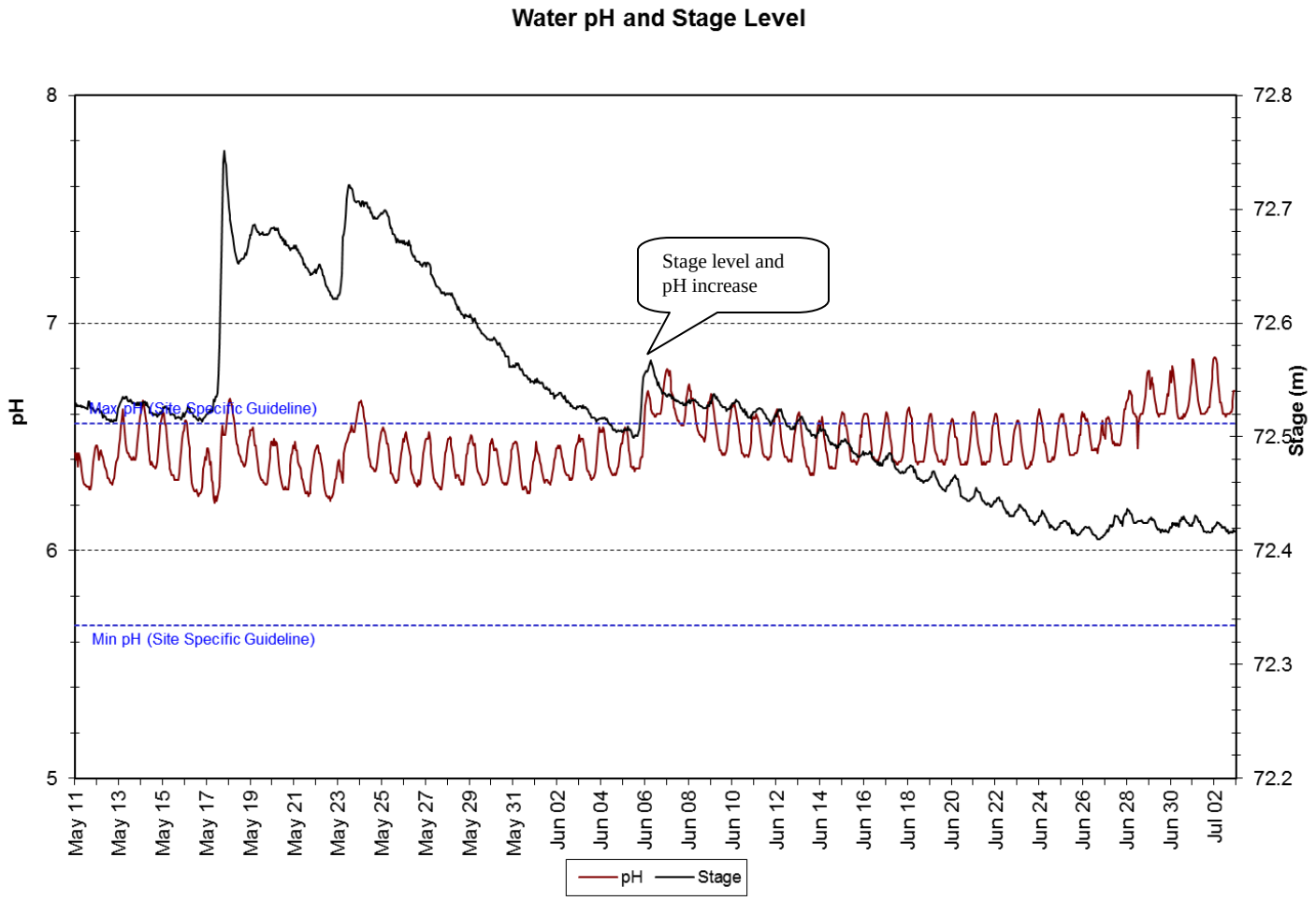
Rattling Brook below Plant Discharge

Figure 11: Water Temperature at Rattling Brook below Plant Discharge from May 11, 2012 to July 3, 2012



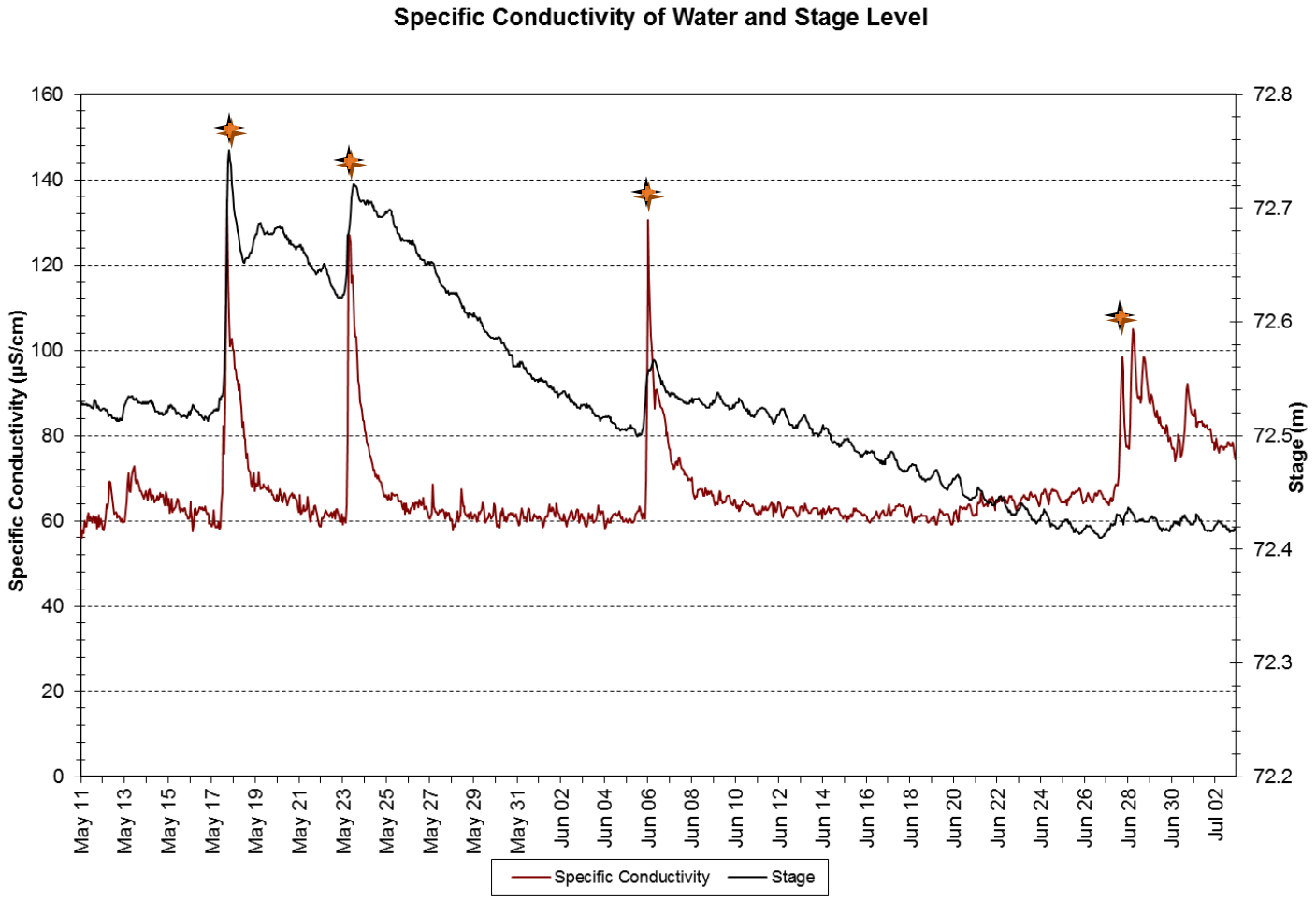
- Water temperature began to rise significantly in early June. Over the course of the deployment, temperature fell between 9.54°C and 23.13°C with a median value of 14.12°C.

Figure 12: pH at Rattling Brook below Plant Discharge from May 11, 2012 to July 3, 2012



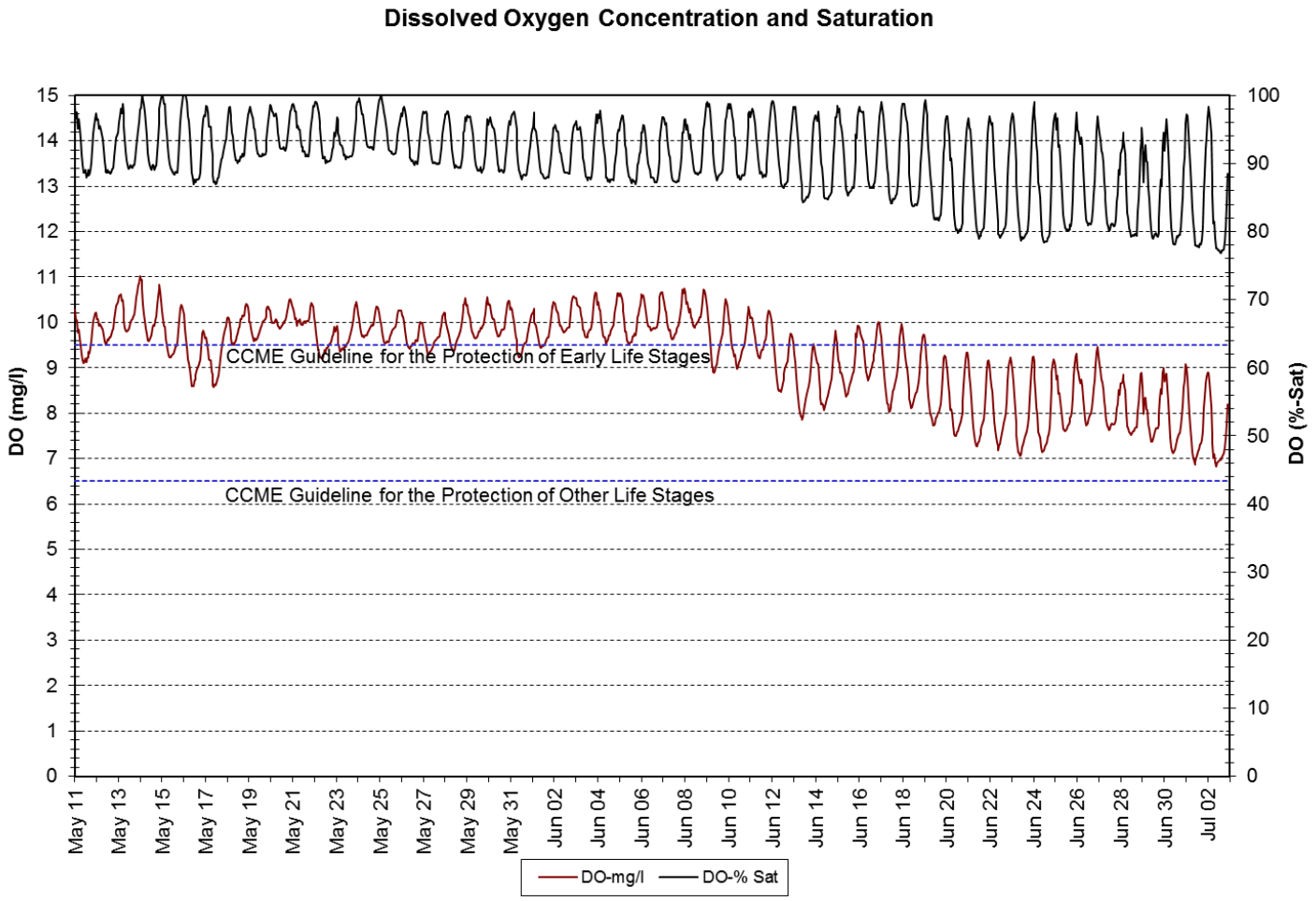
- Most pH values fell within the Site Specific Guidelines for the Rattling Brook network. Values ranged from 6.21 to 6.85 with a median value of 6.45. An increase in pH was observed on June 6 in conjunction with a stage level rise.

Figure 13: Specific Conductivity at Rattling Brook below Plant Discharge from May 11, 2012 to July 3, 2012



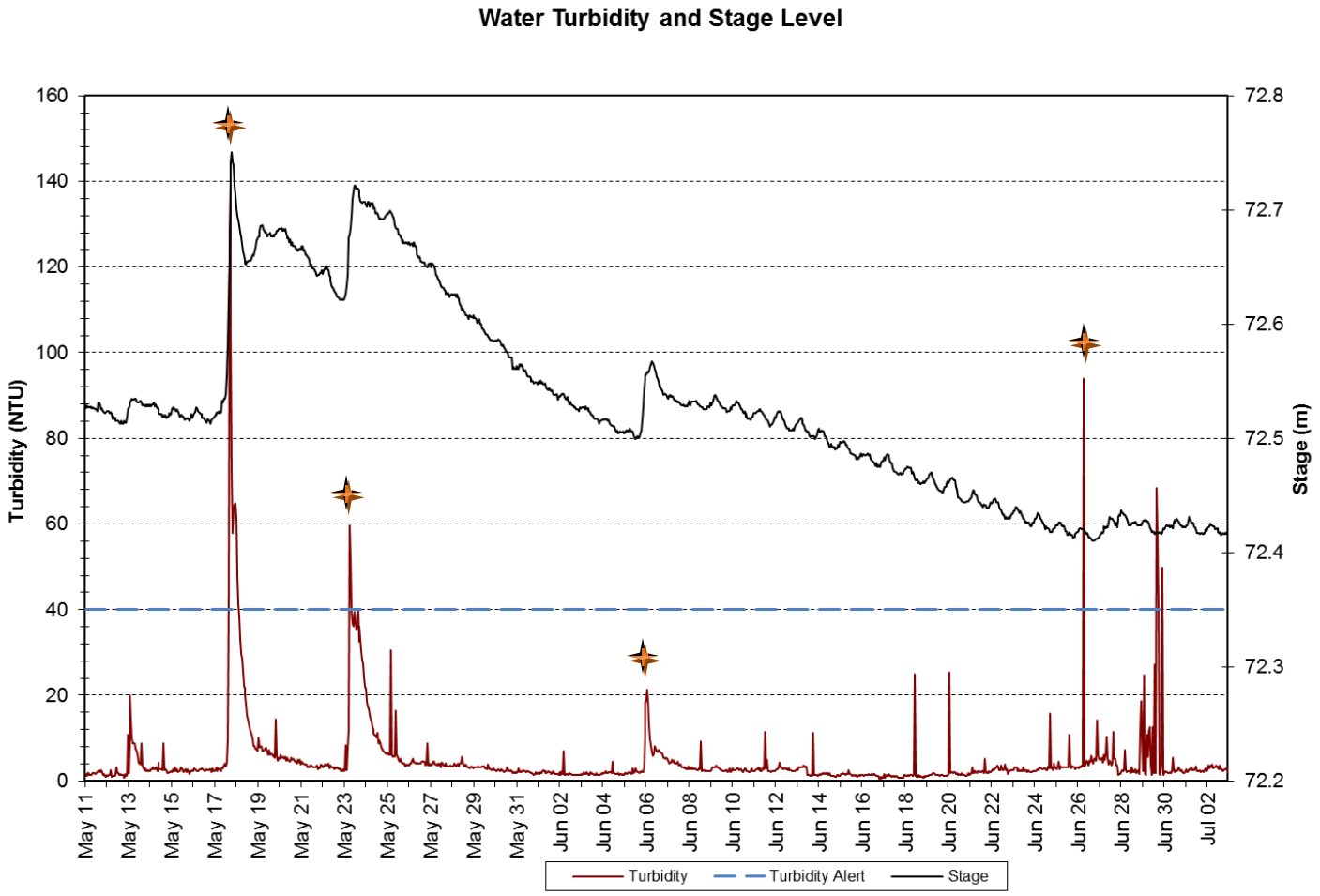
- Four significant specific conductivity spikes were observed and associated with precipitation and stage level rise (see inset stars). The majority of the deployment does not show any appreciable upward trend in conductivity, until late June.
- Conductivity values fell between 56.1 µS/cm and 135.3 µS/cm with a median value of 63.5 µS/cm.

Figure 14: Dissolved Oxygen at Rattling Brook below Plant Discharge from May 11, 2012 to July 3, 2012



- Dissolved oxygen concentrations begin to fall below the CCME Guideline of 9.5 mg/l for the Protection of Early Life Stage cold water biota much sooner than Big Pond and Bridge stations. This is likely due to the warmer water temperatures observed at this station. Additionally, the diel cycles are larger than those seen at the other two stations.
- From May 11th to July 3rd, oxygen concentrations fell between 11.01 mg/l and 6.83 mg/l (median value: 9.55 mg/l). During the evening, oxygen concentrations began to approach the stringent CCME Guideline of 6.5 mg/l for the protection of Other Life Stage cold water biota. This will be monitored closely as low DO concentrations results in stress on aquatic organisms.

Figure 15: Turbidity at Rattling Brook below Plant Discharge from May 11, 2012 to July 3, 2012

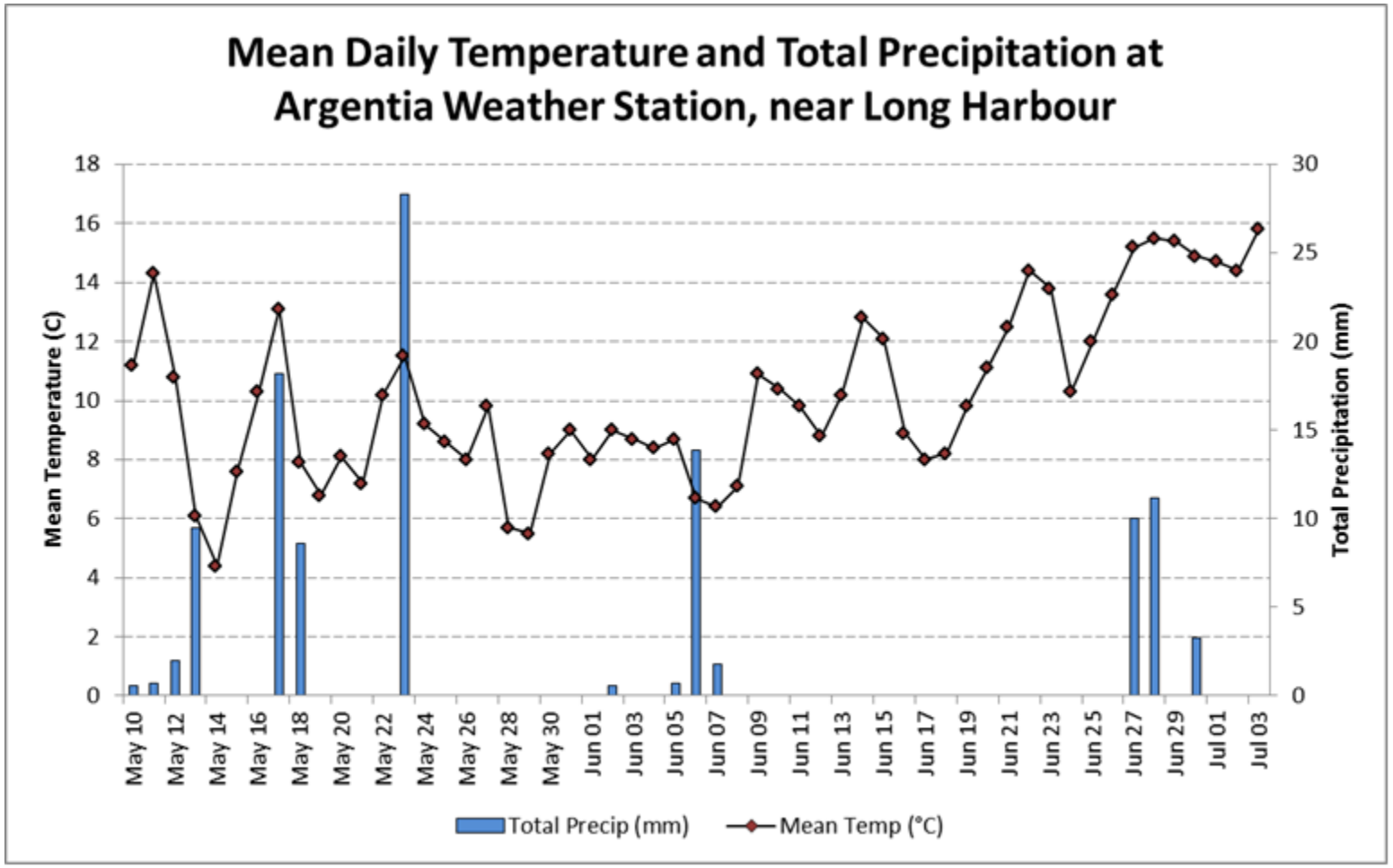


- Turbidity values were ranged from 0.4 NTU to 140.2 NTU (median value: 2.7 NTU) during this deployment period. A total of 18 alerts were received during this deployment period as turbidity exceeded 40 NTU.
- Most incidences of turbidity spikes were associated with stage level increase, indicating siltation from runoff (see inset stars).

Conclusions

- No major water quality events of concern were observed, however, DO concentrations are low due to high temperatures and caution must be exercised to avoid stress on aquatic life. It is possible that DO concentrations may fall below CCME Guideline if water temperatures continue to increase. Oxygen concentrations will be monitored closely over the next several weeks.

Appendix



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