DRAFT
2012 Klamath River Continuous Water Quality Monitoring Summary Report

Yurok Tribe Environmental Program:
Water Division

August 2013

Prepared by: Matthew Hanington

Acknowledgements

The Yurok Tribe Environmental Program (YTEP) would like to thank those that contributed to the data collection efforts that occurred during the 2012 monitoring season. AmeriCorps Watershed Stewards Project Members Mia Wapner and Sarah Gossman were instrumental in maintaining and calibrating the datasondes. Funding was provided by PacifiCorp under the Klamath Hydroelectric Settlement Agreement (KHSA) Interim Measure 15 and USEPA under the Clean Water Act Section 106. We would also like to thank Yellow Springs Inc. for their prompt responses to any inquiries regarding maintenance and/or equipment operation.

Table of Contents

Table of Figures

Table of Tables

I. Introduction

This report summarizes the trends in water quality as measured by Yellow Springs Incorporated (YSI) 6600EDS multi-parameter datasondes on the Klamath and Trinity Rivers from May through November, 2011. The Yurok Tribe Environmental Program (YTEP) measured water quality at several monitoring sites from Weitchpec to the USGS gaging station at Blake's Riffle at half-hour intervals starting in mid-May and ending in early November. This monitoring was performed in an effort to track both temporal and spatial patterns on the lower reaches of the Klamath River during the sampling period. This data was added to previous years' water quality data as part of an endeavor to build a multi-year database on the Lower Klamath River. This summary is part of YTEP's comprehensive program of monitoring and assessment of the chemical, physical, and biological integrity of the Klamath River and its tributaries in a scientific and defensible manner. Datasonde placement along the mainstem of the Klamath and Trinity Rivers and measured parameters were coordinated with the Karuk Tribe and PacifiCorp to expand our understanding of the water quality dynamics in the Klamath basin.

II. Background

The Klamath River Watershed

The Klamath River system drains much of northwestern California and south-central Oregon (Figure 2-1). Thus, even activities taking place on land hundreds miles off the Yurok Indian Reservation (YIR) can affect water conditions within YIR boundaries. For example, upriver hydroelectric and diversion projects have altered natural flow conditions for decades. The majority of water flowing through the YIR is derived from scheduled releases of impounded water from the Upper Klamath Basin that is often of poor quality with regards to human needs as well as the needs of fish and wildlife.

Some historically perennial streams now have ephemeral lower reaches and seasonal fish migration blockages because of inadequate dam releases from water diversion projects along the Klamath and Trinity Rivers. The releases contribute to lower mainstem levels and excessive sedimentation which in turn causes subsurface flow and aggraded deltas. Additionally, the lower slough areas of some of the Lower Klamath tributaries that enter the estuary experience eutrophic conditions during periods of low flow. These can create water quality barriers to fish migration when dissolved oxygen and water temperature levels are inadequate for migrating fish. The Klamath River is on California State Water Resource Control Board's (SWRCB) 303(d) List as impaired for temperature, dissolved oxygen, and nutrients and portions of the Klamath River were recently listed as impaired for microcystin and sedimentation in particular reaches.

The basin's fish habitat has also been greatly diminished in area and quality during the past century by accelerated sedimentation from mining, timber harvest practices, and road construction, as stated by Congress in the Klamath River Act of 1986. Management of private lands in the basin (including fee land within Reservation boundaries) has been, and continues to be, dominated by timber harvest.

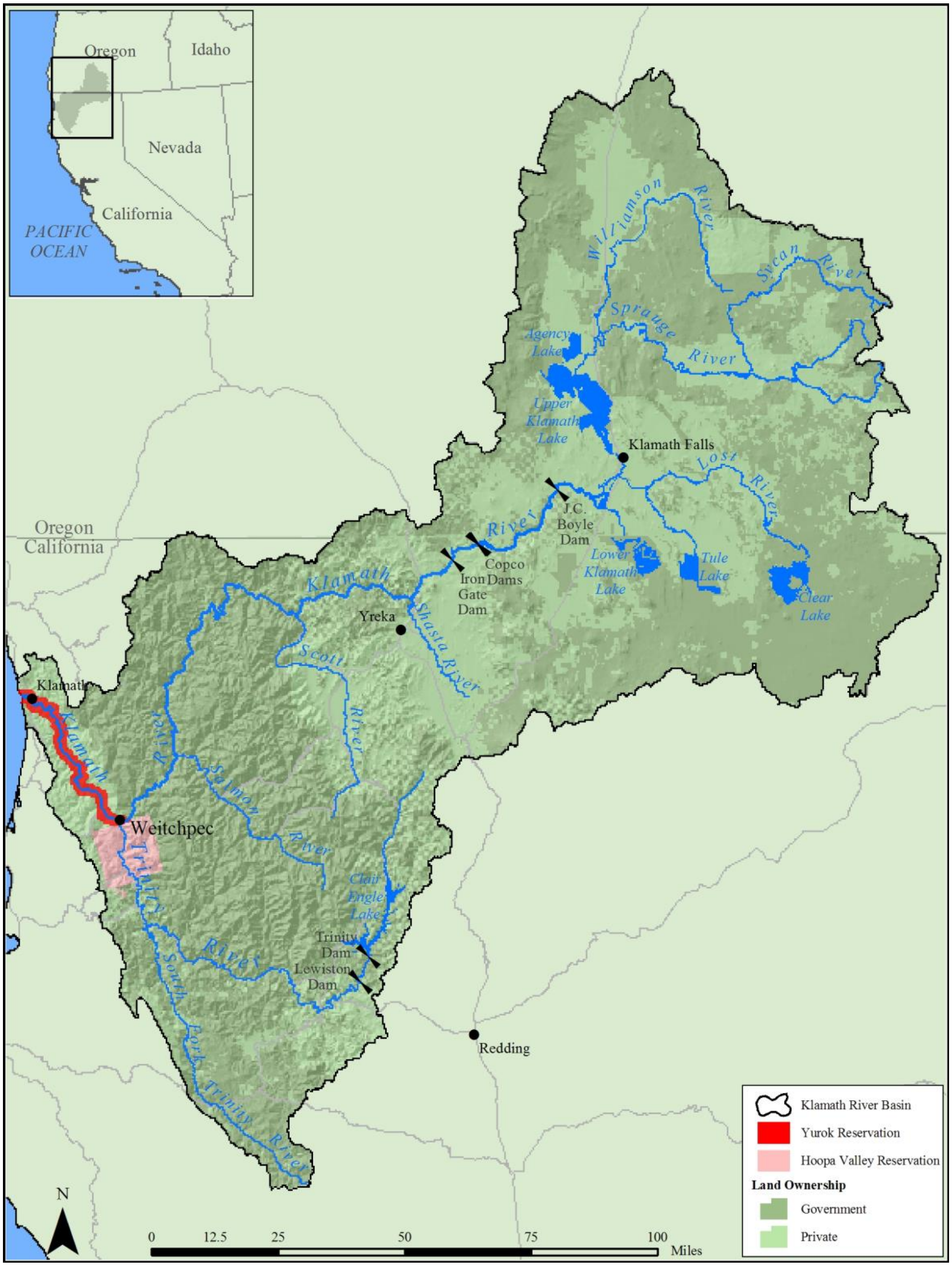

Figure 2-1. Klamath River Basin Map

The Klamath River

The health of the Klamath River and associated fisheries has been central to the life of the Yurok Tribe since time immemorial fulfilling subsistence, commercial, cultural, and ceremonial needs. Yurok oral tradition reflects this. The Yurok did not use terms for north or east, but rather spoke of direction in terms of the flow of water (Kroeber 1925). The Yurok word for salmon, *nepuy*, refers to "that which is eaten". Likewise, the local waterways and watershed divides have traditionally defined Yurok aboriginal territories. Yurok ancestral land encompass approximately 360,000 acres and is distinguished by the Klamath and Trinity Rivers, their surrounding lands, and the Pacific coast extending from Little River to Damnation Creek.

The fisheries resource continues to be vital to the Yurok today. The September 2002 Klamath River fish kill, where a conservative estimate of 33,000 fish died in the lower Klamath before reaching their natal streams to spawn, was a major tragedy for the Yurok people.

The Yurok Indian Reservation

The current YIR consists of a 55,890-acre corridor extending for one mile from each side of the Klamath River from just upstream of the Trinity River confluence to the Pacific Ocean, including the channel and the bed of the river (Figure 2-2). There are approximately two dozen major anadromous tributaries within that area. The mountains defining the river valley are as much as 3,000 feet high. Along most of the river, the valley is quite narrow with rugged steep slopes. The vegetation is principally redwood and Douglas fir forest with little area available for agricultural development. Historically, prevalent open prairies provided complex and diverse habitat.

Yurok Tribe Water Monitoring Division

In 1998, YTEP was created to protect and restore tribal natural resources through high quality scientific practices. YTEP is dedicated to improving and protecting the natural and cultural resources of the Yurok Tribe through collaboration and cooperation with local, private, state, tribal, and federal entities such as the Yurok Tribe Fisheries Program (YTFP), US Fish and Wildlife Service (USFWS), the United States Environmental Protection Agency (USEPA), Green Diamond Resource Company, the NCRWQCB, and the United States Geological Survey (USGS). USEPA funding allocated under the Clean Water Act Section 106 and funding from PacifiCorp primarily fund YTEP's continuous water quality monitoring activities.

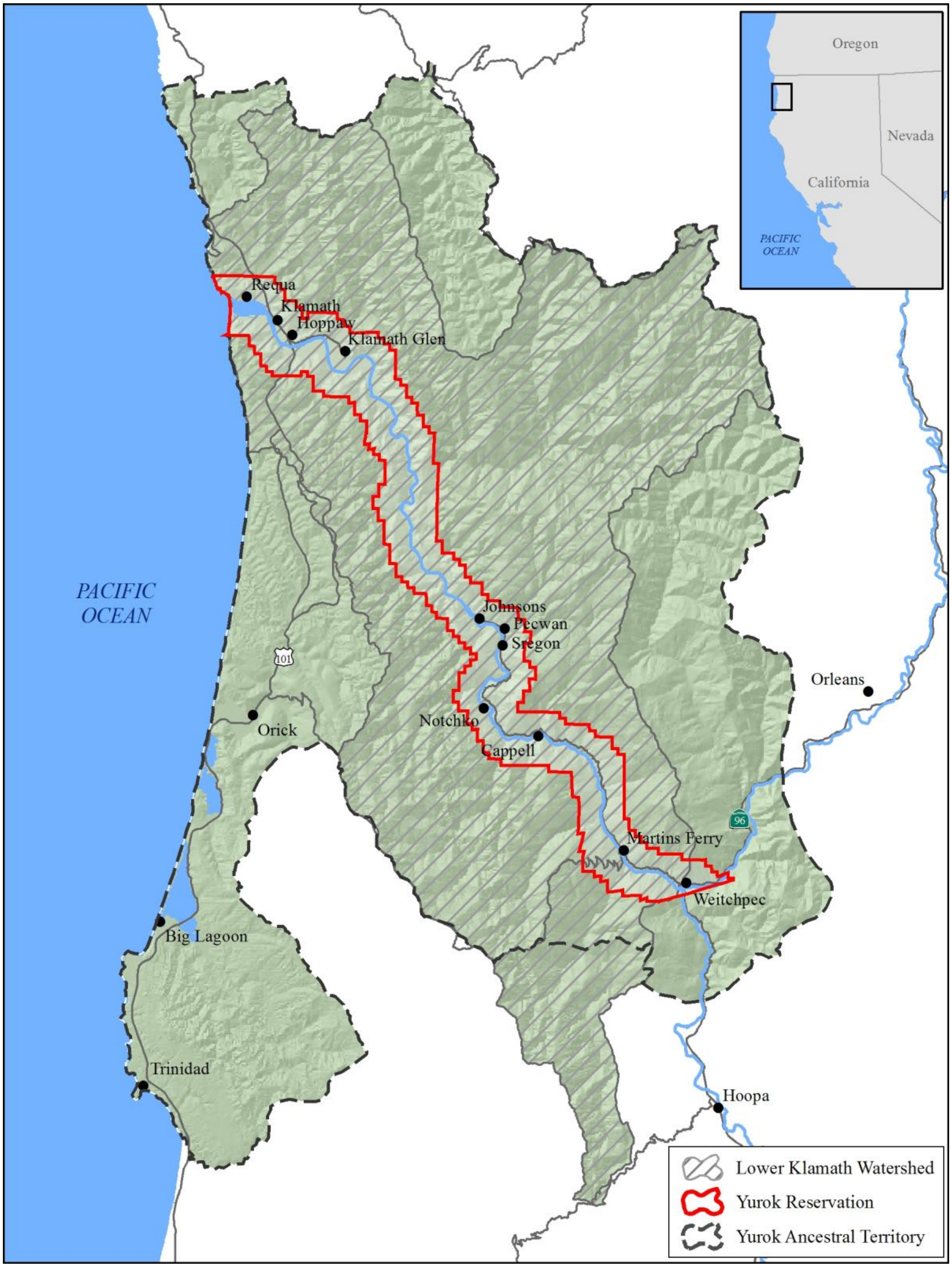

Figure 2-2. Yurok Indian Reservation and Yurok Ancestral Territory Map

III. Methods

The monitoring study initiated in the middle of May, continued throughout the summer months and ended in early November. Continuous water quality information was collected using YSI 6600EDS multi-parameter datasondes equipped with specific conductivity/temperature, pH, DO and phycocyanin probes. ROX DO probes detect concentrations of dissolved oxygen in bodies of water by measuring luminescence as it is affected by the presence of oxygen, while phycocyanin probes are designed to detect the presence of an accessory pigment known to occur in *Microcystis aeurginosa*. These sensors return consistent, high quality measurements.

During this study, many QC measures were undertaken to ensure the data collected with the datasondes were of the highest quality. According to the current datasonde operation protocol (Appendix A), datasondes were pre- and post-calibrated and pre-and post-cleaned on site every two weeks in order to account for electronic drift and bio-fouling. When the datasondes were deployed and extracted, an audit was performed with a freshly calibrated YSI 6600EDS, a portable multi-probe instrument. Effort was made to record the 6600EDS measurements as close as possible to the datasonde and within five minutes of the datasonde recording a measurement.

Once the datasonde was extracted, a pre-clean audit was performed, this time with the site datasonde and reference datasonde in a bucket filled with river water. Once this audit was performed, the site datasonde was cleaned and wiper pads were replaced. Next, a post-clean audit was performed with the site datasonde and reference datasonde in the same bucket of water. After the post clean audit was completed, the dissolved oxygen probe was calibrated using the wet towel method. This protocol requires the user to wrap the datasonde in a wet towel and then place it in a calibration chamber (cylindrical cooler). Dissolved oxygen percent saturation is then calibrated using the current barometric pressure. Barometric pressure was measured using a reliable barometer on site.

Once dissolved oxygen was calibrated, specific conductivity was calibrated, followed by pH with fresh calibration solutions. These were calibrated using the rinse method outlined in the current datasonde operation protocol (Appendix A). Once calibrations were completed the accuracy of the BGA probe was checked by recording readings from DI water, and, during periods of blue-green algae blooms, a solution of rhodamine dye.

After all calibrations and audits were completed, the site datasonde was returned to its housing and redeployed.

IV. Site Selection

The sampling area includes the lower 44 river miles of the mainstem Klamath River on the YIR and the Trinity River above its convergence with the Klamath near the southern boundary of the YIR. In general, the various sampling locations were chosen in order to represent the average ambient water conditions throughout the water column. The sites listed below in bold indicate established sampling locations for the collection of continuous water quality data from May through November.

YTEP collected continuous water quality data at the following mainstem Klamath River locations (Figure 4-1) (river miles are approximate):

- **KAT - Klamath River above Turwar Boat Ramp – RM 8 (Figure 4-2)**
- **TC - Klamath River above Tully Creek – RM 38.5 (Figure 4-3)**
- **WE - Klamath River at Weitchpec (upstream of Trinity River) – RM 43.5 (Figure 4-4)**

YTEP collected water samples for nutrient analysis at the following major tributary locations:

- **TR - Trinity River near mouth (above Klamath River confluence) – RM 0.5 (Figure 4-5)**

V. Quality Assurance

During this study, many quality assurance and quality control (QA/QC) measures were undertaken to ensure that the continuous water quality data collected was of the highest quality.

All field personnel that were involved in datasonde maintenance have been trained appropriately by the Water Division Program Manager and are properly supervised to ensure proper protocol is followed consistently throughout the monitoring season. Each field visit requires that staff fill out field data sheets and follow protocols appropriately in the field. Datasonde maintenance is always conducted by at least two staff for safety reasons and to maintain consistency.

Data is thoroughly reviewed once downloaded from the datalogger. YTEP is the primary organization responsible for data review. The data manager will visually inspect all entered data sets to check for inconsistencies with original field data sheets. Where inconsistencies are encountered, data will be re-entered and re-inspected until the entered data is found to be satisfactory or results will be discarded. Any unusual values outside the range of norm will be flagged and all aspects of field data sheets will be reviewed. Outliers will be identified and removed from the dataset if deemed necessary by the QA Officer. The Project Manager will maintain field datasheets and notebooks in the event that the QA Officer needs to review any aspect of sampling for QA/QC purposes. Data is reviewed and finalized once data are merged or entered into a database.

The Yurok Tribe received a grant under the Environmental Information Exchange Network Program and used it to develop the Yurok Tribe Environmental Data Storage System (YEDSS). Continuous water quality data covered in this report have been entered in YEDSS, where each water quality parameter is assigned a grade based on USGS criteria (Appendix B) for each two week deployment, and will be uploaded to USEPA's WQX database. The data is then adjusted for instrument calibration drift and sensor-fouling errors that occurred during the interval between servicing visits because of

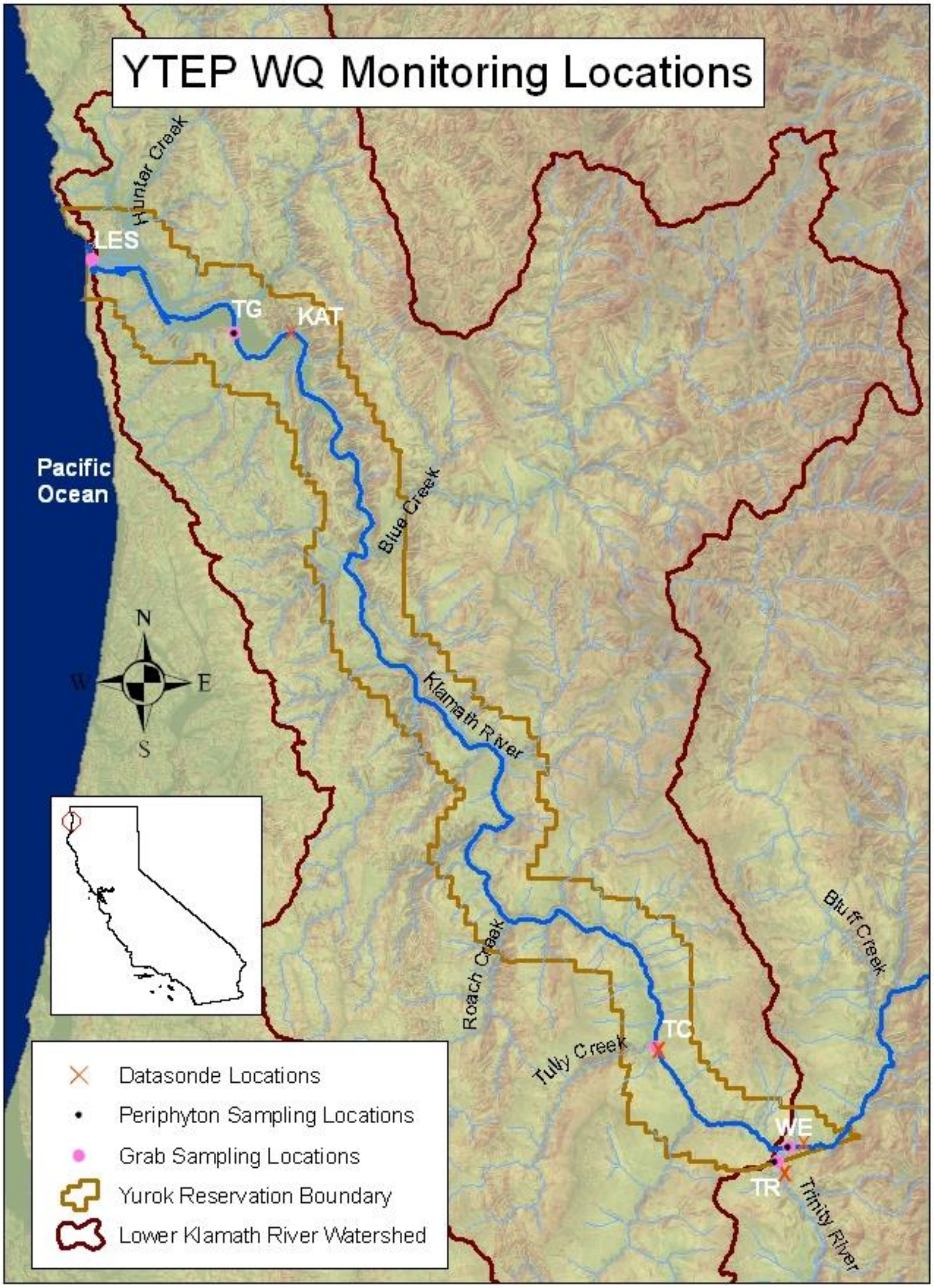

Figure 4-1 .Datasonde Locations for 2012 (as indicated by the brown X's)

Figure 4-2. Klamath Above Turwar (KAT)

Figure 4-3. Klamath Above Tully Creek (TC)

Figure 4- 4. Klamath River at Weitchpec (WE)

Figure 4- 5. Trinity River near Mouth (TR)

environmental or instrumentation effects. These adjustments are made based on USGS criteria for water-quality data corrections and fouling and sensor drift calculations (Wagner et al., 2006). The metadata associated with each data type are also stored within the system and can be easily accessed when questions arise.

VI. Results

Temperature

All Riverine Sites

Water temperatures on the Lower Klamath and Trinity River varied greatly during the 2012 monitoring season. The coolest daily water temperature was 10.660.ºC on October 26 at WE. The warmest daily water temperature was 25.13ºC on August 14 at TR. In this discussion, the daily minimum and maximum water temperatures were compared to the Yurok Tribe's water temperature standards in order to assess the water temperatures of the Klamath and Trinity Rivers. The discussion reflects water temperature standards as of November 1, 2005. Temperature standards are under review and will be updated for all salmonid life stages at a later date.

Daily maxima and minima were disregarded when more than five measurements were missing from a 24-hour period and when the daily maximum or minimum was expected to occur during the gap. Gaps in data may occur during service or due to instrument malfunction or vandalism. When gaps occurred in water temperature data, information was filled in using data from U.S. Fish and Wildlife Service (USFWS) HOBO temperature probes. These probes, which are deployed and extracted by YTEP, are placed in close proximity to each datasonde site. These probes record water temperature every hour throughout the entire year, and are switched out twice a year for data upload and probe maintenance and calibration. There is high confidence in the comparability of this temperature data with YTEP's datasonde data since nearly all data for the period of simultaneous deployment is within +/- 0.2ºC. Continuous datasonde water temperature data from the lower Klamath and Trinity River is available from YTEP upon request. For more information regarding HOBO water temperature data on the lower Klamath and Trinity River, contact the Arcata office of the U.S. Fish and Wildlife Service.

Klamath River above Turwar (KAT)

Maximum water temperature at KAT increased during the first couple days of deployment in early May then decreased until late May. After late May, water temperature generally increased until early August, with small dips in temperature in early June, late June, and mid-July (Figures 6-1 and 6-2). Maximum water temperature generally held steady for August. In mid-August water temperature gradually decreased until mid-October, with a sharp reduction in temperature in mid-October. After mid-October, temperatures increased until datasondes were removed for the season in early November.

The lowest temperature recorded at KAT during 2012 was 11.81ºC on October 26 and the highest temperature recorded was 23.84ºC on August 14. The daily maximum water temperature at KAT exceeded 21ºC beginning on July 7-18, then exceeded again from July 20 to August 27. (Figure 6-1).

Daily maximum water temperatures at KAT exceeded 21ºC 28.18% of the time, or 51 out of 181 days of the monitoring season (Figure 6-3). Water temperature exceeded 21ºC 20.83% of the time, or 1,801 out of 8,646 readings for all half-hour measurements during the monitoring season (Figure 6-3). The seven-day moving average of the daily maximum water temperature exceeded 15.5ºC from June 2 to June 8, and from June 12 to October 23 (Figure 6-2).

Klamath River above Tully Creek (TC)

Maximum water temperature at TC increased slightly for the first few days after initial deployment, took a dip in mid-May, then increased until late May. Water temperature then increased steadily until late July, with small dips in early June, late June and mid-July (Figures 6-4 and 6-5). After late July, maximum temperature generally held steady until mid-August. After mid-August water temperature steadily decreased until mid-October, with small bumps in early, mid, and late September. In mid-October, water temperature showed a large bump followed by a sharp decrease until late October. Temperatures then began a steady increase until datasondes were removed in Early November.

The lowest temperature recorded at TC during 2012 was 11.06ºC on October 26 and the highest temperature recorded was 24.43ºC on August 14. The daily maximum water temperature at TC exceeded 21ºC beginning on July 7 and remained above this temperature until July 18, exceeding it again from July 21- August 27 (Figure 6-4).

Daily maximum water temperatures at TC exceeded 21ºC 29.65% of the time, or 51 out of 172 days of the monitoring season (Figure 6-6). Water temperatures exceeded 21ºC 23.07% of the time, or 1,912 out of 8,287 readings for all half-hour measurements during the 2011 monitoring season (Figure 6-6). The seven-day moving average of the daily maximum water temperature exceeded 15.5ºC from June 22 until October 8 and then again from October 16-25 (Figure 6-5).

Klamath River at Weitchpec (WE)

Water temperature at WE increased from deployment in early May until mid-May, then dropped until late May. (Figures 6-7 and 6-8). Temperature then increased until mid-July, with dips in early and late June. After late July, water temperature generally held steady until late August, with a dip in late July. After mid-August temperature gradually decreased until mid-October, with small bumps in early and mid-September. In mid-October, water temperature decreased sharply until late October, then increased, with a small dip in early November, until the datasonde was removed on November 7 for the season.

The lowest temperature recorded at WE during 2012 was 10.66ºC on October 26, while the highest recorded temperature was 24.84ºC on August 17. The daily maximum water temperature at WE exceeded 21ºC beginning on July 3-4, then again on July 6 and remained above this temperature until August 31. Daily max temperatures again exceeded 21ºC on September 2-7 and September 14-15. (Figure 6-7).

Daily maximum water temperature at WE exceeded 21ºC 36.07% of the time, or 66 out of 183 days of the monitoring season (Figure 6-9). Water temperatures exceeded

21ºC 27.70% of the time, or 2,421 out of 8,739 readings for all half-hour measurements during the 2012 monitoring season (Figure 6-9). The seven-day moving average of the daily maximum water temperature exceeded 15.5ºC from June 2-8, June 12 through October 22 (Figure 6-8).

(TR)

Maximum water temperature at TR increased from deployment in early May until mid-May, then decreased until late May. (Figures 6-10 and 6-11). It then generally increased until mid-August with dips in early June, late June, and mid-July. In late August, water temperature decreased gradually until mid-October with bumps in mid-September, late September, and mid-October. After mid-October, water temperature decreased significantly until late October, then increased quickly until early November. Water temperature then decreased followed by an increase for the final week until datasondes were removed on November 7.

The lowest temperature recorded at TR during 2012 was 11.29ºC on May 26, and the highest temperature recorded was 25.13ºC on August 14. The daily maximum water temperature at TR exceeded 21 ºC beginning on July 11-16, exceeding it again on July 21 and remained above this temperature until August 23 (Figure 6-10).

Daily maximum water temperature at TR exceeded 21ºC 22.10% of the time, or 40 out of 181 days of the monitoring season (Figure 6-12). Water temperatures exceeded 21ºC 15.35% of the time, or 1,341 out of 8,734 readings for all half-hour measurements during the 2012 monitoring season (Figure 6-12). The seven-day moving average of the daily maximum water temperature exceeded 15.5ºC from June 3-7, exceeding again from June 13 through October 23 (Figure 6-11).

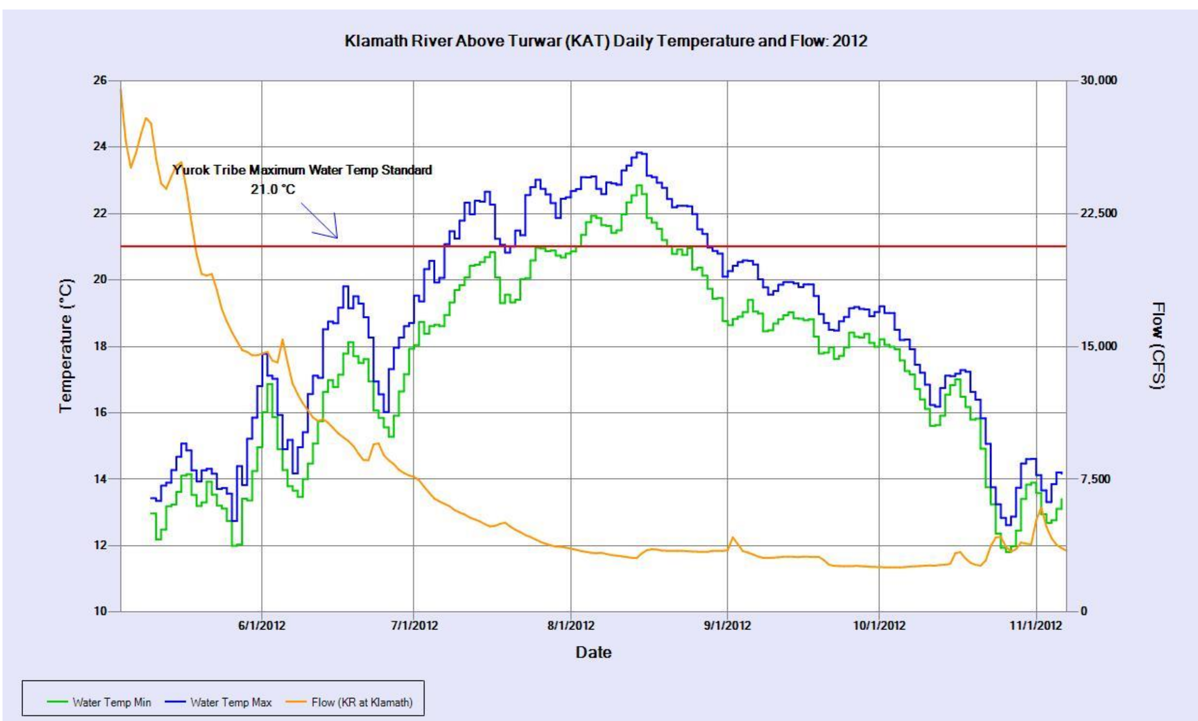

Figure 6-1. KAT Maximum/minimum Water Temperatures and Flow: 2012

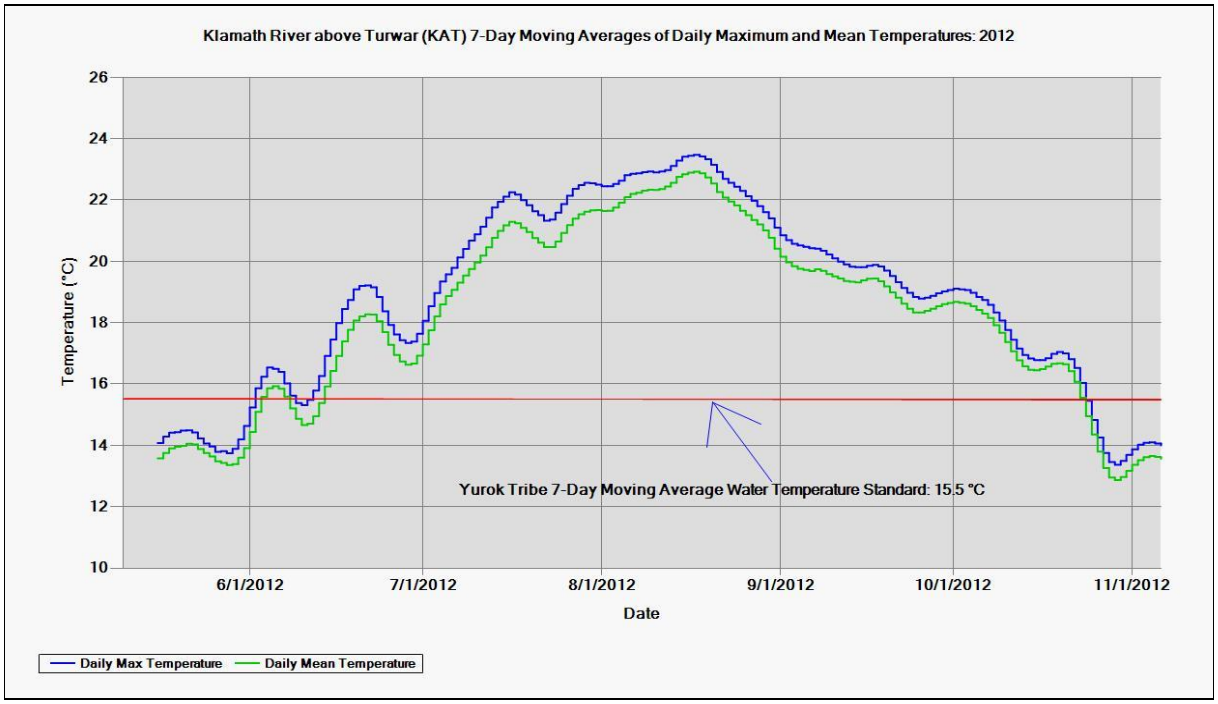

Figure 6-2. KAT 7-Day Moving Averages: 2012

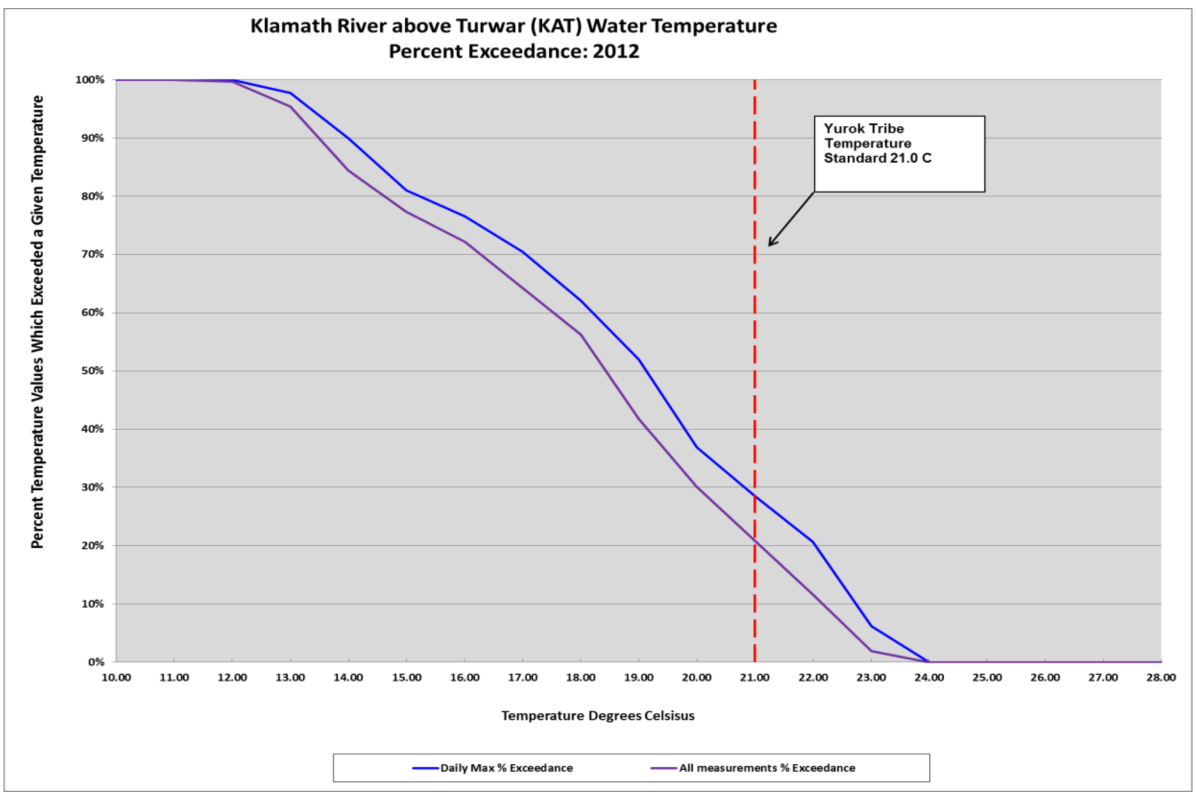

Figure 6-3. KAT Water Temperature Percent Exceedance: 2012

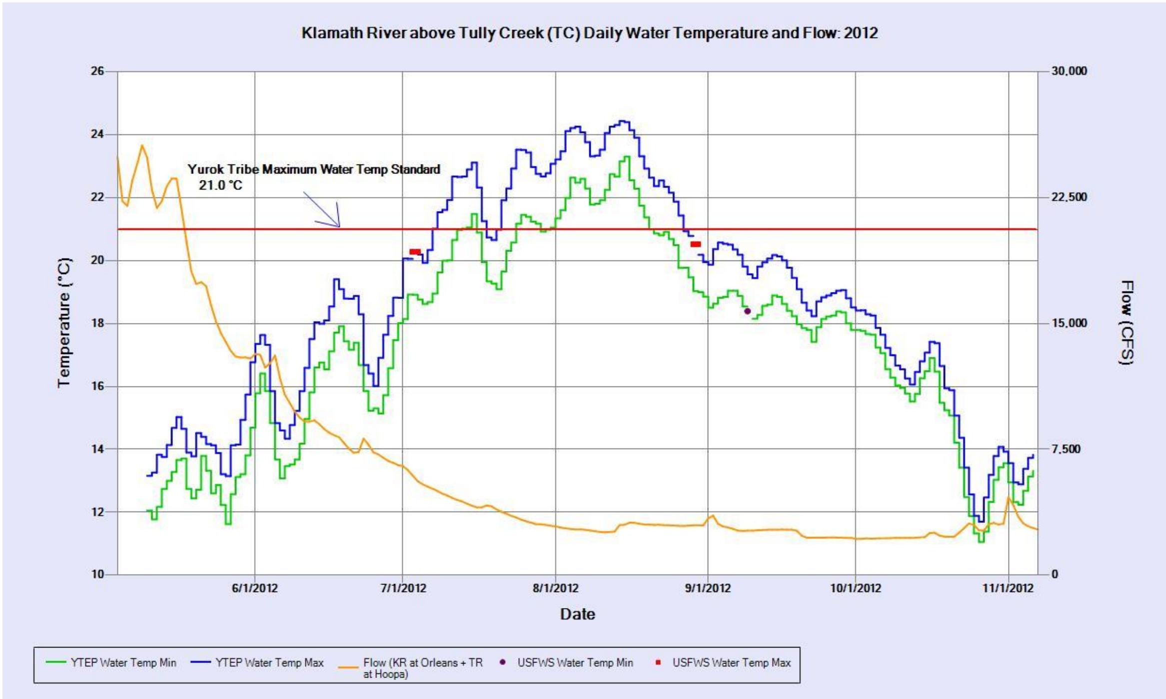

Figure 6-4. TC Maximum/minimum Water Temperature and Flow: 2012

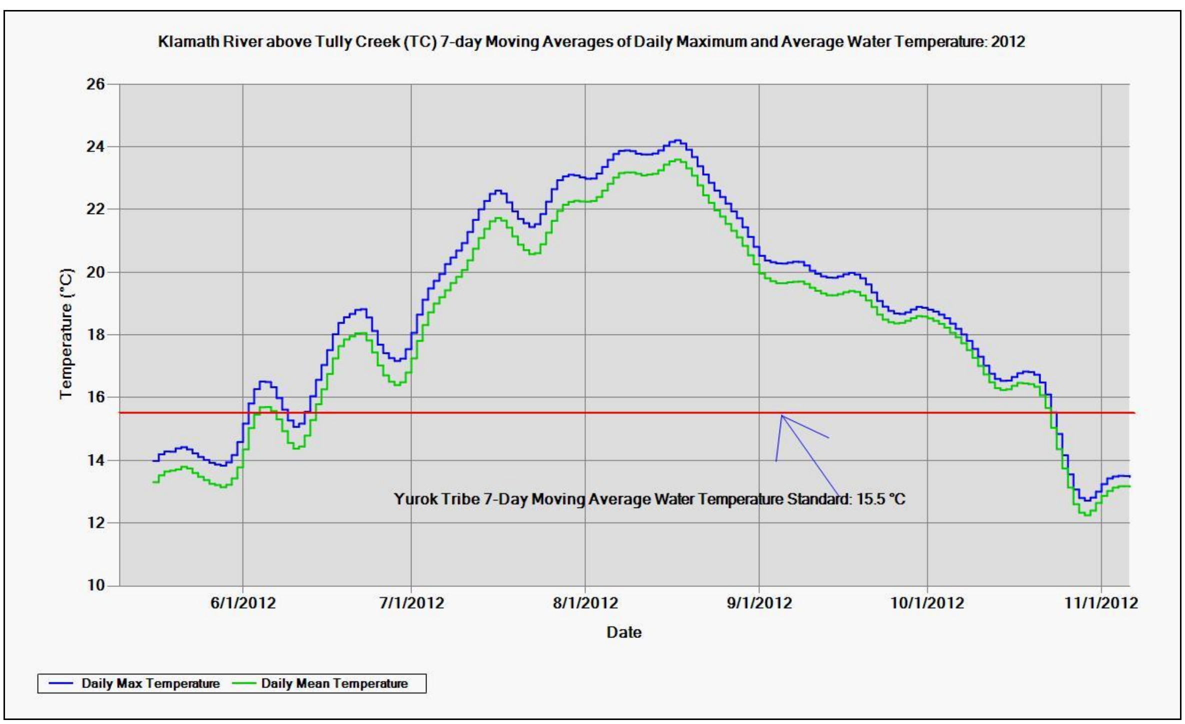

Figure 6-5. TC 7-Day Moving Averages: 2012

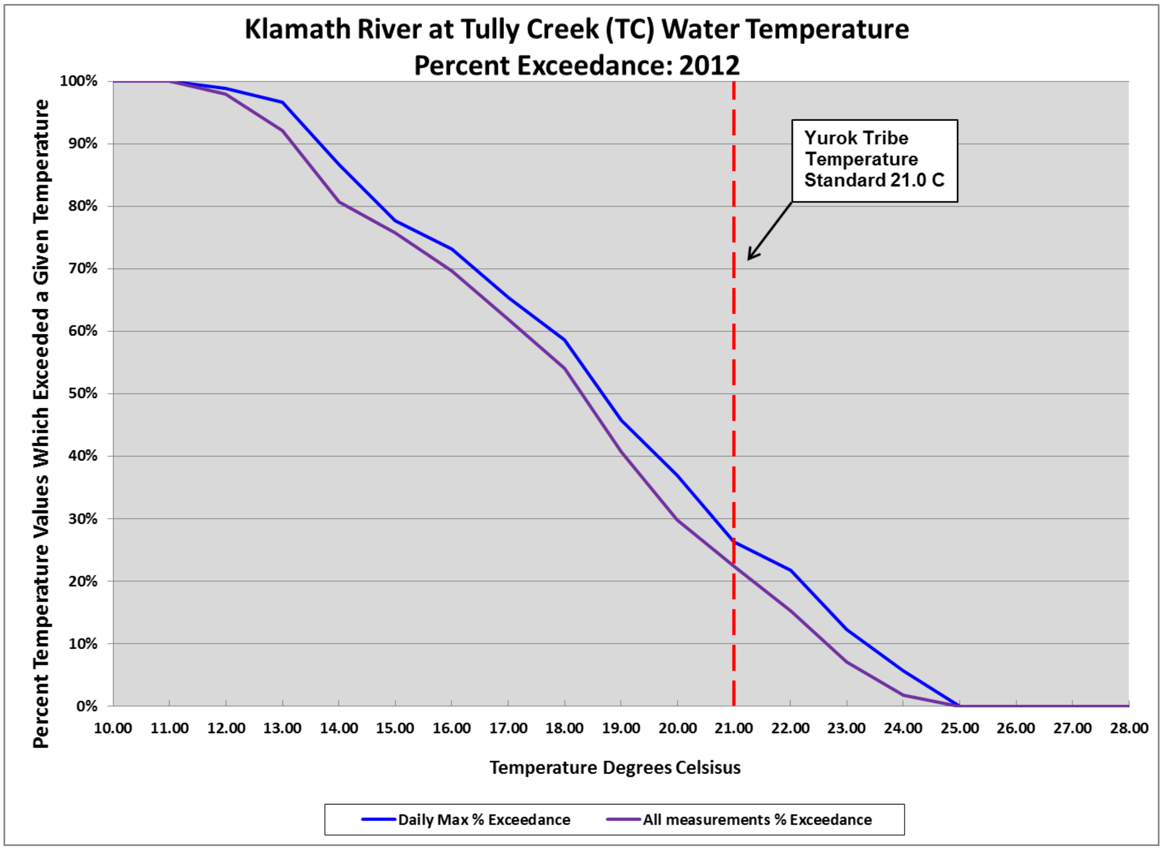

Figure 6-6. TC Water Temperature Percent Exceedance: 2012

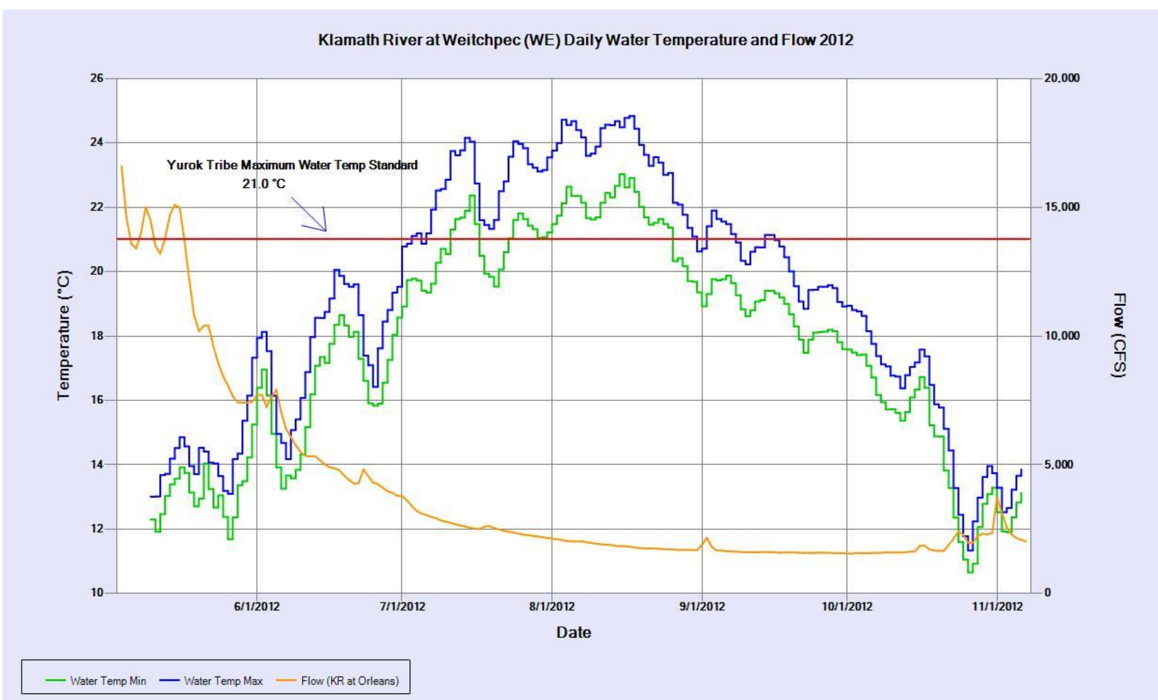

Figure 6-7. WE Maximum/minimum Water Temperature and Flow: 2012

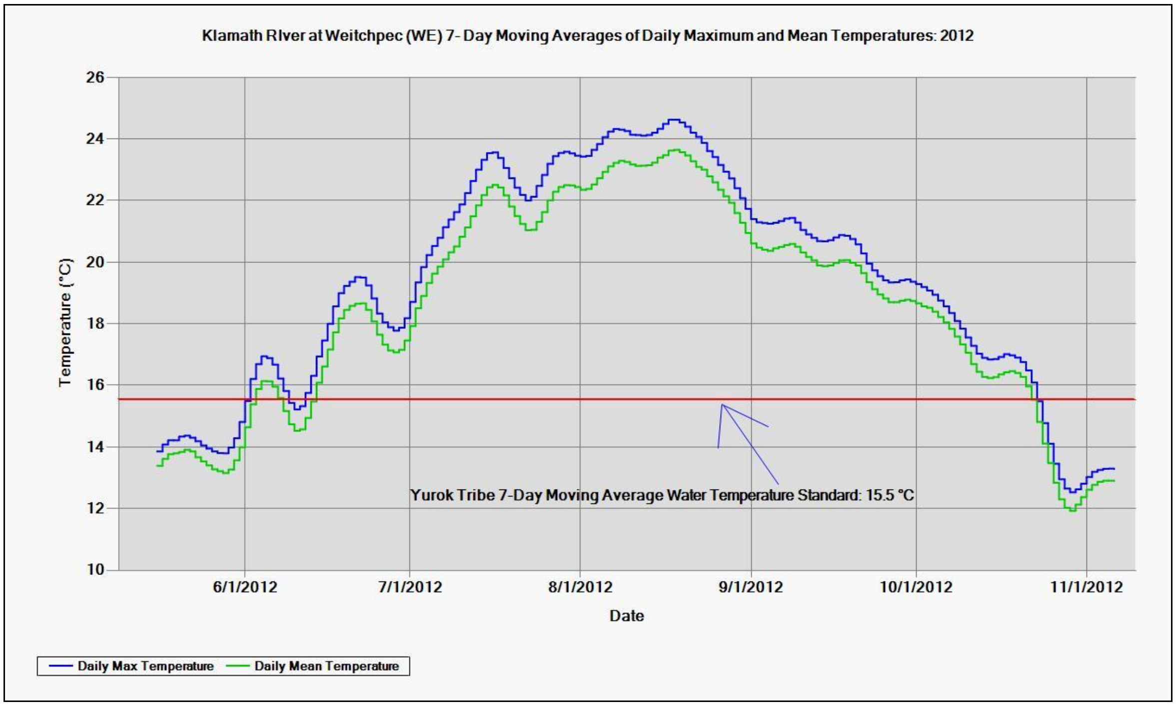

Figure 6-8. WE 7-Day Moving Averages: 2012

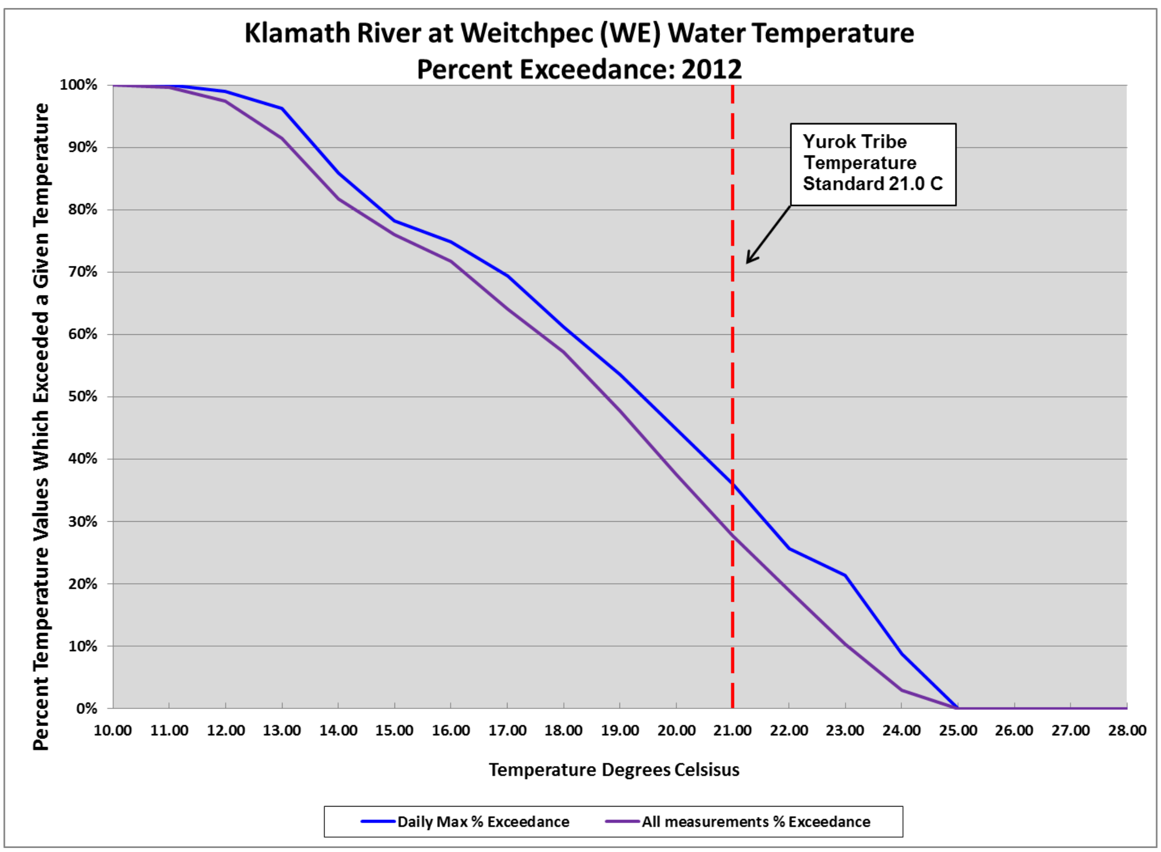

Figure 6-9. WE Water Temperature Percent Exceedance: 2012

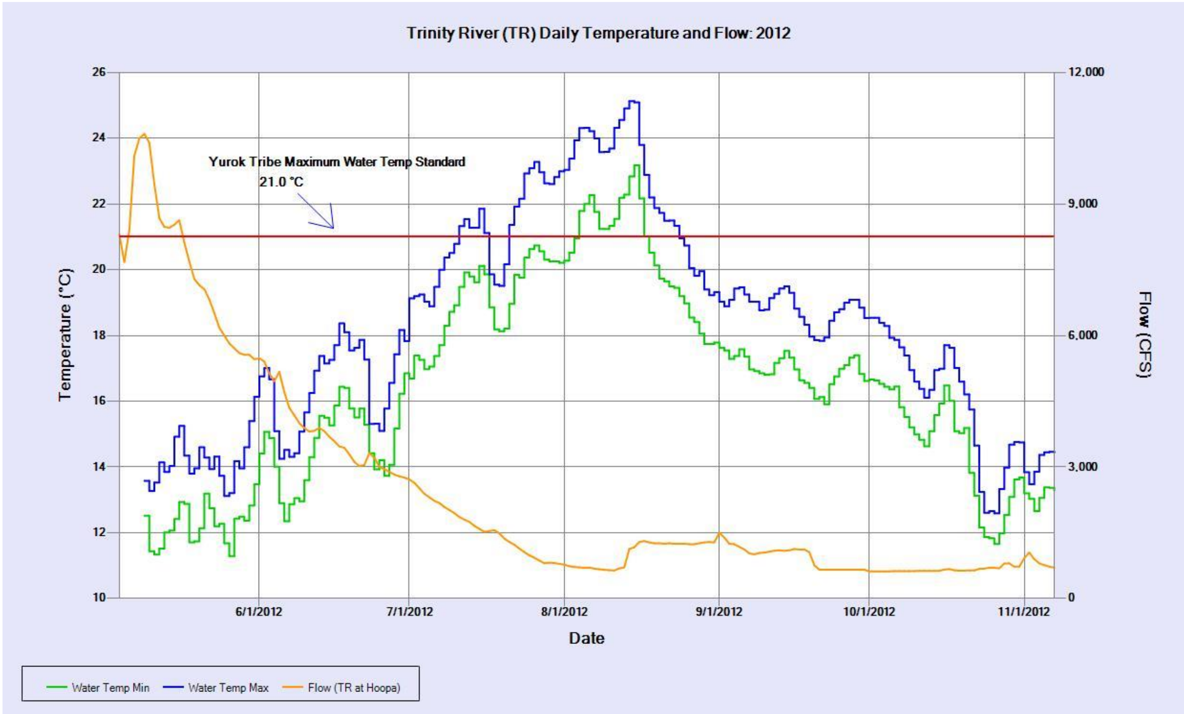

Figure 6-10. TR Maximum/minimum Water Temperature and Flow: 2012

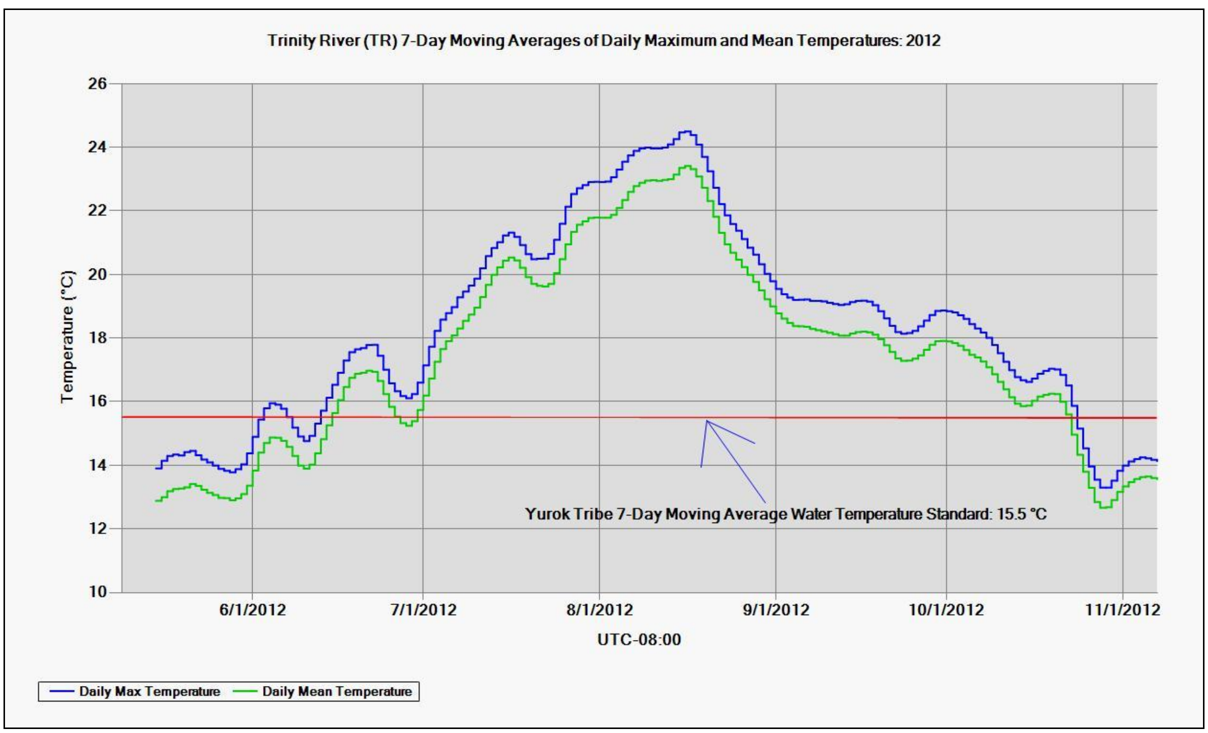

Figure 6-11. TR 7-Day Moving Averages: 2012

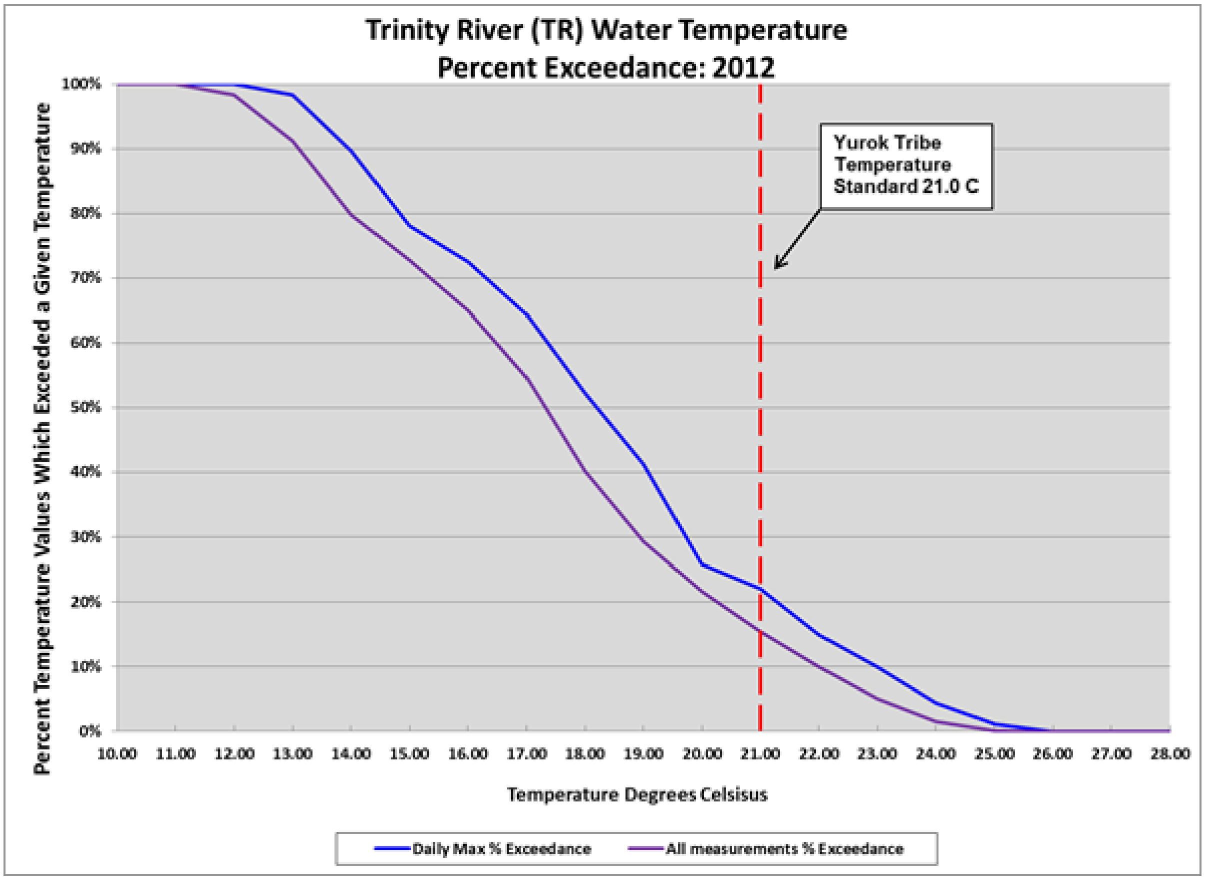

Figure 6-12. TR Water Temperature Percent Exceedance: 2012

Dissolved Oxygen

All Riverine Sites

Dissolved oxygen (DO) concentrations are reported in milligrams per liter (mg/L). The datasonde calculates this concentration based on the DO sensor's percent saturation reading. Percent saturation is the amount of oxygen dissolved in the water compared to the maximum amount that could be present at the same temperature and barometric pressure. Water is said to be 100% saturated if it contains the maximum amount of oxygen at that temperature and pressure. Sometimes water can become supersaturated with oxygen, returning percent saturations readings above 100%. This happens in two main situations. One is in fast-moving, turbulent water, which encourages more air to mix with the water. The other is in situations with large numbers of photosynthetic aquatic planss. These aquatic plants release oxygen into the water during photosynthesis, which mixes with the water as it rises to the surface.

In general, DO levels of the Lower Klamath and Trinity River follow an inverse relationship compared to water temperature. As water temperature rises, its ability to hold oxygen in solution is decreased, causing DO levels to drop. Therefore, as water temperatures increase throughout the summer, DO levels tend to decrease. There is also a diurnal fluctuation within the system, with minimum DO levels occurring late at night and/or early in the morning when aquatic organisms are respiring and photosynthesis is not occurring. Conversely, maximum levels occur late in the afternoon and/or early in the evening when aquatic vegetation is at peak photosynthesis. These diurnal fluctuations can cause large swings in DO throughout the day, which can be harmful to aquatic organisms dependent on DO for respiration.

DO levels at all sites varied greatly during the 2011 monitoring season. The lowest DO concentration recorded was 7.66 mg/L at KAT on August 15. The highest DO concentration recorded was 11.96 mg/L at KAT on Octoberber 28. The lowest DO% saturation recorded was 87.7% at KAT on August 25. The highest DO% saturation recorded was 116.2% at WE on September 26. In this discussion, daily minimum and maximum DO concentrations and percent saturation were compared to the Yurok Tribe's dissolved oxygen standards in order to assess dissolved oxygen levels of the Klamath and Trinity Rivers. These standards are 8.0 mg/L for DO concentration and 90% percent saturation from September 1 through May 31 and 85% percent saturation from June 1 through August 31.

Daily maxima and minima were disregarded when more than five measurements were missing from a 24-hour period and when the daily maximum or minimum was expected to occur during the gap. Gaps in data may occur during service or due to instrument malfunction or vandalism. Continuous DO data from the Lower Klamath and Trinity River is available from YTEP upon request.

Klamath River above Turwar (KAT)

Minimum DO concentrations at KAT tended to drop from May until late September, with spikes in late May, late June, mid-July and late August/early September (Figure 6-13). DO concentrations then gradually increased until datasonde extraction in early November, with spikes in mid-September and late October.

The lowest DO concentration recorded at KAT was 7.66 mg/L on August 15, while the highest DO concentration recorded was 11.96 mg/L on October 28 (Figure 6-13). Daily minimum dissolved oxygen concentration dropped below 8.0 mg/L from August 3-27, for a total of 25 out of 179 days, or 13.97% of the time. Measurements of DO dropped below 8.0 mg/L 2.57 % of the time, or 222 out of 8,646 readings for all half-hour measurements during the 2012 monitoring season. The lowest percent saturation was 87.7% on August 25, and the highest recorded percent saturation was 114.9% on August 28 (Figure 6-14). On September 4, and from September 6-9, 13-21, September 23 to October 6 and October 7-8, daily minimum DO percent saturation dropped below 90%, for a total of 48 out of 179 days, or 26.82% of the time. Measurements of DO percent saturation dropped below 90% for 215 out of 8,646 readings, or 2.49% of all half-hour measurements during the 2012 monitoring season. DO percent saturation did not fall below 85% from June 1 through August 31.

Klamath River above Tully Creek (TC)

Minimum DO concentrations at TC generally decreased from May until mid-August, with spikes in late May, early June, late June, mid-July. (Figure 6-15). DO concentrations then gradually increased until datasonde extraction in early November, with a dip in mid-September and a spike in late October.

The lowest DO concentration recorded at TC was 7.860 mg/L on August 15, while the highest was 11.62 mg/L on October 26 (Figure 6-15). Daily minimum dissolved oxygen concentration dropped below 8.0 mg/L for August 4 and from August 12-15, for a total of 5 out of 181 days, or 2.76% of the time. Measurements of DO dropped below 8.0 mg/L 0.64% of the time, or 56 out of 8,704 readings during the 2012 monitoring season. The lowest recorded percent saturation was 93.5% on August 14, and the highest was 112.9% on September 12 (Figure 6-16). Daily minimum DO percent saturation did not drop below 90% from September 1 to May 31, and did not drop below 85% from June 1 to August 31.

Klamath River at Weitchpec (WE)

Minimum DO concentrations at WE tended to drop from May until mid-August, with spikes in late May, early and late June, and mid-July (Figure 6-17). DO concentrations then gradually increased until datasonde extraction in early November, with spikes in early September, early October and late October.

The lowest DO concentration recorded at WE was 7.70 mg/L on August 15, while the highest was 11.85 mg/L on October 26 (Figure 6-17). Daily minimum dissolved oxygen concentration dropped below 8.0 mg/L from August 2-7, 10-21, and 23-25 during the 2012 monitoring season for a total of 21 out of 181 days or 11.60%. Measurements of DO dropped below 8.0 mg/L 3.04% of the time, or 266 out of 8,739 readings for all half-hour measurements during the 2012 monitoring season. The lowest recorded percent saturation was 89.1% on September 6, and the highest was 116.2% on September 26 (Figure 6-18). On September 5-7 and September 12 daily minimum DO percent saturation dropped below 90% for a total of 4 out of 181 days, or 2.21% of the time. Measurements of DO percent saturation dropped below 90% for 20 out of 8739 readings, or 0.23% of all half hour measurements during the 2012 monitoring season. Daily minimum DO percent saturation did not drop below 85% from June 1 to August 31.

Trinity River near Mouth (TR)

Minimum DO concentrations at TR generally dropped from early May until mid-August, with peaks in late May, early June, late June, and mid-July (Figure 6-19). DO concentrations then increased until datasonde extraction in early November, with peaks in late September and late October.

The lowest DO concentration recorded at TR was 7.94 mg/L on August 14, while the highest was 11.17 mg/L on October 27 (Figure 6-19). Daily minimum dissolved oxygen concentration dropped below 8.0 mg/L from August 14-15 during the 2012 monitoring season for a total of 2 out of 181 days, or 1.10% of the time. Measurements of DO dropped below 8.0 mg/L 0.03% of the time or 3 out of 8734 readings for all half-hour measurements during the 2012 season. The lowest recorded percent saturation was 95.2% on August 14, and the highest was 107.2% on July 31 (Figure 6-20). Daily minimum DO percent saturation did not drop below 90% from September 1 to May 31, and did not drop below 85% from June 1 to August 31.

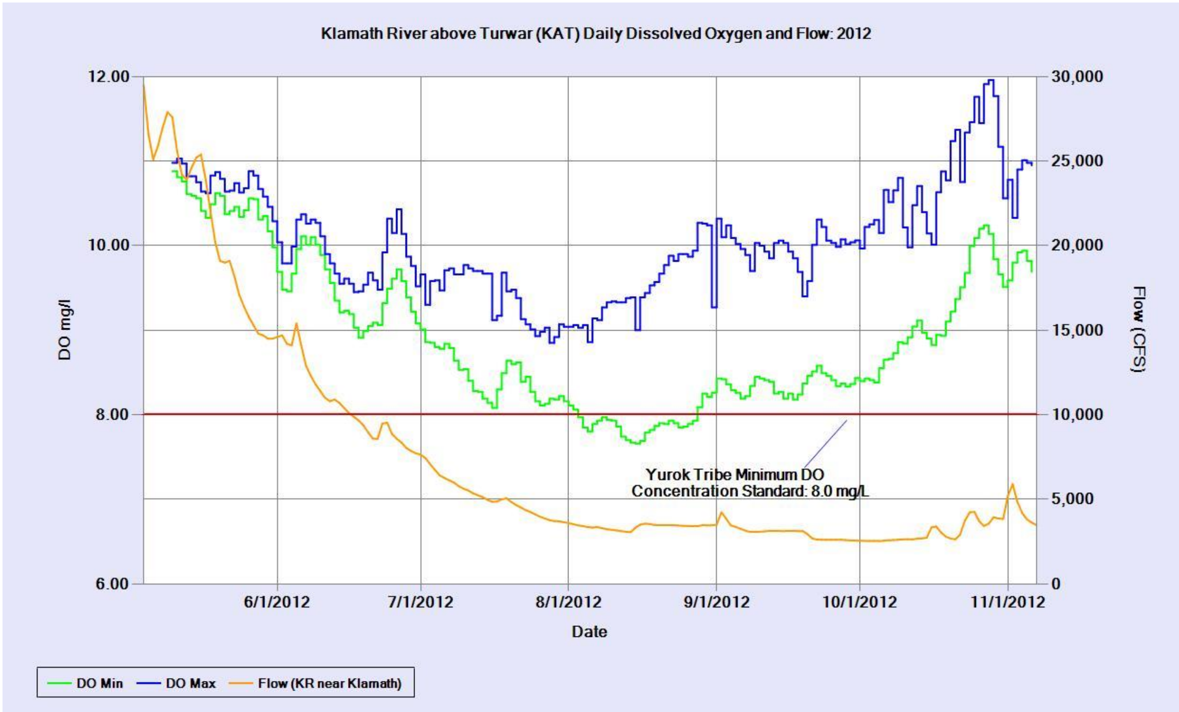

Figure 6-13. KAT Dissolved Oxygen and Flow: 2012

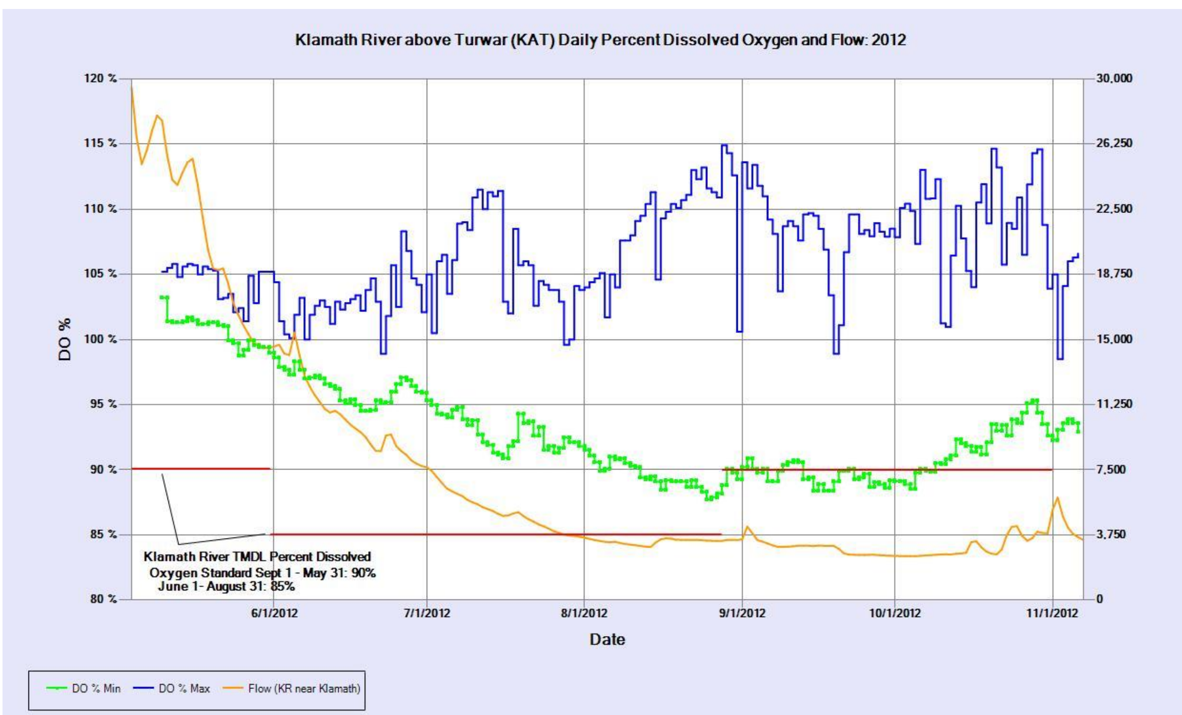

Figure 6-14. KAT Percent Dissolved Oxygen and Flow: 2012

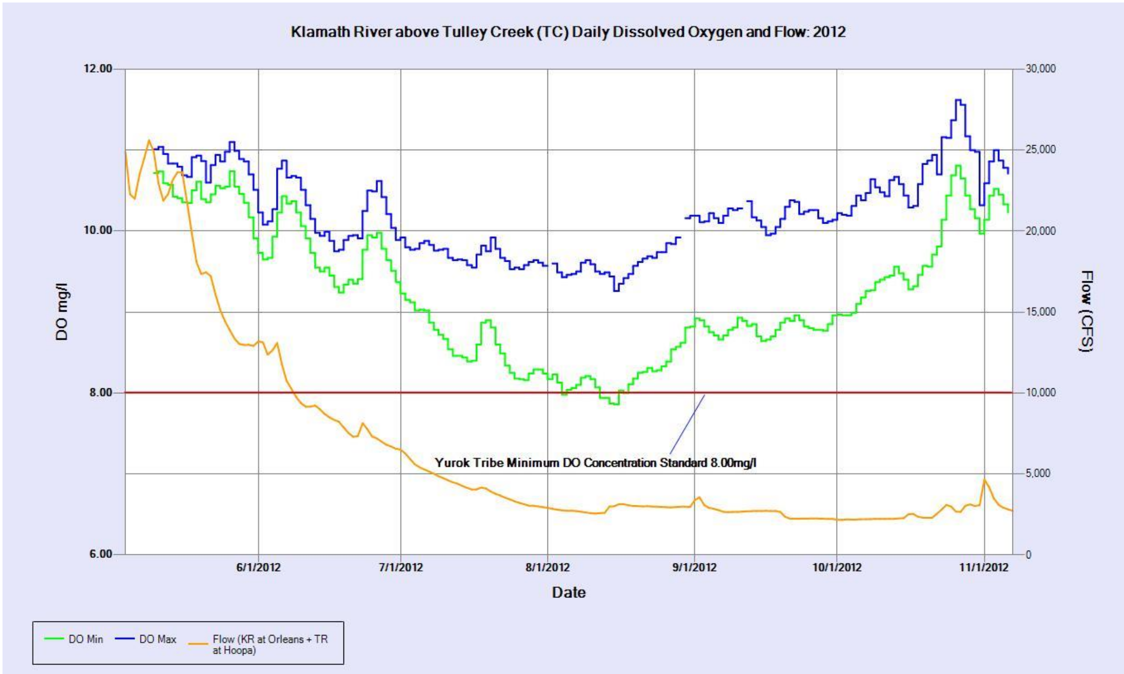

Figure 6-15. TC Dissolved Oxygen and Flow: 2012

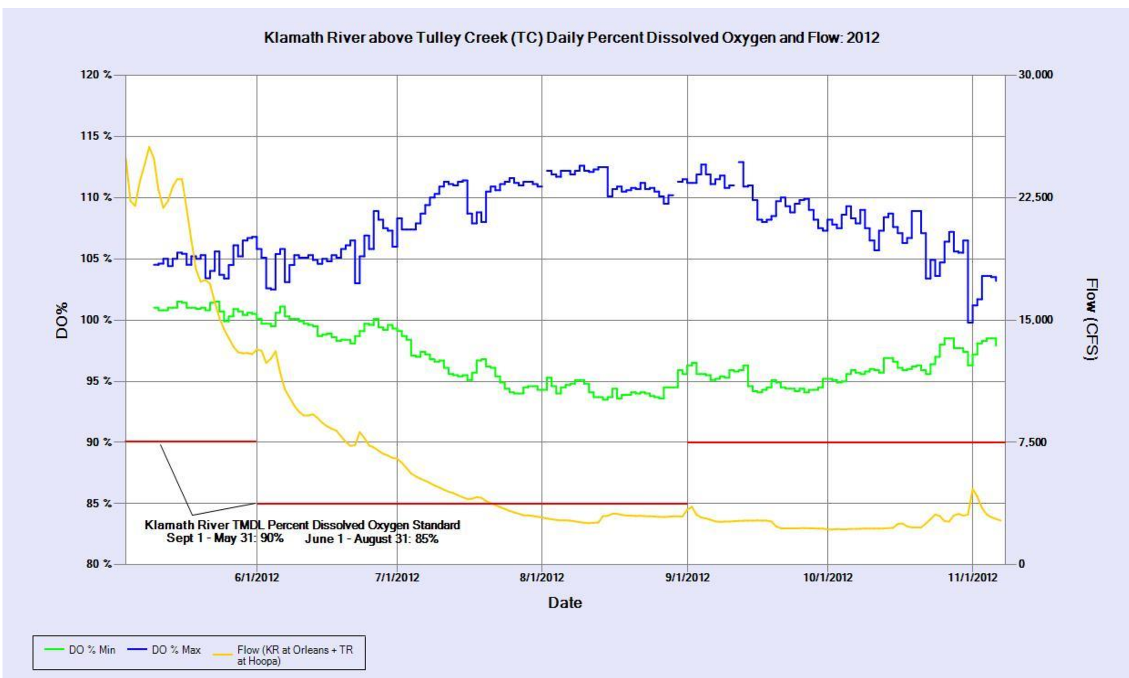

Figure 6-16. TC Percent Dissolved Oxygen and Flow: 2012

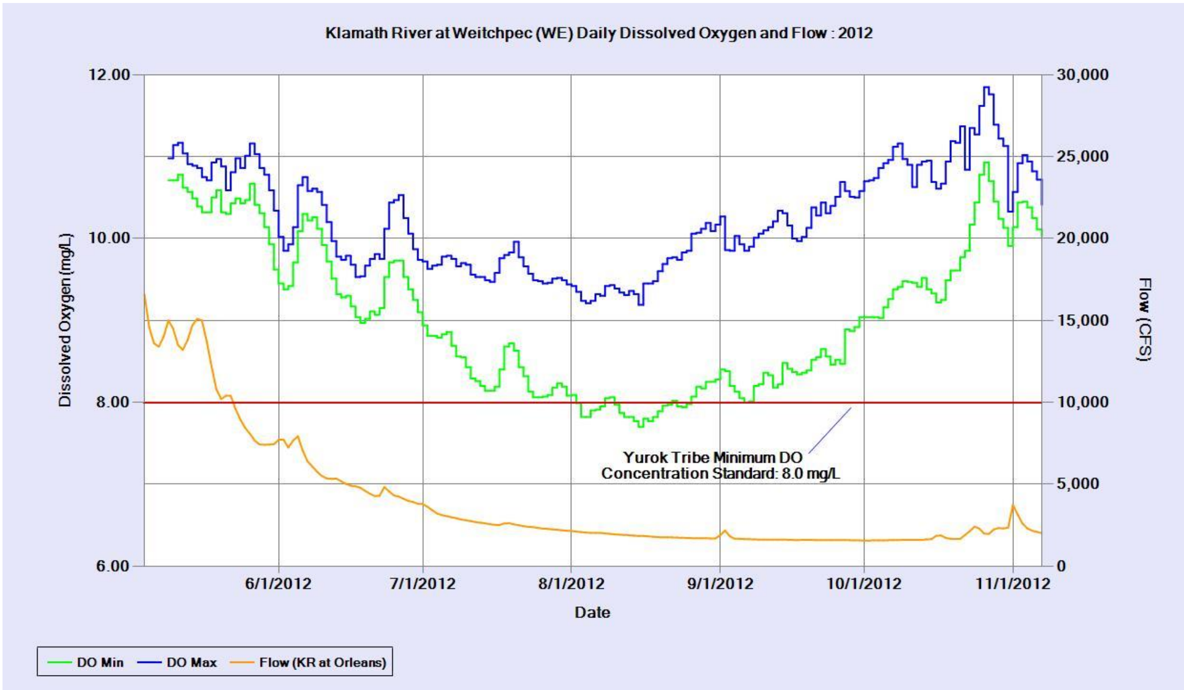

Figure 6-17. WE Dissolved Oxygen and Flow: 2012

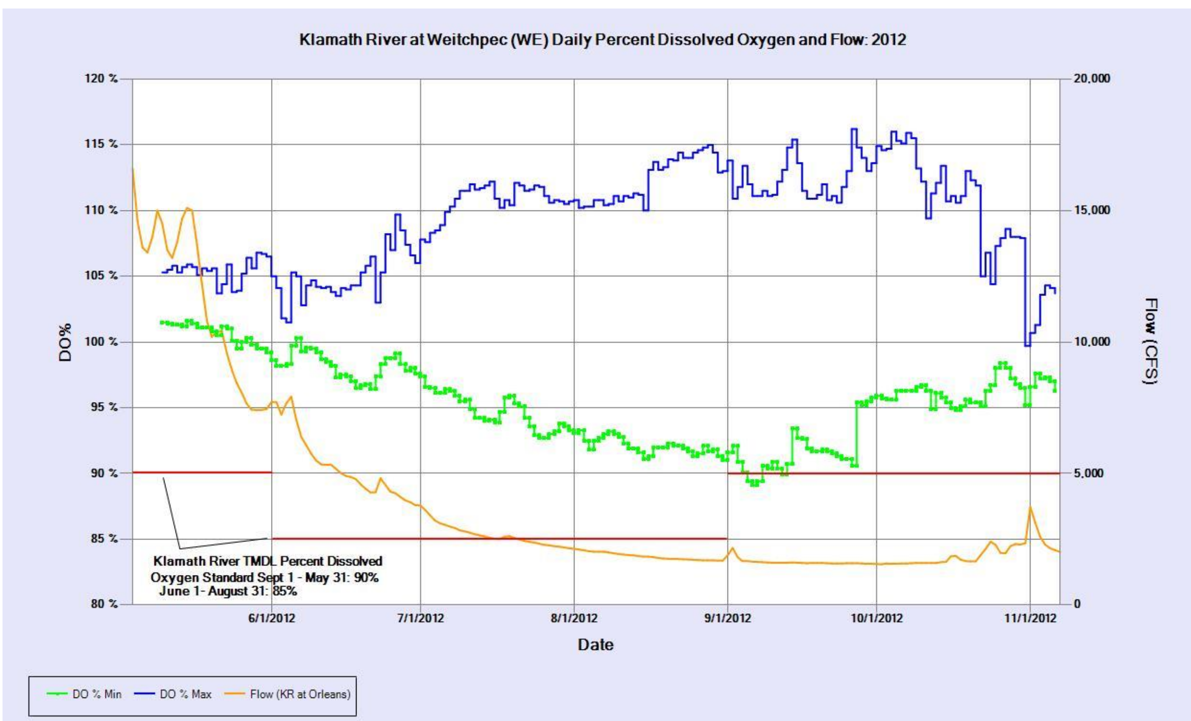

Figure 6-18. WE Percent Dissolved Oxygen and Flow: 2012

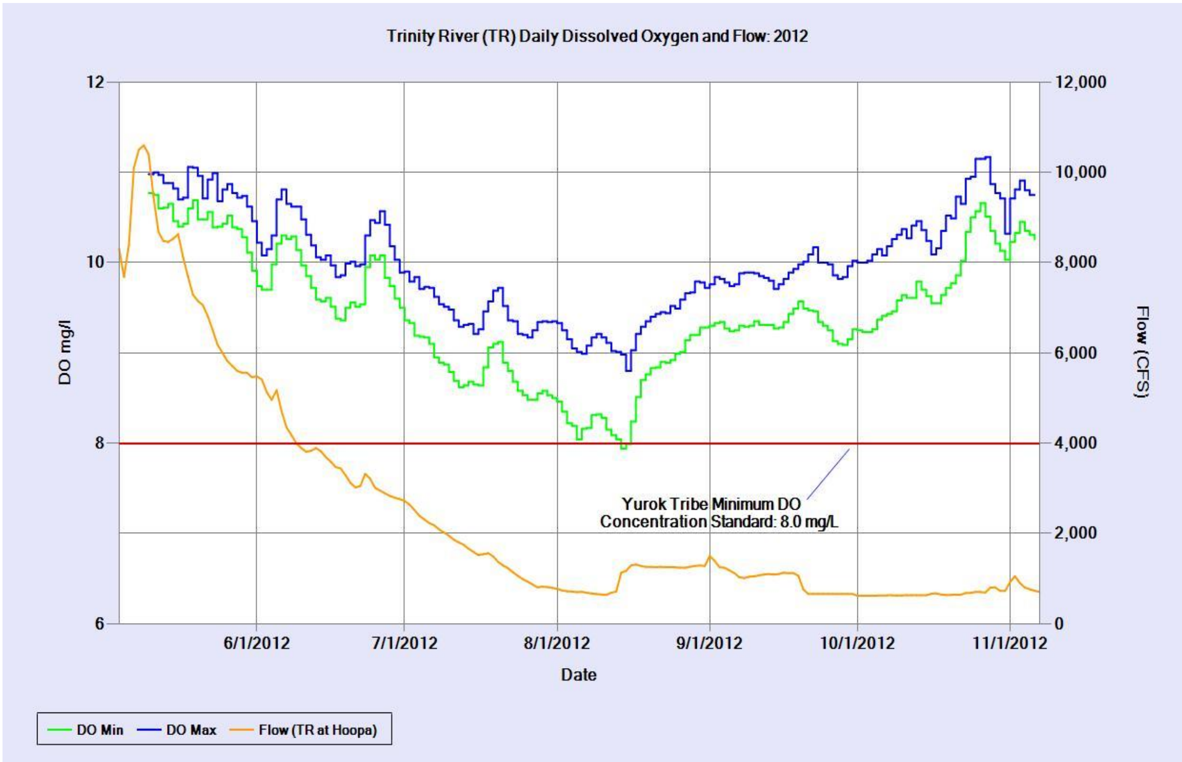

Figure 6-19. TR Dissolved Oxygen and Flow: 2012

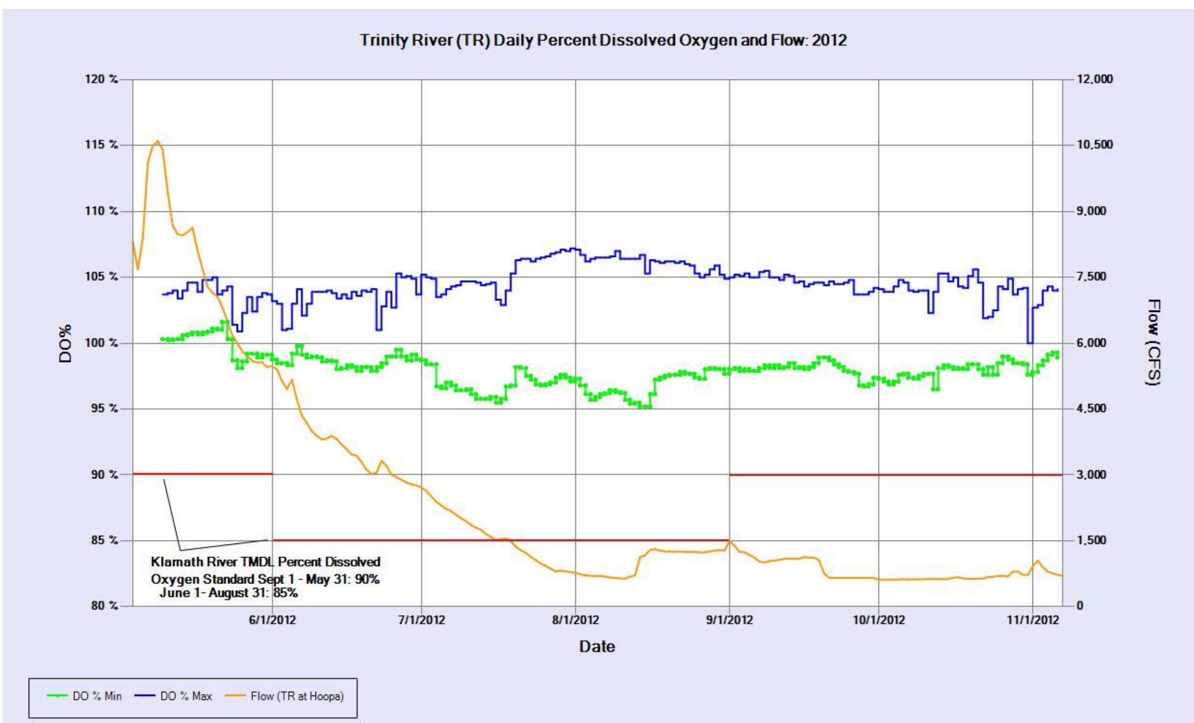

Figure 6-20. TR Percent Dissolved Oxygen and Flow: 2012

pH

All Riverine Sites

pH values on the lower Klamath and Trinity River varied greatly throughout the 2012 monitoring season. The lowest recorded pH was 7.89 at KAT on November 3, while the highest recorded pH was 8.71 at KAT on August 24.

Due to its implications for fish health, maximum pH is focused on in this summary. The Yurok Tribe has set a standard of 8.5 for pH on the lower Klamath and Trinity River. pH values above this standard can cause chronic stress and exhaustion to salmonids. Values above 9.6 are often lethal. The combined effects of high pH and high water temperature increases unionized ammonia, which can be highly toxic to salmon and steelhead. For results of nutrient samples collected on the Lower Klamath and Trinity River, see the Yurok Tribe's 2012 Klamath River Nutrient Summary Report.

Daily maxima and minima were disregarded when more than five measurements were missing from a 24-hour period and when the daily maximum or minimum was expected to occur during the gap. Gaps in data may occur during service or due to instrument malfunction or vandalism. Continuous pH data from the Lower Klamath and Trinity River is available from YTEP upon request.

Klamath River above Turwar (KAT)

Maximum pH at KAT generally increased from deployment in early May until late August, with a dip in late July and spikes in late June and mid-July (Figure 6-21). pH then fluctuated around this level until Early November. Values then declined until extraction in early November.

The lowest pH recorded at KAT was 7.89 on November 3, while the highest recorded pH was 8.71 on August 24 (Figure 6-21). Daily maximum pH initially exceeded the standard of 8.5 on July 7-15, below 8.5 July 16, just to exceed 8.5 again on July 18 for the day. pH then steadily declined and rose again until it exceeded 8.5 from August 14-30, and again from September 1-7. pH fluctuated at this level through October exceeding 8.5 again from September 13-15, September 22-30, October 2-9, October 13, October 17-23, and October 28-29. Daily maximum pH values exceeded the standard of 8.5, 34.64% of the time, or 62 out of 179 days. Measurements of pH surpassed 8.5 for 703 out of 8,646 readings, or 8.13% of all half-hour measurements during the 2012 monitoring season.

Klamath River above Tully Creek (TC)

Maximum pH at TC gradually increased from early May until late August, with spikes in late May and late June (Figure 6-22). In late August, pH gradually decreased until late October. After late October values sharply decreased heading into November. Values increased from the beginning of November until datasonde extraction on November 11.

The lowest recorded pH at TC was 7.97 on May 17, while the highest was 8.64 on August 26 (Figure 6-22). Daily maximum pH initially exceeded the standard of 8.5 from July 12-15, then again from July 22-30. Values dropped to 8.50 for July 31, then exceeded the standard once again from August 1-31. Values exceed on September 2, 4, 13-14, 20-22, 26, and October 5-8 during the 2012 monitoring season. Daily maximum pH values exceeded the standard of 8.5 30.94% of the time, or 56 out of 181 days. Measurements of pH surpassed 8.5 for 485 out of 8704 readings, or 5.72%.

Klamath River at Weitchpec (WE)

Maximum pH at WE gradually increased after deployment in early May until late August, with spikes in late May and late June (Figure 6-23). pH levels then fluctuated above 8.5 until mid-October. After mid-October, pH levels decreased until October/November then increased until datasonde extraction in early November.

The lowest recorded pH at WE was 7.90 on November 2, while the highest was 8.69 on October 7 (Figure 6-23). Daily maximum pH initially exceeded the standard of 8.5 in July, from the 10-15, then again from July 21-28. On August 1 daily maximum pH again exceeded the standard and began to increase.. Daily maximum pH values exceeded the standard of 8.5, 51.38% of the time, or 93 out of 181 days. Measurements of pH surpassed 8.5 for 760 out of 8,739 readings, or 8.69% of all half-hour measurements during the 2012 monitoring season.

Trinity River near Mouth (TR)

Maximum pH values at TR fluctuated around 8.25 from initial deployment in early May until late July (6-24). After late July, pH increased slowly until early August, after which slowly declined until mid-September. After mid-September values increased again until late October. Values then declined until datasondes were extracted on November 7.

The lowest recorded pH at TR was 7.91 on November 5, while the highest pH was 8.49 on August 5 (Figure 6-24). At no point during the 2011 monitoring season did daily maximum pH exceed the standard of 8.5.

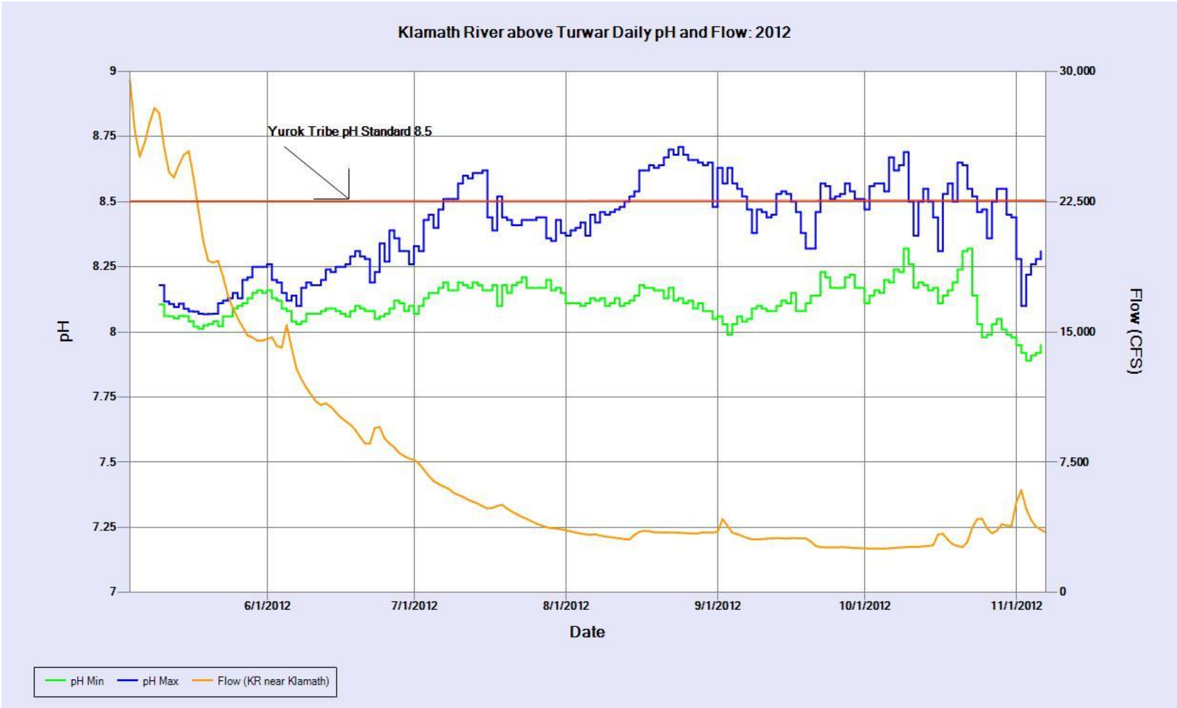

Figure 6-21. KAT Maximum/minimum pH and Flow: 2012

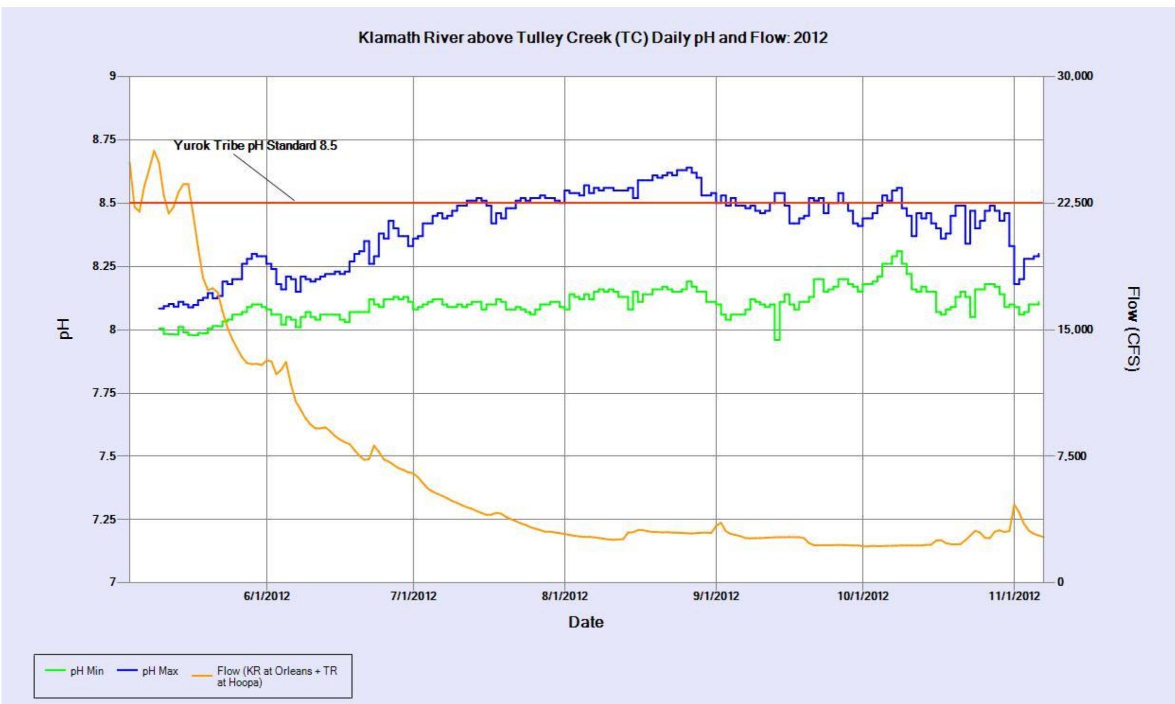

Figure 6-22. TC Maximum/minimum pH and Flow: 2012

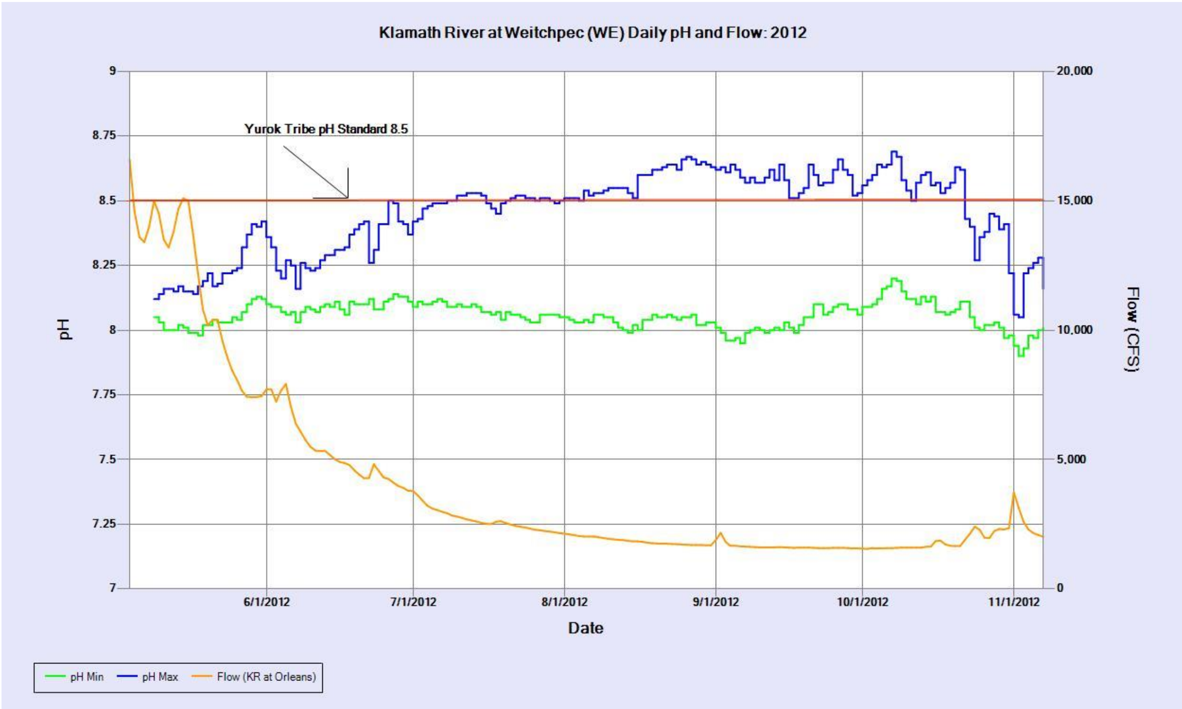

Figure 6-23. WE Maximum/minimum pH and Flow: 2012

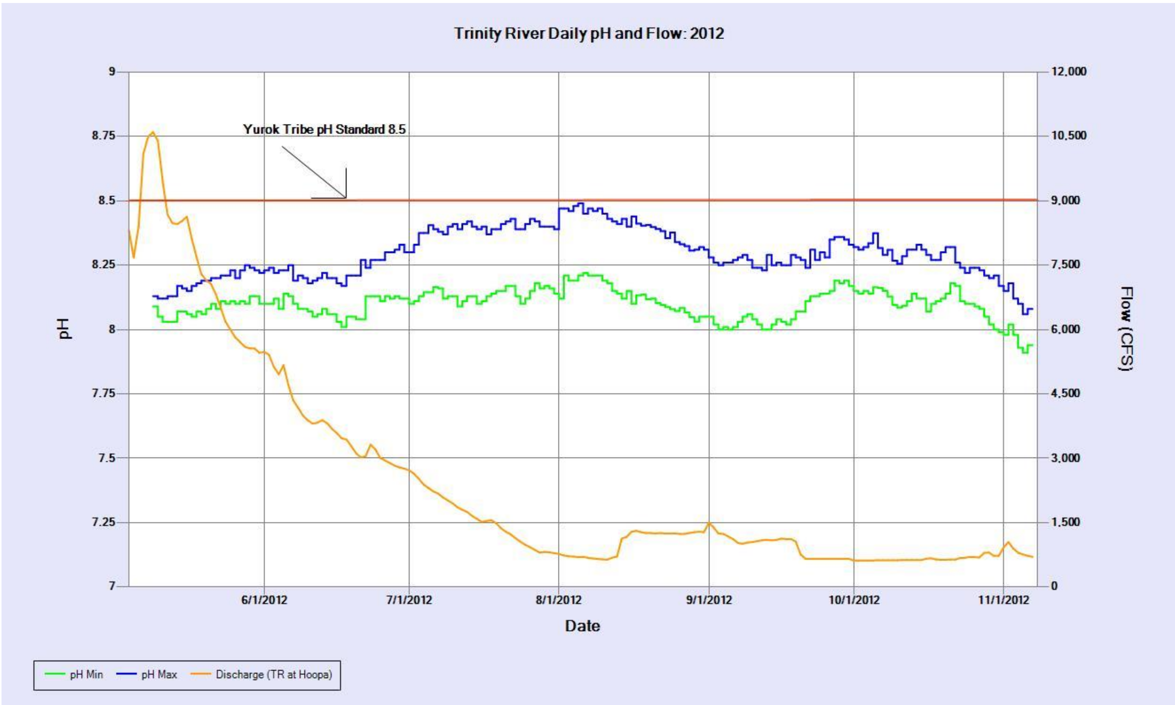

Figure 6-24. TR Maximum/minimum pH and Flow: 2012

Specific Conductivity

All Riverine Sites

Specific conductivity measures how well an aqueous solution can pass an electric current, which increases with the quantity of dissolved ionic substances in the water column, thus another method to determine the level of dissolved substances present. Specific conductivity is measured in microsiemens per centimeter.

Specific conductivity varied greatly at all sites during the 2012 monitoring season. The highest specific conductivity recorded was 189 µS/cm at WE on October 15,20, and 21 while the lowest specific conductivity recorded was 89µS/cm at WE on May 16. At no time did specific conductivity levels exceed the Yurok Tribe's specific conductivity standard, which states that levels shall have a 90% upper limit of 300 µS/cm at 25 ºC, and a 50% upper limit of 200 µS/cm at 25ºC.

Daily maxima and minima were disregarded when more than five measurements were missing from a 24-hour period and when the daily maximum or minimum was expected to occur during the gap. Gaps in data may occur during service or due to instrument malfunction or vandalism. Continuous specific conductivity data from the lower Klamath and Trinity River is available from YTEP upon request.

Klamath River above Turwar (KAT)

Specific conductivity at KAT increased slightly initially, decreased in mid-May, then increased into early June (Figure 6-25). In early June specific conductivity decreased slightly. After early June values increased steadily until mid-August. In mid-August specific conductivity took a large dip that lasted through late September with a small spike in early September. After late September values increased through late October. Specific conductivity then dropped to November, with a spike at the end of August. Specific conductivity values were increasing when monitoring was suspended on November 11.

The lowest recorded specific conductivity reading at KAT was 96 µS/cm on May 16, while the highest recorded specific conductivity reading was 186 µS/cm on October 21 (Figure 6-25).

Klamath River above Tully Creek (TC)

Specific conductivity at TC gradually increased until mid-August, with dips in mid-May and early June (Figure 6-26). After mid-August a large bowl shaped dip occurred until mid-September. Afterwards values increased until late October. In early November values sharply decreased, then reversed the trend until sondes were removed on November 11.

The lowest specific conductivity reading at TC was 96 µS/cm on May 16, while the highest recorded reading was 178 µS/cm on October 28 (Figure 6-26).

Klamath River at Weitchpec (WE)

Specific conductivity at WE decreased from deployment until mid-May, then increased until early June (Figure 6-27). In early June specific conductivity decreased a bit for about a week, then increased gradually until late October. In late October, values began decreasing, then increased for a short period. After the late October increase values sharply declined into early November. Values then increased and were increasing when datasondes were extracted on November 11.

The lowest recorded specific conductivity reading at WE was 89 µS/cm on May 16, while the highest recorded reading was 189 µS/cm on October 15, and 20-21 (Figure 6-27).

Trinity River near Mouth (TR)

Specific conductivity at TR increased slightly from initial deployment in early May for a few days before declining until mid-May (Figure 6-28). Values then increased slightly through the end of the month, dropping into early June. Values gradually increased from early June until mid-August. Specific conductivity then took a significant dip until late September. From late September to mid-October values remained steady. In mid-October values sharply rose until late October, when they took a dip to finish out the month. Values increased from until datasondes were extracted on November 11.

The lowest recorded specific conductivity reading at TR was 101 µS/cm on May 17, while the highest recorded specific conductivity was 176 µS/cm on October 28 (Figure 6-28).

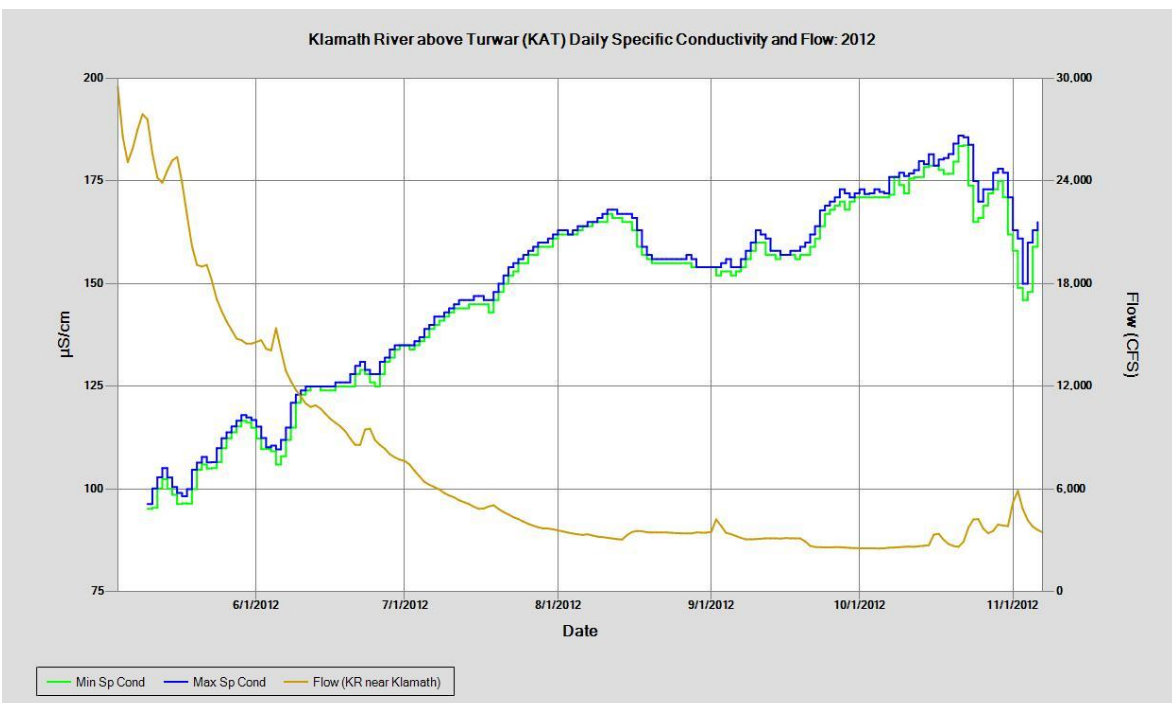

Figure 6-25. KAT Maximum/minimum Specific Conductivity and Flow: 2012

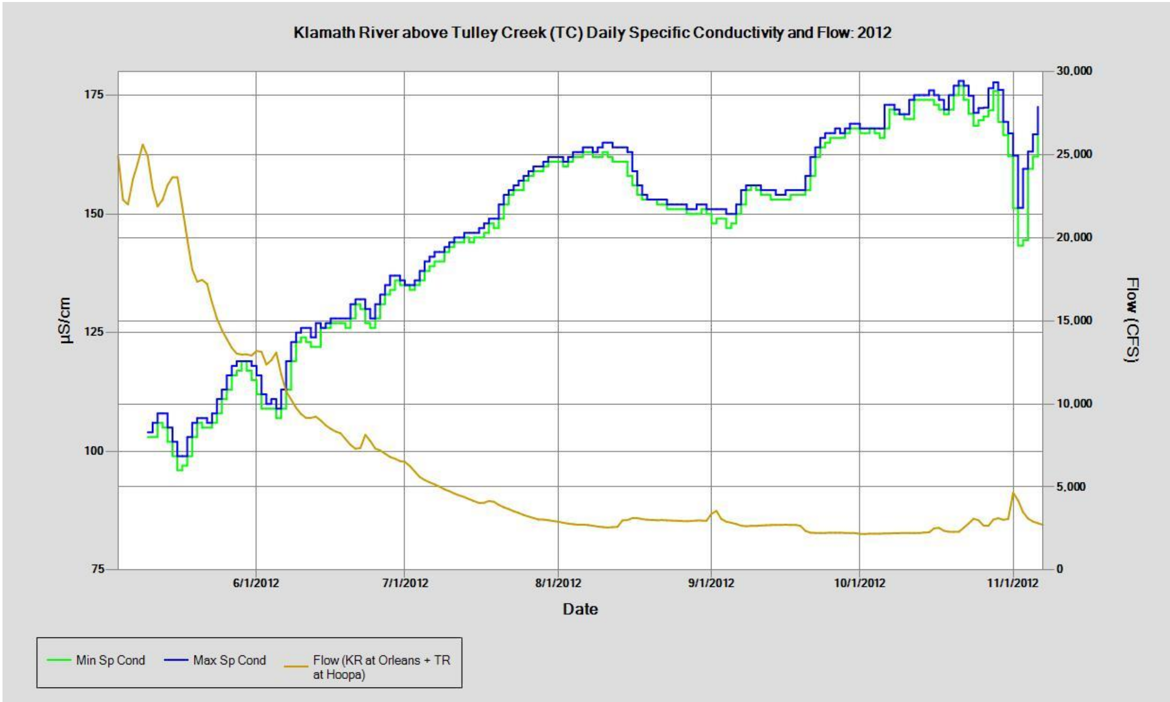

Figure 6-26. TC Maximum/minimum Specific Conductivity and Flow: 2012

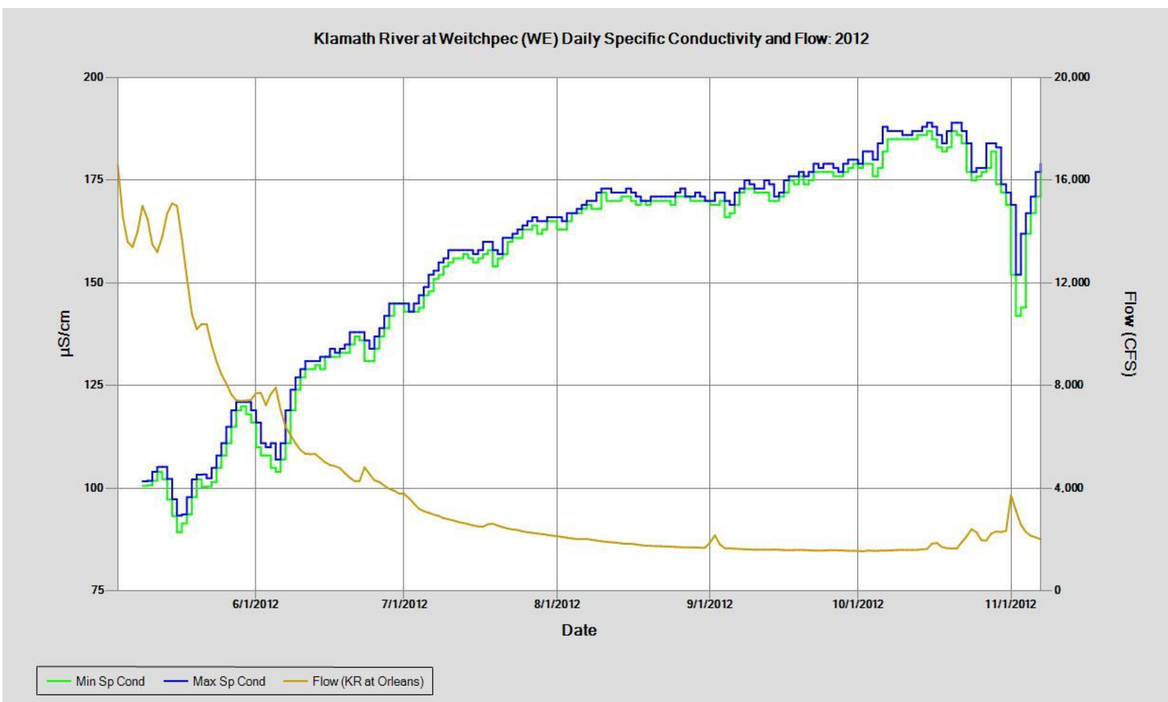

Figure 6-27. WE Maximum/minimum Specific Conductivity and Flow: 2012

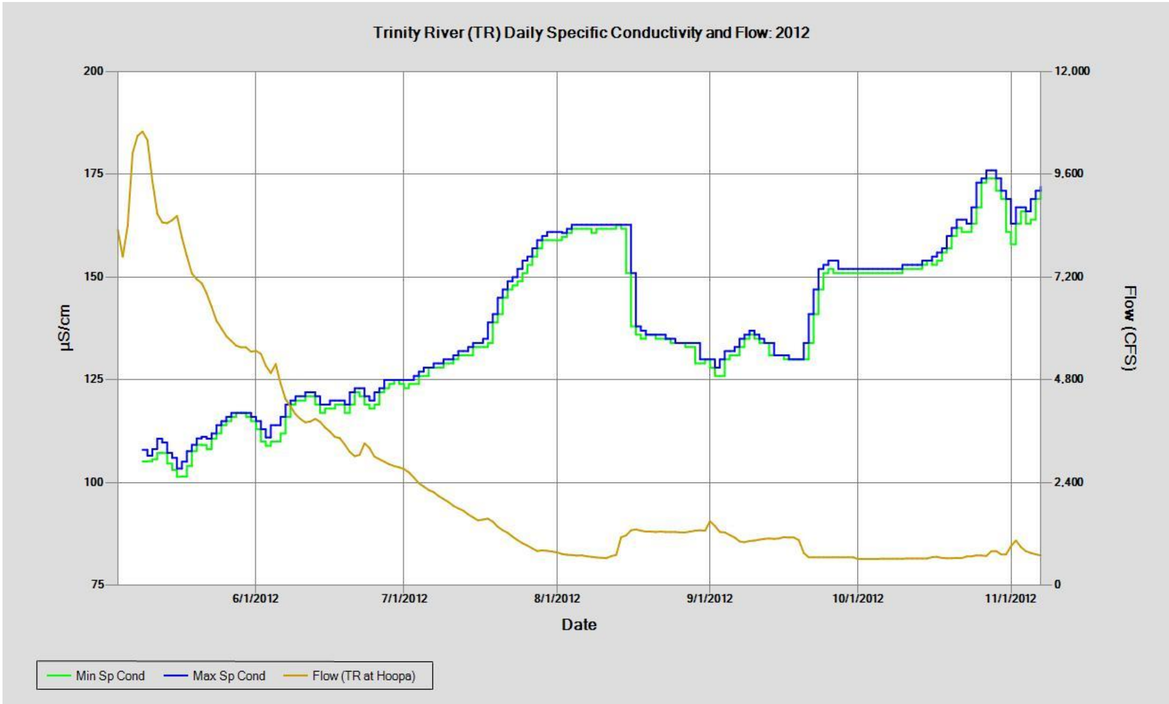

Figure 6-28. TR Maximum/minimum Specific Conductivity and Flow: 2012

Blue-Green Algae (Phycocyanin)

All Riverine Sites

The Blue-Green Algae (BGA) probe is an optical probe that uses "in-vivo fluorometry (IVF) to measure the fluorescence to detect the phycobilin pigments called phycocyanin that are found in the living cells of blue-green algae (a.k.a. cyanobacteria). The blue-green algae sensors do not provide quantitative pigment concentration data, but rather supply relative data on the biomass of blue-green algae. IVF data can be correlated to quantitative data in order to calibrate the IVF data to provide concentration estimates.

The BGA probe readings varied at all sites from early September to the end of the monitoring season. The minimum BGA reading from the Phycocyanin probe was -44 cells.mL at TC on 8/5/13 at 15:30. The highest BGA reading of the 2012 monitoring season was 16,205 cells/mL which occurred at WE on 10/9 at 02:00.

Without correlation, IVF provides a relative cyanobacteria measure that can be used to track trends and trigger more specific tests. YTEP determines the relationship between the IVF readings of the phycocyanin probe by taking open composite grab samples at the same time at the same location as the data sonde. These composite grab samples are poured off into a Nalgene sample bottle with preservative, and shipped to Aquatic Analysts located in Washington. These samples are then graphed with the continuous data to show the general relationship between the probe readings and the lab results. These graphs indicate that when the phycocyanin probes read at elevated levels the lab results also show that *Microcystis aeruginosa* is present in the water column.

Klamath River above Turwar (KAT)

BGA probe readings at KAT showed concentrations close to zero from the beginning of the monitoring season in early May until early September. From September mid-October the Klamath showed elevated levels of BGA, exceeding the State of California's Recommended Threshold for Recreational Waterways of 40,000 cells/mL for the grab sampling event that occurred at TG on September 5th, with a concentration of 41,364 cells/mL.

The lowest recorded BGA reading from the phychocyanin probe at KAT was 229 cells/mL on June 19th, while the highest recorded concentration of cells/mL was 13,226 cells/mL on October 16th. The lowest recorded BGA reading from grab samples taken at KAT was 200 cells/mL on August 22nd, while the highest recorded concentration of cells/mL was 41,364 cells/mL on September 5th.

Klamath River above Tully Creek (TC)

BGA at TC showed concentrations close to zero from the beginning of the monitoring season in early May until early September. From September mid-October the Klamath showed elevated levels of BGA, exceeding the State of California's Recommended Threshold for Recreational Waterways of 40,000 cells/mL for the grab sampling event that occurred at TC on September 5th, with a concentration of 48,973 cells/mL.

The lowest recorded BGA reading from the phychocyanin probe at TC was -44.0 cells/mL on August 5th, while the highest recorded concentration of cells/mL was 8,597 cells/mL on October 9th. The lowest recorded BGA reading from grab samples taken at TC was 37 cells/mL on July 25th, while the highest recorded concentration of cells/mL was 48,973 cells/mL on September 5th.

Klamath River at Weitchpec (WE)

BGA at KAT showed concentrations close to zero from the beginning of the monitoring season in early May until early September. From September mid-October the Klamath showed elevated levels of BGA, exceeding the State of California's Recommended Threshold for Recreational Waterways of 40,000 cells/mL for the grab sampling event that occurred at WE on September 5, with a concentration of 57,897 cells/mL.

The lowest recorded BGA reading from the phychocyanin probe at WE was 466 cells/mL on July 21st, while the highest recorded concentration of cells/mL was 16,205 cells/mL on October 9th. The lowest recorded BGA reading from grab samples taken at WE was 98 cells/mL on May 16th, while the highest recorded concentration of cells/mL was 57,897 cells/mL on September 5th.

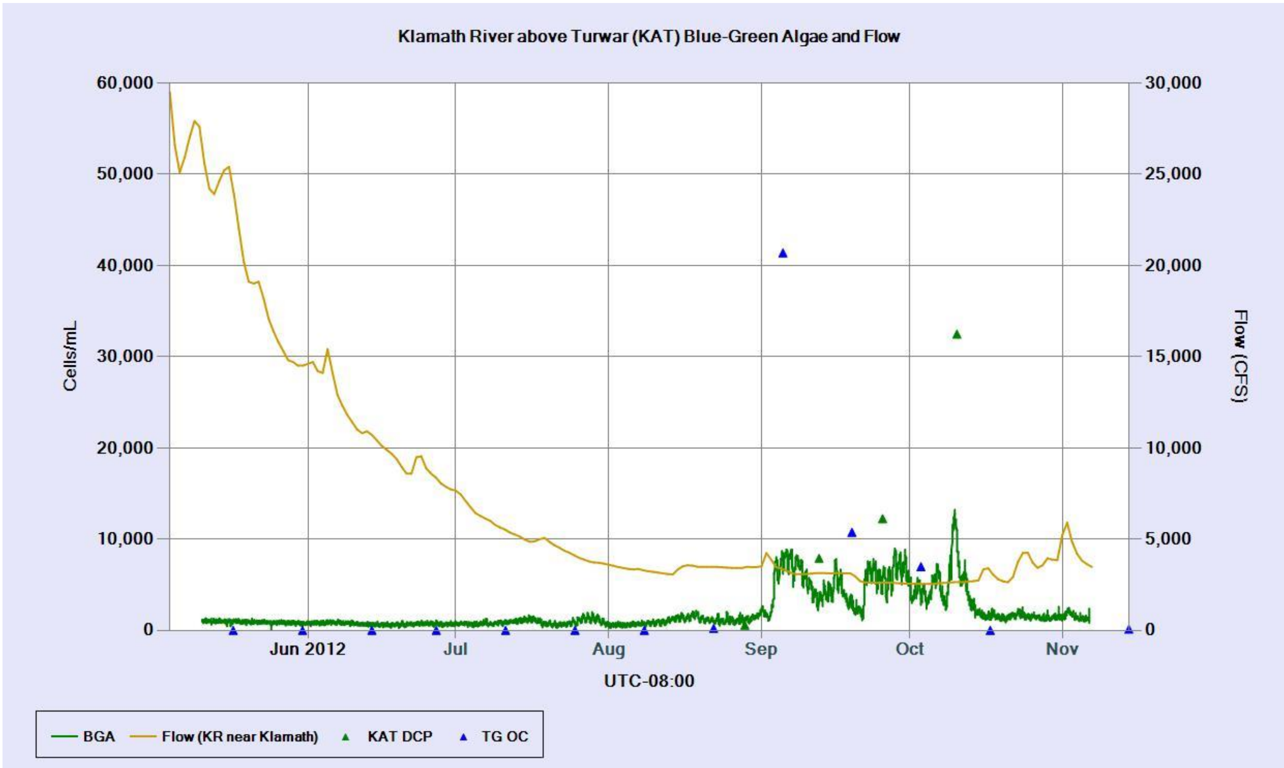

Figure 6-29. KAT BGA and Flow: 2012

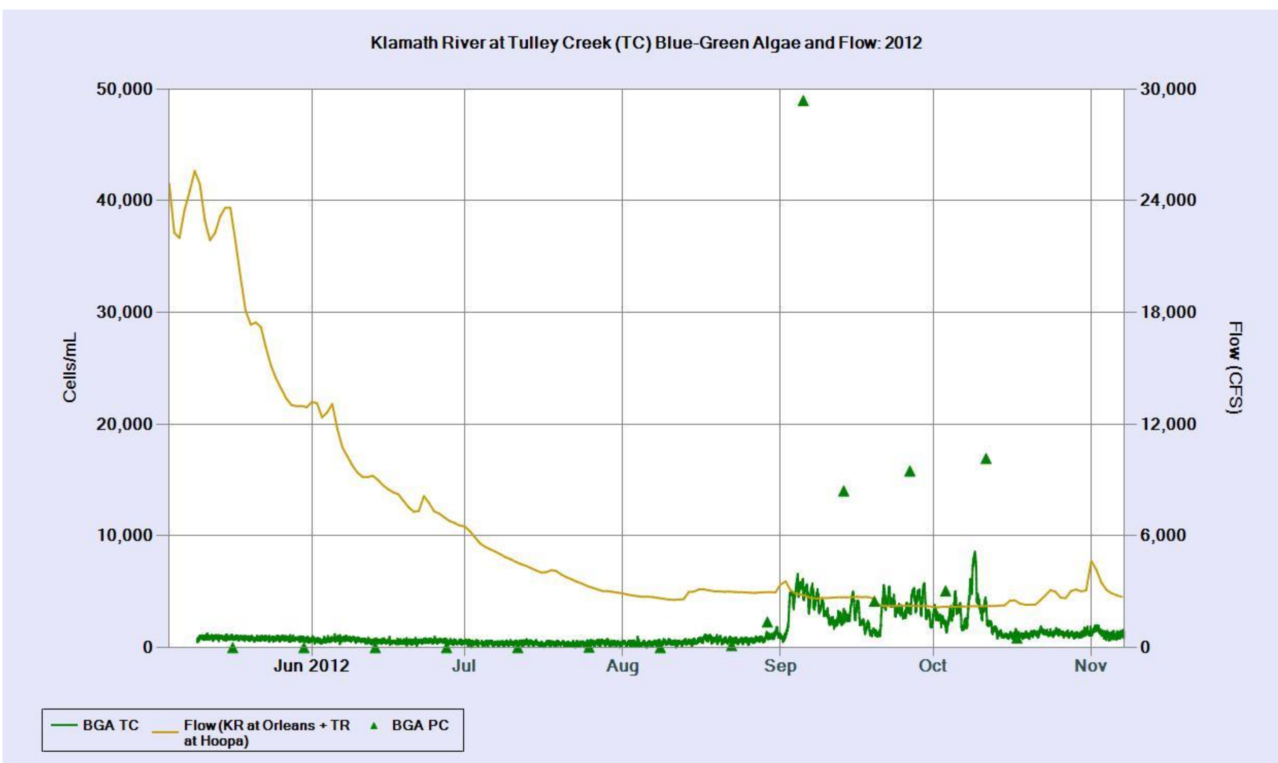

Figure 6-30. TC BGA and Flow: 2012

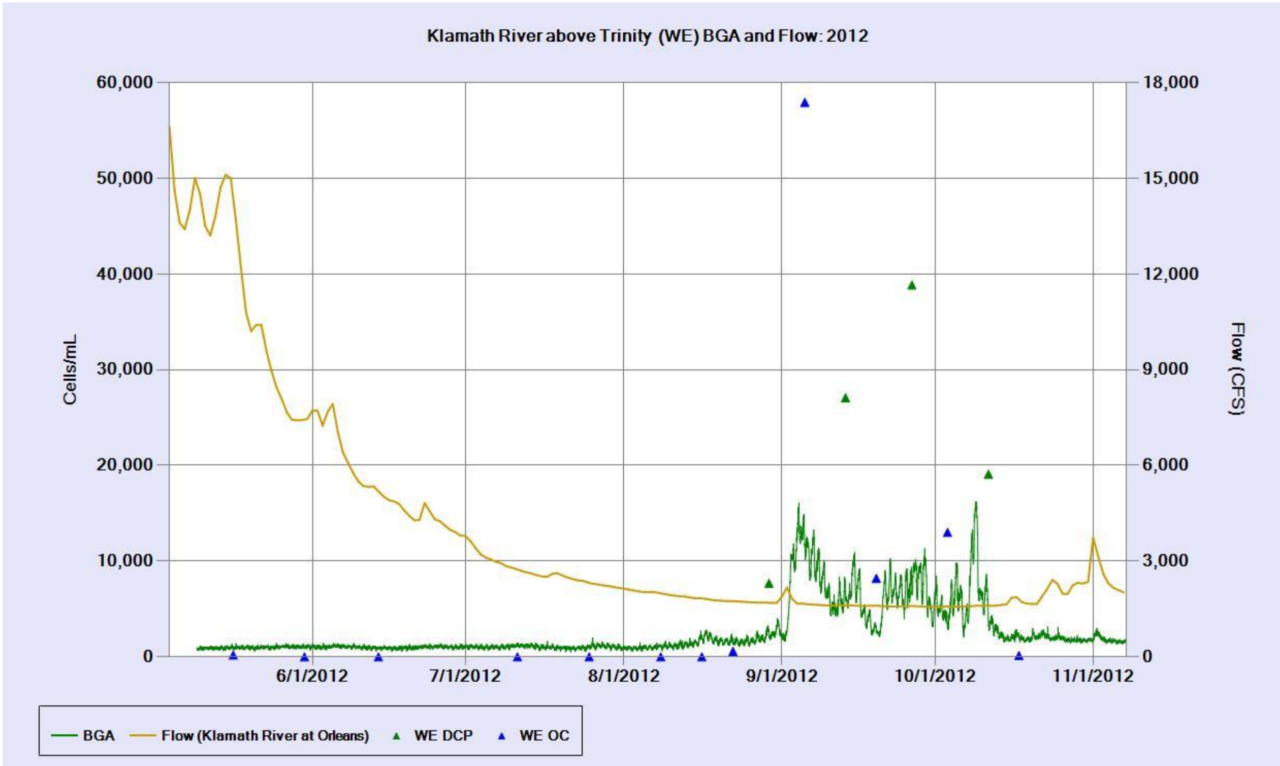

Figure 6-31. WE BGA and Flow: 2012

VII. Discussion

Temperature

All Riverine Sites

From initial deployment in early May until June, the highest daily maximum water temperatures tended to be indiscernible across the 4 sites. (Figure 7-1). From June to mid-July, the highest temperatures were recorded at WE. From mid-July to mid-August WE retained the highest temperatures, but TR significantly increased in temperature, and eclipsed WE as the highest maximum temp on August 14. From mid-August until the beginning of October From late September into the beginning of October the highest temperatures were variable among sites, while from early October until extraction in early November, highest daily maximum temperatures tended to be recorded at KAT.

In the water temperature graphs shown in Section VI, daily average flow was graphed with water temperature to illustrate how water temperatures may have been affected by volume of water present in the river at that time. Flow discharge data used to generate these graphs was downloaded from the USGS website. These graphs provide additional information when trying to determine the impact flow has on water temperature.

Klamath River above Turwar (KAT)

Rain events seem to have decreased maximum water temperature at KAT for short periods of time (Figures 6-1 and 6-2). During the period leading up to the rain event in late May/June, maximum water temperature was generally increasing. On June 7, however, maximum water temperature was 14.18ºC, a reduction of 3.60ºC from June 1. A similar trend can be seen from mid-June to late June. Prior to the rain event in mid-October, maximum water temperature was decreasing gradually. On October 23, however, maximum water temperature was 13.76ºC, a reduction of 3.48ºC from October 18.

The pulse flow from Lewiston Dam on the Trinity River in mid-August also appears to have briefly influenced the maximum water temperature in the Lower Klamath River at KAT (Figures 6-1 and 6-2). Leading up to the pulse flow in late August, maximum water temperature was generally holding steady. On August 19, however, the maximum water temperature was 22.78ºC, a reduction of 1.02ºC from August 15.

Klamath River above Tully Creek (TC)

Rain events seem to have decreased maximum water temperature at TC for short periods of time (Figures 6-4 and 6-5). During the time leading up to the rain event in late June, maximum water temperature was slightly increasing. On June 23, however, maximum water temperature was 16.68ºC, a reduction of 2.19ºC from June 21. Prior to the rain event in mid-October, maximum water temperature was decreasing gradually. On October 25, however, maximum water temperature was 11.89 ºC, a reduction of 5.48ºC from October 17.

The pulse flow from Lewiston Dam on the Trinity River in mid-August also appears to have briefly influenced the maximum water temperature in the Klamath River downstream of the confluence at TC (Figures 6-1 and 6-2). Leading up to the pulse flow in mid-August, maximum water temperature was generally holding steady. On August 21, however, maximum water temperature was 22.36ºC, a reduction of 1.56ºC from August 17.

Klamath River at Weitchpec (WE)

Rain events seem to have decreased maximum water temperature at WE for short periods of time (Figures 6-8 and 6-9). During the period leading up to the rain event in early June, maximum water temperature was slightly increasing. On June 5, however, maximum water temperature was 14.96ºC, a reduction of 3.17ºC from June 2. Prior to the rain event in mid-October, maximum water temperature was gradually decreasing. On October 26, however, maximum water temperature was 11.34ºC, a reduction of 6.03ºC from October 17.

Trinity River near Mouth (TR)

Rain events seem to have decreased maximum water temperature at TR for short periods of time (Figures 6-10 and 6-11). During the time leading up to the rain event in late June, maximum water temperature was holding steady. On June 5, however, maximum water temperature was 14.25 ºC, a reduction of 2.76ºC from June 2. Prior to the rain event in early October, maximum water temperature was gradually decreasing.

On October 24, however, maximum water temperature was 12.61ºC, a reduction of 5.02ºC from October 17.

The pulse flow from Lewiston Dam upstream on the Trinity River in late August also appears to have briefly influenced the maximum water temperature at TR (Figures 6-10 and 6-11). Leading up to the pulse flow in late August, maximum water temperature was slightly increasing. On August 18, however, maximum water temperature was 22.20ºC, a reduction of 2.89ºC from August 15.

Impacts of the Trinity River on Water Temperature in the Klamath River

During the 2012 monitoring season the Trinity River had a variable effect on water temperature in the Klamath River. From early May to mid-July, it appears that the Trinity River had a slight cooling effect on the Klamath River, with daily maximum temperature at TC slightly lower than at WE (Figure 7-2). This cooling effect was less than 0.5ºC for most of this time period. From mid-July until mid-August it seems that the Trinity River had a no cooling effect on the Klamath River, with the daily maximum temperature at TC was usually slightly lower than at WE. Again, this cooling effect was less than 0.5ºC for most of this time period. From mid-August to late September the Trinity River had a significant cooling effect, averaging around 1ºC, on the Klamath River. Sometime after late September until datasonde extraction in early November, the Trinity River again had a no to a slight cooling influence on the Klamath River.

The pulse flow from Lewiston Dam in late August appears to have caused a short-term reduction in water temperature in the Klamath River below the confluence with the Trinity River. After the pulse flow, water temperature at both KAT and TC was reduced by several degrees for a short period of time (Figures 6-1 and 6-4). WE was also reduced, but the difference between the daily max's of WE and TC substantially increased from about 0.5 ºC to 1.0 ºC. WE's temperature also was reduced around this time, it just took a more gradual decline.

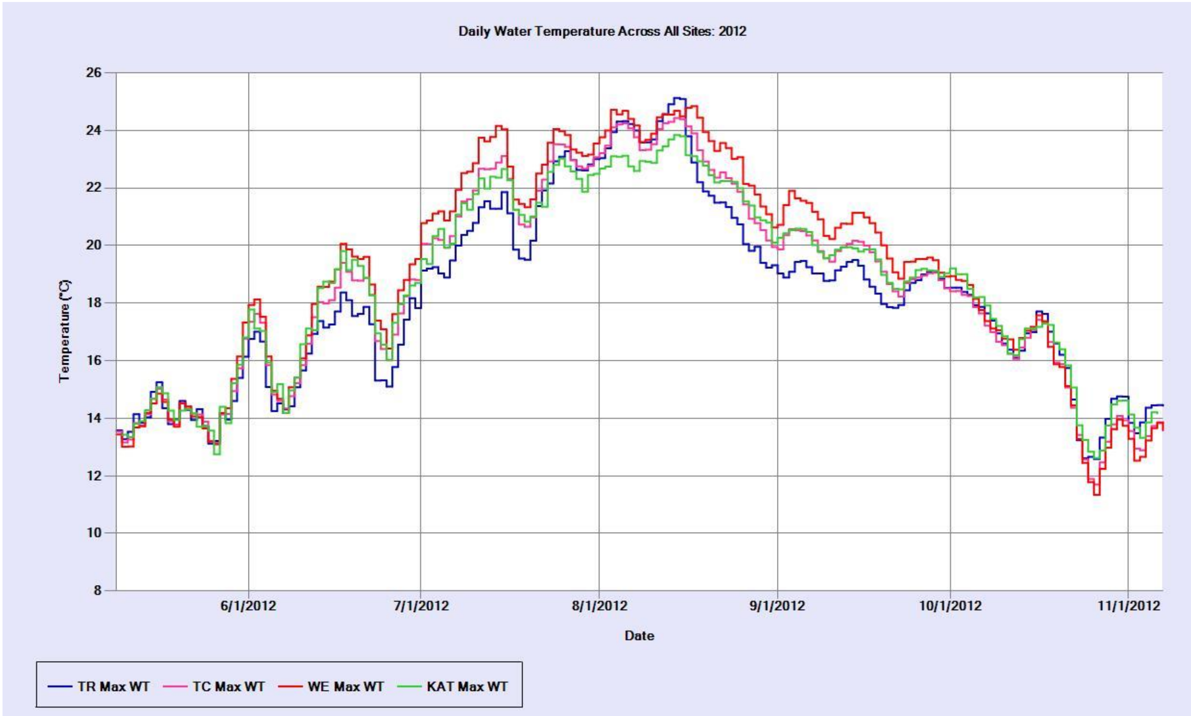

Figure 7-1.Daily Maximum Temperature Across All Sites: 2012

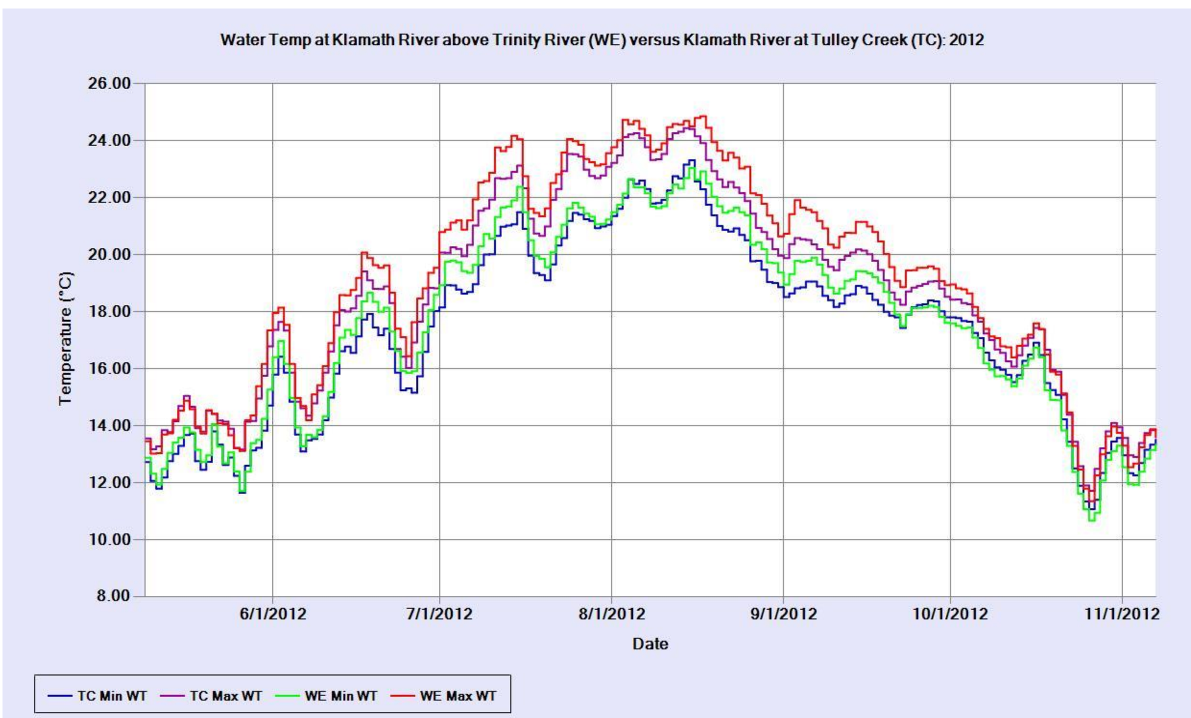

Figure 7-2.WE vs. TC Water Temperature: 2012

Dissolved Oxygen

All Riverine Sites

Throughout the 2012 monitoring season TR consistently showed the highest minimum dissolved oxygen concentrations (7-3). Exceptions to this occurred from late May to mid-June when TC recorded the highest minimum concentration. The other instance is from late October to datasonde extraction in early November when WE and TC exchanged places as having the highest minimum concentration of DO. Readings also show that after late September KAT's minimum concentration dropped, while the other sites remained a tight grouping.

In the DO graphs shown in Section VI, daily average flow was graphed with DO to illustrate how DO concentrations may have been affected by volume of water present in the river at that time. Flow discharge data used to generate these graphs was downloaded from the USGS website. These graphs provide additional information when trying to determine the impact flow has on DO concentrations.

Klamath River above Turwar (KAT)

Rain events seem to have increased minimum DO concentrations at KAT for short periods of time (Figures 6-13 and 6-14). During the period leading up to the rain event in early June, minimum DO concentrations were steadily decreasing. On June 6, however, minimum DO was 10.11 mg/L, an increase of 0.63 mg/L from June 3.

The pulse flow from Lewiston Dam in mid-August also appears to have briefly influenced minimum DO concentrations at TC (Figures 6-13 and 6-14). Leading up to the pulse flow in mid-August, minimum DO was decreasing. On August 20, however, minimum DO was 7.90 mg/L, an increase of 0.21 mg/L from August 16. Minimum DO continued its upward trend until late September when flows were decreased.

Klamath River above Tully Creek (TC)

Rain events seem to have increased minimum DO concentrations at TC for short periods of time (Figures 6-15 and 6-16). During the time leading up to the rain event in late June, minimum DO concentrations were decreasing. On June 26, however, minimum DO was 9.96 mg/L, an increase of 0.55 mg/L from June 22. Prior to the rain event in late October, minimum DO concentrations were slightly decreasing. On October 26, however, minimum DO was 10.81 mg/L, an increase of 1.36 mg/L from October 22.

The pulse flow from Lewiston Dam in late August also appears to have briefly influenced minimum DO concentrations at TC (Figures 6-15 and 6-16). Leading up to the pulse flow in mid-August, minimum DO was generally holding steady. On August 20, however, minimum DO was 8.25 mg/L, an increase of 0.39 mg/L from August 15.

Klamath River at Weitchpec (WE)

Rain events seem to have increased minimum DO concentrations at WE for short periods of time (Figures 6-17 and 6-18). Prior to the rain event in early June, minimum DO concentrations were decreasing. On June 6, however, minimum DO was 10.30mg/L, an increase of 0.88mg/L from June 3. Prior to the rain event in late October, minimum

DO concentrations were increasing slightly. On November 2, however, minimum DO was 10.44 mg/L, an increase of 0.53 mg/L from October 31.

Trinity River near Mouth (TR)

Rain events seem to have increased minimum DO concentrations at TR for short periods of time (Figures 6-19 and 6-20). During the time leading up to the rain event in late June, minimum DO concentrations were decreasing. On June 24, however, minimum DO was 10.08 mg/L, an increase of 0.57 mg/L from June 21. Prior to the rain event in late October, minimum DO concentrations were decreasing. On November3, however, minimum DO was 10.45 mg/L, an increase of 0.42 mg/L from October 31.

The pulse flow from Lewiston Dam in mid-August also appears to have significantly influenced minimum DO concentrations at TR for an extended period of time. (Figures 6-19 and 6-20). Leading up to the pulse flow in late August, minimum DO was steadily decreasing. On August 18, however, minimum DO was 8.70 mg/L, an increase of 0.71 mg/L from August 15. TR continued to show an increase in DO from the release until releases stopped in late September.

Impacts of the Trinity River on Dissolved Oxygen in the Klamath River

During the 2012 monitoring season it appears that the Trinity River had effect on DO concentrations in the Klamath River. The effect of TR on TC seems to have no effect from May – June. From June – August TC consistently had slightly higher minimum and maximum DO concentrations. (Figure 7-4). The pulse flow from Lewiston at the end of August/early September appeared to have increased DO concentrations at TC. Daily minimum and maximum DO concentrations showed a more dramatic increase at TC than the general upward trend that occurred at WE at the time the pulse flow reached TC, up until flows were ramped back down in late September (Figure 6-15 and 6-16).

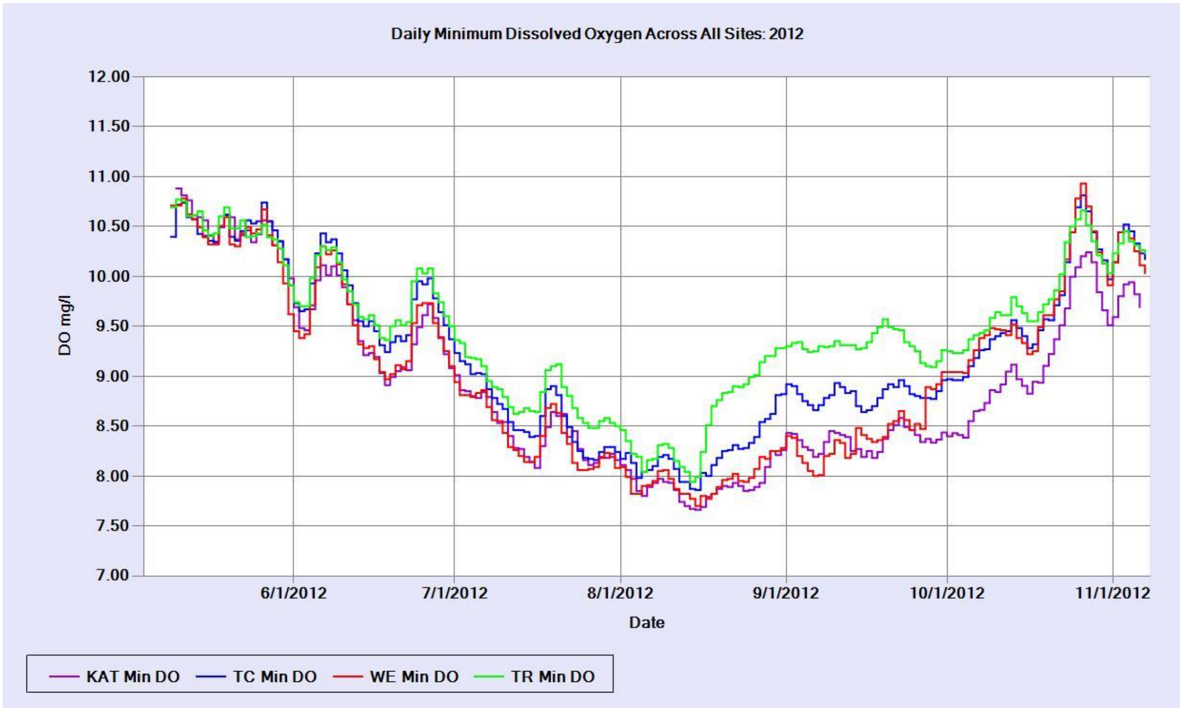

Figure 7-3.Daily Minimum Dissolved Oxygen Across All Sites: 2012

Figure 7-4.WE vs. TC Dissolved Oxygen: 2012

pH

All Riverine Sites

Throughout a majority of the 2012 monitoring season, WE had the highest maximum pH values of all sites (Figure 7-5). The exception to this was a period from mid-July to late August in which KAT and TC had the highest maximum pH values. From mid-October until the end of the monitoring pH concentration at KAT again exceeded WE for a few intermittent days.

In the pH graphs shown in Section VI, daily average flow was graphed with pH to illustrate how pH values may have been affected by volume of water present in the river at that time. Flow discharge data used to generate these graphs was downloaded from the USGS website. These graphs provide additional information when trying to determine the impact flow has on pH.

Klamath River above Turwar (KAT)

Rain events seem to have decreased daily maximum pH at KAT for short periods of time (Figure 6-21). During the time leading up to the rain event in early June, pH was slightly increasing. On June 7, however, maximum pH was 8.10, a decrease of 0.16 from June 1. pH values leading up to the rain event in late October were holding steady, this rain event, which was actually two pulses of rain over the course of two weeks (Figure 6-21), reduced pH values twice. During the first pulse of water, maximum pH dropped to 8.36 on October 26, a decrease of 0.29 from October 20. During the second pulse, maximum pH dropped to 8.10 on November 2, a reduction of 0.45 from October 29.

The pulse flow from Lewiston Dam in late August appears to have influenced maximum pH at KAT very minimally, if at all (Figure 6-21).

Klamath River above Tully Creek (TC)

Rain events seem to have decreased daily maximum pH at TC for short periods of time (Figure 6-22). During the time leading up to the rain event in early June, pH was slightly increasing. On June 4, however, maximum pH was 8.16, a decrease of 0.13 from May 31. pH values leading up to the rain event in late October were generally holding steady. This October rain event, which was actually two pulses of rain over the course of two weeks (Figure 6-22), reduced pH values twice. During the first pulse of water, maximum pH dropped to 8.34 on October 22, a decrease of 0.15 from October 20. During the second pulse, maximum pH dropped to 8.18 on November 1, a reduction of 0.28 from October 30.

The pulse flow from Lewiston Dam in late August appears to have influenced maximum pH at KAT very minimally, if at all (Figure 6-22).

Klamath River at Weitchpec (WE)

Rain events seem to have decreased daily maximum pH at WE for short periods of time (Figure 6-23). During the time leading up to the rain event in late June, pH was slightly increasing. On June 4 maximum pH was 8.20, a decrease of 0.22 from May 31. pH values leading up to the rain event in late October were slightly dropping. This rain event, which was actually two pulses of rain over the course of two weeks (Figure 6-23), reduced pH values twice. During the first pulse of water, maximum pH dropped to 8.27 on October 24, a decrease of 0.35 from October 21. During the second pulse, maximum pH dropped to 8.05 on November 2, a reduction of 0.36 from October 30. The first pulse of water helped to reduce maximum pH values below the standard of 8.5 for short periods of time.

Trinity River near Mouth (TR)

Rain events seem to have decreased daily maximum pH at TR for short periods of time (Figure 6-24). pH values leading up to the rain event in late October were slightly increasing. This rain event, which was actually two pulses of rain over the course of a week (Figure 6-24), reduced pH values twice. During the first pulse of water, maximum pH dropped to 8.23 on October 5, a decrease of 0.18 from October 2. During the second pulse, maximum pH dropped to 8.18 on October 12, a reduction of 0.20 from October 9.

The pulse flow from Lewiston Dam in late August also appears to have briefly influenced pH at TR (Figure 6-24). Leading up to the pulse flow in late August, maximum pH was holding steady. On August 31, however, maximum pH was 8.25, a reduction of 0.19 from August 29.

Impacts of the Trinity River on pH in the Klamath River

During the 2012 monitoring season the Trinity River had a variable effect on pH in the Klamath River with no clear trend apparent of the impacts of the Trinity River on pH in the Klamath River (Figures 7-6 and 7-7). Daily maximum pH at TC was nearly always lower than daily maximum pH at WE throughout the 2012 monitoring season. The exception occurs in Late July and early August, when TC and KAT eclipsed WE as having the highest pH. This indicates there may be factors other than the influx of water from the Trinity River affecting pH in the Klamath River in the reach from the confluence of the Klamath and Trinity Rivers to the Klamath River above Tully Creek.

What is clear is that the extended pulse flows out of Lewiston Dam in 2012 lowered pH in The Klamath River from TC to the mouth. (Figure 7-6) There is a significant drop in the pH readings of TR, TC, and KAT from late August to late September. There is no drop in pH recorded at WE for this time period in 2012.

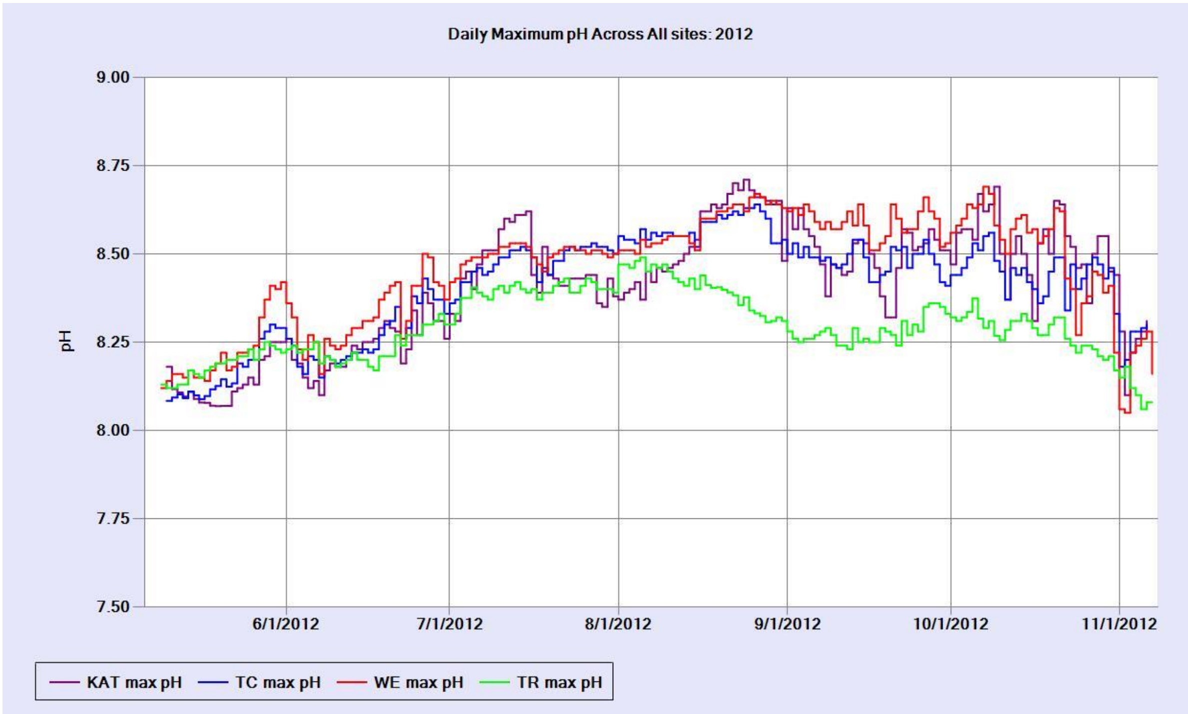

Figure 7-5. Daily Maximum pH Across All Sites: 2012

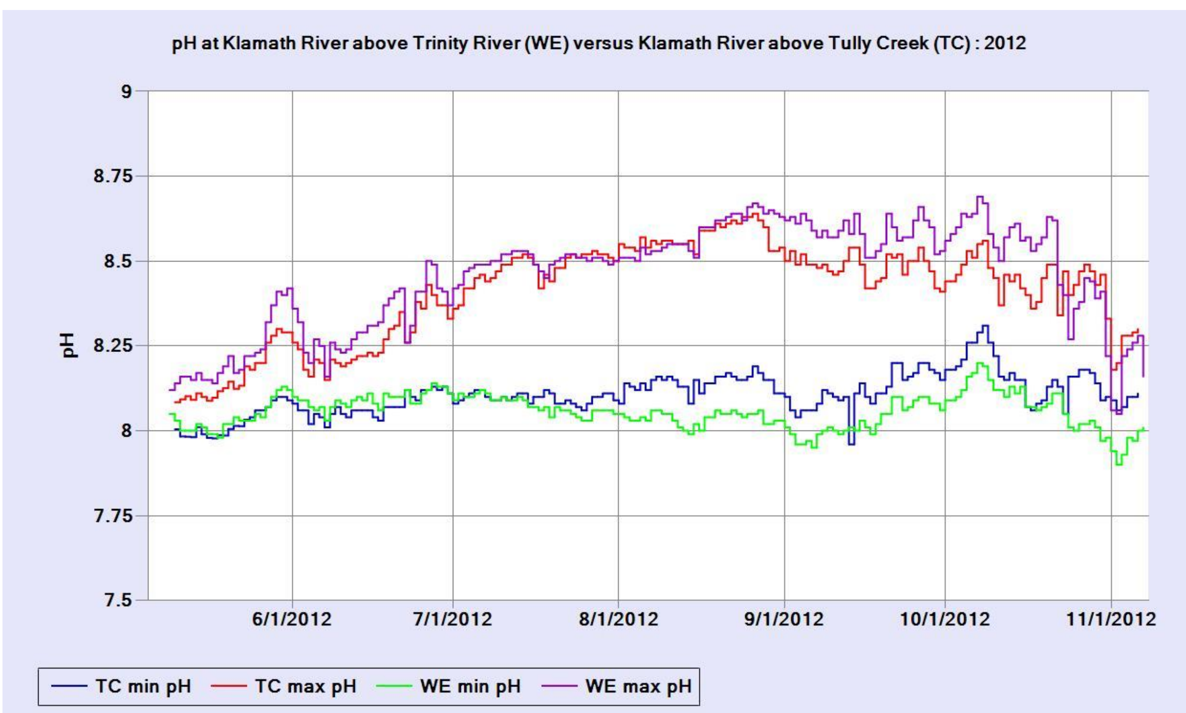

Figure 7-6. WE vs. TC pH: 2012

Specific Conductivity

All Riverine Sites

From early May to early June, the highest daily maximum specific conductivity was variable among sites (Figure 7-7). From early June until November the highest readings were recorded at WE, the highest readings were variable from November until datasondes were extracted.

In the specific conductivity graphs shown in Section VI, daily average flow was graphed with specific conductivity to illustrate how specific conductivity may have been affected by volume of water present in the river at that time. Flow discharge data used to generate these graphs was downloaded from the USGS website. These graphs provide additional information when trying to determine the impact flow has on specific conductivity.

Klamath River above Turwar (KAT)

Rain events seem to have decreased daily maximum specific conductivity at KAT for short periods of time (Figure 6-25). During the time leading up to the rain event in early June, specific conductivity was increasing. On June 5, however, maximum specific conductivity was 109 µS/cm, a decrease of 9 µS/cm from May 29. Specific conductivity values leading up to the rain event in late October were increasing. This rain event, which was actually two pulses of rain over the course of two weeks (Figure 6-25), reduced specific conductivity values twice. During the first pulse of water, maximum specific conductivity dropped to 170 µS/cm on October 25, a decrease of 15 µS/cm from October 22. During the second pulse, maximum specific conductivity dropped to 151 µS/cm on November 3, a decrease of 27 µS/cm from October 30.

The pulse flow from Lewiston Dam in late August also appears to significantly reduced specific conductivity at KAT (Figure 6-25). Leading up to the pulse flow in mid-August, maximum specific conductivity was generally increasing. On August 20, however, maximum specific conductivity dropped to 156 µS/cm, a reduction of 11 µS/cm from August 15. Specific Conductivity values did not exceed 167 µS/cm until September 23.

Klamath River above Tully Creek (TC)

Rain events seem to have decreased daily maximum specific conductivity at TC for short periods of time (Figure 6-26). During the time leading up to the rain event in early June, specific conductivity was steadily increasing. On June 5, however, maximum specific conductivity was 109 µS/cm, a decrease of 10 µS/cm from May 30. Specific conductivity values leading up to the rain event in late October were generally holding steady. This rain event, which was actually two pulses of rain over the course of two weeks (Figure 6-26), reduced specific conductivity values with the second pulse. During the second pulse, maximum specific conductivity dropped to 151 µS/cm on November 2, a decrease of 15 µS/cm from October 29.

The pulse flow from Lewiston Dam in mid-August also appears to have influenced specific conductivity at TC (Figure 6-26). Leading up to the pulse flow in mid- August, maximum specific conductivity was generally increasing. On August 19, however, maximum specific conductivity dropped to 153 µS/cm, a reduction of 10 µS/cm from August 15. This drop in Specific Conductivity remained steady and did no reach 163 µS/cm again until September 22.

Klamath River at Weitchpec (WE)

Rain events seem to have decreased daily maximum specific conductivity at WE for short periods of time (Figure 6-27). During the time leading up to the rain event in early June, specific conductivity was increasing. On June 5, however, minimum specific conductivity was 107 µS/cm, a decrease of 14 µS/cm from May 30. Specific conductivity values leading up to the rain event in late October were generally holding steady. This rain event, which was actually two pulses of rain over the course of two weeks (Figure 6-27), reduced specific conductivity values only during the second event. During the second pulse, maximum specific conductivity dropped to 152 µS/cm on November 2, a decrease of 31 µS/cm from October 29.

Trinity River near Mouth (TR)

Rain events seem to have decreased daily maximum specific conductivity at TR for short periods of time (Figure 6-28). Specific conductivity values leading up to the rain event in late October were generally holding steady. This rain event, which was actually two pulses of rain over the course of a week (Figure 6-26), seems to have affected specific conductivity values only in the second pulse. During the second pulse, maximum specific conductivity dropped to 163 µS/cm on November 1, a decrease of 13 µS/cm from October 28.

The pulse flow from Lewiston Dam in mid-August also appears to have significantly influenced specific conductivity at TR (Figure 6-28). Leading up to the pulse flow in mid-August, maximum specific conductivity was generally holding steady. On August 17, however, maximum specific conductivity dropped to 138 µS/cm, a reduction of 14 µS/cm from August 19. Specific conductivity stayed at a reduced level until flows receded on September 24.

Impacts of the Trinity River on Specific Conductivity in the Klamath River

From early May to early July the Trinity River tended to increase daily maximum specific conductivity in the Klamath River, with higher daily maximum and minimum specific conductivity values at TC than WE (Figure 7-8). In fact, for large portions of time daily minimum specific conductivity at TC was higher than daily maximum specific conductivity at WE during this period. From mid-July to early November this trend was reversed with the Trinity River usually lowering daily maximum specific conductivity on the Klamath River. During this time daily maximum specific conductivity at TC tended to be lower than daily minimum specific conductivity at WE (Figure 7-8). This is especially prevalent during the release from Lewiston dam from August 18 to September 23.

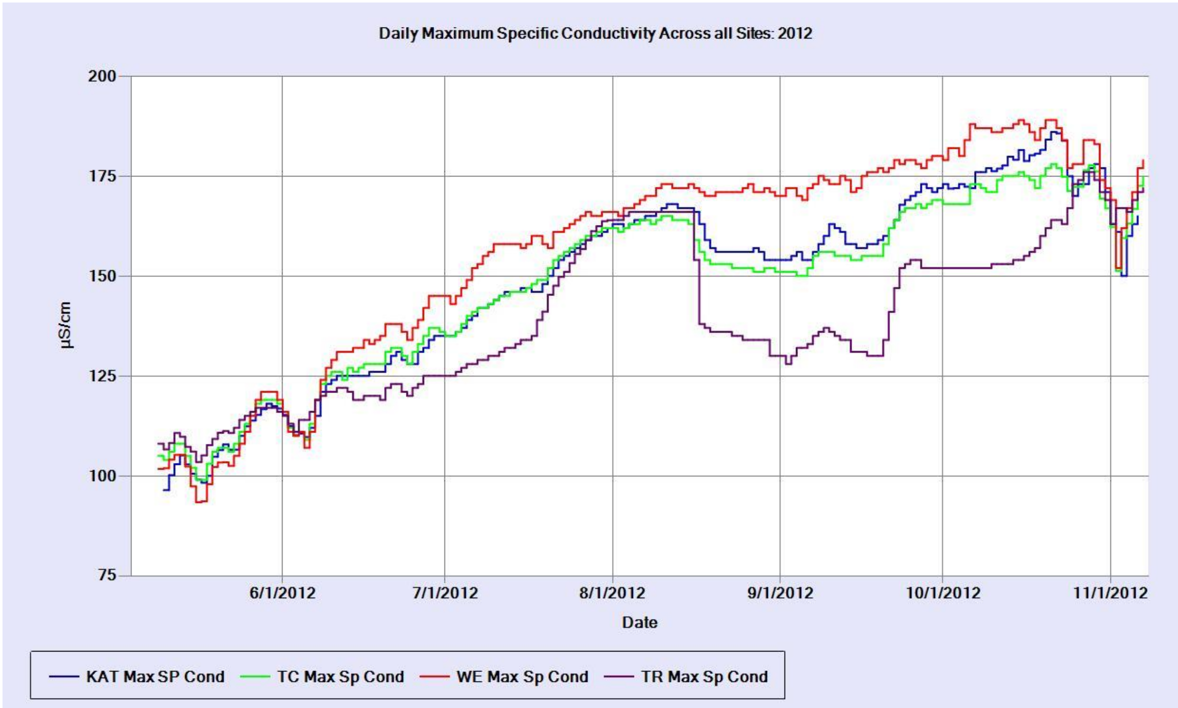

Figure 7-7. Daily Maximum Specific Conductivity Across All Site: 2012

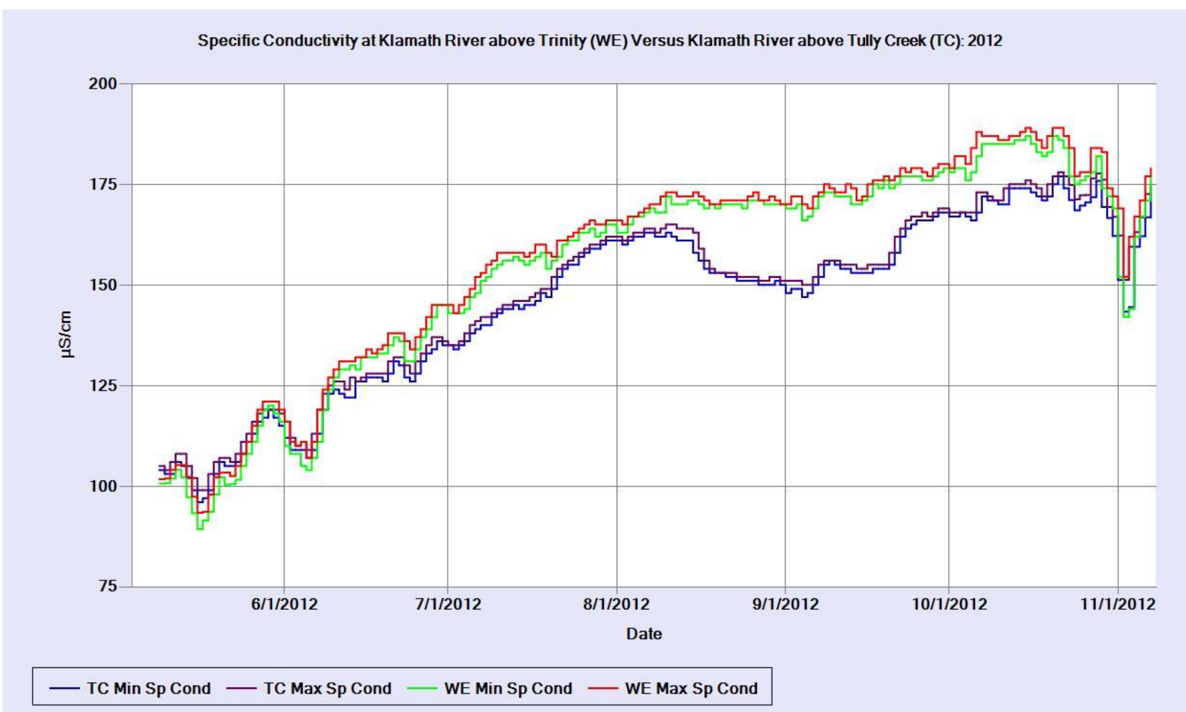

Figure 7-8. WE vs. TC Specific Conductivity: 2012

Blue-Green Algae (Phycocyanin)

All Riverine Sites

From early May to early September the concentration of BGA (BGA) in the Klamath River was minimal among all sites. In early September, following a dam release from Iron Gate Dam, BGA levels in the Klamath began to rise at all sites (figures 6-29, 6-30, 6-31). WE was the first site to show signs of BGA in the river along with having the highest concentrations of BGA on the YIR.

In the BGA graphs shown in Section VI, daily average flow was graphed with cells/mL to illustrate how Algae concentration may have been affected by volume of water present in the river at that time, along with how dam releases may have brought BGA downstream. Flow discharge data used to generate these graphs was downloaded from the USGS website. These graphs provide additional information when trying to determine the impact flow has on Algal concentrations.

Open water composite samples are taken at each of the sonde sites to validate the phycocyanin probes. These samples are collected using a 4L churn splitter, and samples are poured off into a bottle and shipped to a phycologist for identification and toxic algae numeration. These samples follow the same general trends as the phycocyanin probes at all sites. They show that the phycocyanin probes are inferior when reading high concentrations of BGA, greater than or equal to 5,000 cells/mL.

Klamath River above Turwar (KAT)

Sufficient flow and temperature in the Klamath may have deterred BGA from being present in the river before late July. A small increase in BGA occurred in mid-August. A release from Lewiston Dam helped to dilute this concentration of BGA in the water column. An increase of BGA occurs in Early September following a release from Iron Gate Dam. A second spike of BGA in late September may be correlated to the stop of water releasing from Lewiston Dam. It is unapparent what caused BGA concentrations to drop in Early October, as this drop predated any precipitation.

Klamath River above Tully Creek (TC)

Sufficient flow and temperature in the Klamath may have deterred BGA from being present in the river before late July. A small increase in BGA occurred in mid-August. A release from Lewiston Dam helped to dilute this concentration of BGA in the water column. An increase of BGA occurs in Early September following a release from Iron Gate Dam. A second spike of BGA in late September may be correlated to the stop of water releasing from Lewiston Dam. It is unapparent what caused BGA concentrations to drop in Early October, as this drop predated any precipitation.

Klamath River at Weitchpec (WE)

Sufficient flow and temperature in the Klamath may have deterred BGA from being present in the river before late July. A small increase in BGA occurred in mid-August. A release from Lewiston Dam helped to dilute this concentration of BGA in the water column. An increase of BGA occurs in Early September following a release from

Iron Gate Dam. A second spike of BGA in late September may be correlated to the stop of water releasing from Lewiston Dam. It is unapparent what caused BGA concentrations to drop in Early October, as this drop predated any precipitation.

Impacts of the Trinity River on Blue-Green Algae in the Klamath River

From Early May to Early September the Trinity River had no apparent effects on the concentrations of BGA in the Klamath River, as BGA was not present at elevated levels. From early September to Early October BGA levels at WE are consistently higher than BGA at TC or KAT. (Figure 7-9) Furthermore, when water stopped being released from Lewiston Dam, BGA concentrations rose at TC and KAT (figures 6-29, 6-30), and the concentration gap between WE and TC closes as water stops coming from Lewiston Dam (figure7-10).

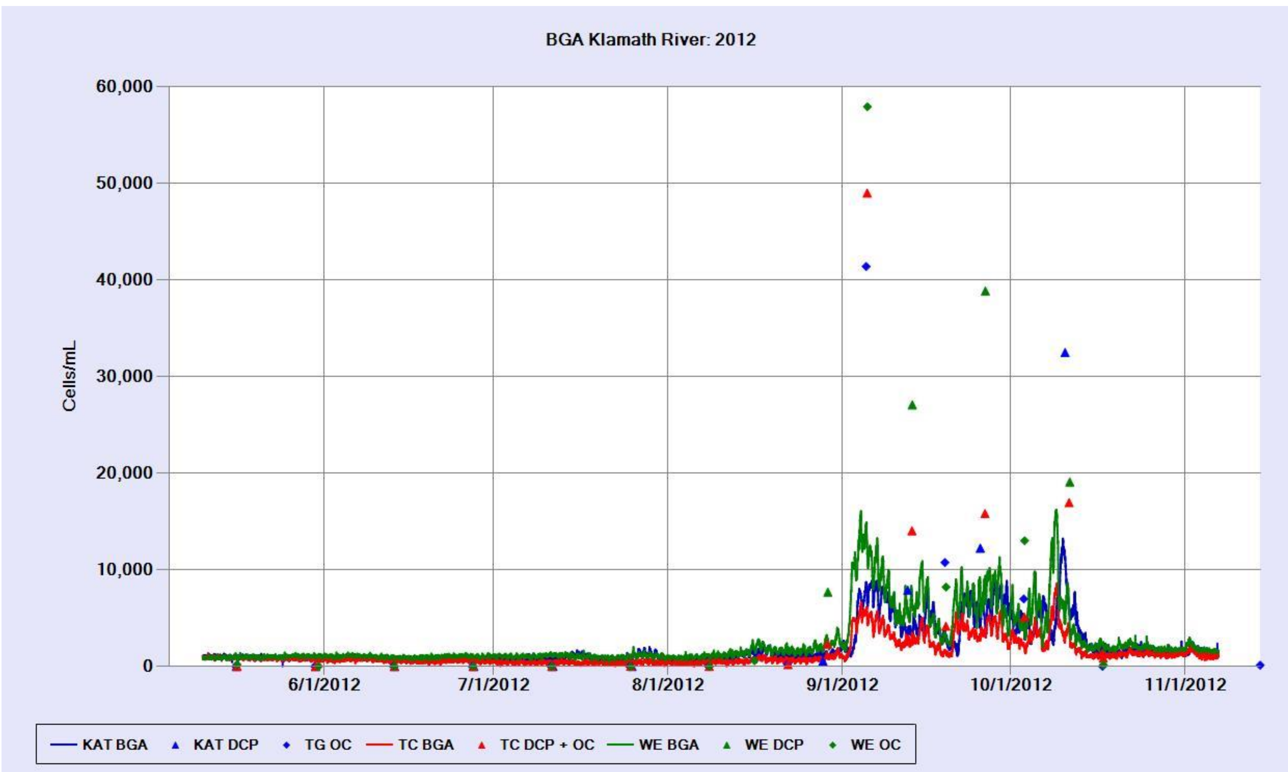

Figure 7-9. BGA across all sites: 2012

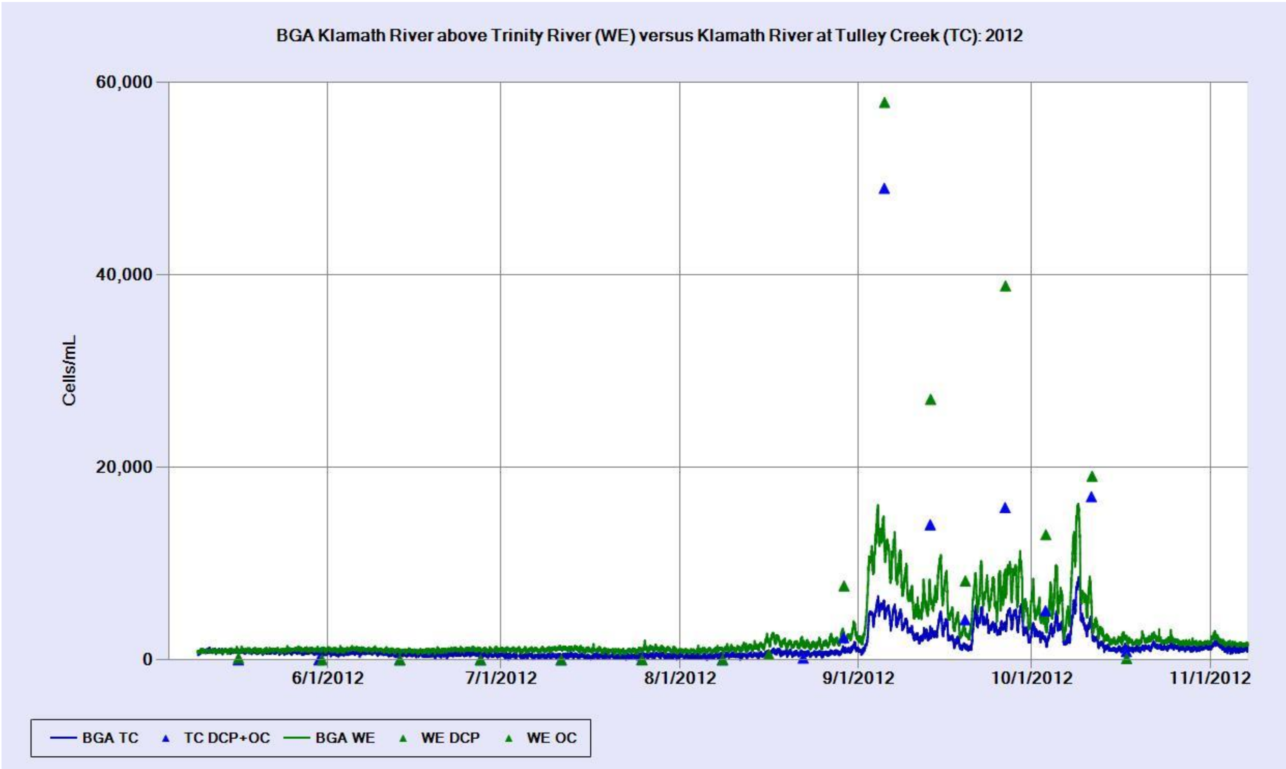

Figure 7-10. WE vs. TC BGA: 2012

Works Cited

Kroeber, A.L. *Handbook of the Indians of California*. Bureau of American Ethnology, Smithsonian Institute. 1925

Lindenberg, M.K., Hoilman, Gene, and Wood, T.M., 2009, *Water Quality Conditions in Upper Klamath and Agency Lakes, Oregon, 2006*.U.S. Geological Survey Scientific Investigations Report 2008-5201, 54 p.

Mueller, David K., and Spahr, Norman E., 2006, *Nutrients in Streams and Rivers Across the Nation—1992–2001*.U.S. Geological Survey Scientific Investigations Report 2006–5107, 44 p.

Norton, Ken, Pliny McCovey Jr., Curtis Miller, Louisa McConnell, Mike Orcutt, Nolan Colgegrove, Mark Higley. *Water Quality Control Plan: Hoopa Valley Indian Reservation*. 2008

Sprague, L.A., Mueller, D.K., Schwarz, G.E., and Lorenz, D.L., 2009, *Nutrient Trends in Streams and Rivers of the United States, 1993–200.*U.S. Geological Survey Scientific Investigations Report 2008–5202, 196 p.

Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors, station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1D3, 51 p. + 8 attachments.

Appendix A: YSI Calibration SOP

Upon arrival at each monitoring site, numerous tasks must be performed to successfully meet the QA/QC protocol and service the Sonde. Properly filling out the calibration sheet is critical to collecting all the data that is needed for the evaluation of the sonde file. Here is an overview of a typical field tour consisting of extracting the sonde, performing scheduled maintenance and redeploying.

- Arrive on site: Record current barometric pressure and temperature using DeltaCal barometer at the site. Also record other environmental conditions, such as: weather, changing water levels, color of water, water clarity, etc on the datasheet. If at KAT or TC calibrate dissolved oxygen of reference sonde to current barometric pressure onsite.

- Audit the site sonde (datasonde that is dedicated to the site) by placing the reference sonde as close as possible to the lock box that contains the site sonde. As close to the half hour or top of the hour as possible (+/- 2 minutes), record the reference sonde water quality parameters on the datasheet. Remove the lock box containing the site sonde from the water no earlier than2 minutes after the 30 minute or top of the hour reading. Carefully remove the site sonde from the housing trying not to disturb any fouling on the probes. Inspect the probes and determine if the wiper was properly wiping al of the sondors and make any notes such as extreme biofouling was present or the probes were extremely silted in by sand.

- Fill insulated water jug with river water.

- Connect site sonde to hand held and put in run mode by going to the sonde menu, highlight **Run** and press ENTER, highlight **Discrete Sample** and press ENTER, highlight **Start Sampling** and press ENTER.

- Place the site sonde, reference sonde, and NIST thermistor in the water jug and record pre-cleaning readings after WQ parameters have stabilized (Temp, SpCond, DO %, DO mg/L, pH, BGA) of site sonde in addition to readings of reference sonde and NIST thermistor in bucket.

- Turn off the site sonde. Remove site sonde and thoroughly clean.

- Cleaning site sonde: **Note: only site sonde is cleaned during cleaning process**

- YSI Sonde cleaning Procedure is as follows:
    - Remove sondegaurd
    - Use an Alan head wrench to remove the wiper brush and the wiper on the BGA probe.
    - Clean conductance probe with wire brush.

- To clean the probes carefully loosen any built up sediment or algae by brushing sides (**NOTMEMBRANE SURFACES**) with toothbrush. When completed, use squirt bottle with DI water to rinse surfaces of probes.
- Swipe the sides of the probes with a Q-tip moistened with alcohol. **DO NOT APPLY TO MEMBRANE SURFACES**
- Swipe membrane surfaces with Q-tip moistened with DI water.
- Rinse all surfaces once more with squirt bottle of DI water.
- Install wiper brush and wiper (with new wiper pads) back onto probes with the proper gap (width of Rite-In-The-Rain paper).
- Put sonde guard back on.

WHILE SOMEONE IS CLEANING THE SONDE THE OTHER CAN:

- Take the big brush and thoroughly clean the inside and outside of the sonde lock box and outside of conduit.

- Get new wiper brush from cleaning kit and apply new wiper pad. Apply new wiper pad to wiper.

- Clean the site sonde sensor guard with a toothbrush and Q-tips.

- Take a Q-tip and clean out the data line connection on the data line ensuring it is free of water and sand.

- Download data from logger.
    - **If you are at the KAT site you do not download data until USGS is present**

    - **If you are at the Weitchpecor Trinity River site then follow the attached SOP to download data off of the H-350 XL data logger using the compact flash card.**

    - **If you are at the TC site then follow the other SOP to swap linear flash cards from the H-350 datalogger.**

After site sonde has been cleaned:

- Replace site sonde, reference sonde, and NIST thermistor in bucket and record post-clean readings of YSI site sonde and reference sonde in bucket after WQ parameters have stabilized.

- **Post calibrate site sondeDO probe:**Remove any water from the optical DO probe with Q-tip or Kim wipe**(careful not to push too hard on membrane)**. Wrap the wet towel over the sensor guard and entire datasondeto provide insulation. Place the entire sonde with wet towel into the DO calibration chamber (red jug with lid on) and make sure the sonde will not fall over.

- Go to the sonde main menu, highlightcalibrate and press enter.Select **ODOsat %** and then **1-Point** to access the DO calibration procedure. Enter the current barometric pressure in **mm of Hg.** Press **Enter** and the current values of all enabled sensors will appear on the screen and change with time as they stabilize. Observe the readings under ODO mg/L. **After the DO stabilizes = shows no significant change for approximately 30 seconds,**Record the temp and the initial in DO mg/L and press **ENTER** to calibrate. The screen will indicate that the calibration has been accepted , record the Final DO in mg/L

- **Next: post calibrate the Specific Conductivity Probe**
- Rinse probes two times with DI water.
- Rinse probes two times with specific conductivity standard.
- Fill calibration cup with fresh specific conductivity standard.
- Under the main menu highlight calibrate and hit enter
- Highlight **Conductivity** and hit ENTER
- Highlight **SpCond** and hit ENTER
- Enter the value of calibration standard (for 1,000 μS/cm, enter 1.0) and press ENTER.
- Wait at least 30 seconds until specific conductivity stabilizes and record the temperature and initial specific conductivity value onto data sheet.
- Press ENTER to calibrate the sonde
- Never accept an "Out of Range" message – if this occurs ensure there are no bubbles in the hole where the Sp Cond probe is located and that the standard covers the hole completely
- Record the final value of specific conductivity onto data sheet.
- Press ESCAPE several times to go to the Main Menu and highlight **Advanced** and hit ENTER
- Highlight**Cal constants** and hit ENTER
- Record conductivity cell constant onto data sheet and verify the number ranges between 4.5 to 5.5
- Dump conductivity standard into rinse jar.

- **Next: post calibrate the pH probe**
- Rinse two times with DI water
- Rinse two times with pH 7.0_ standard.
- Fill calibration cup with fresh pH 7.0_ standard ensuring that the temp probe is covered with calibration standard
- Press ESCAPE twice to the main menu and highlight **RUN** and hit ENTER
- Highlight **Discrete Sample** and hit ENTER
- Highlight **Start Sampling** and hit ENTER
- Wait until temp stabilizes and record the temperature of the pH 7.0_ standard and the temperature compensated value for the pH standard, this is done to determine the temperature compensation for the pH standard, for example if the temp is 18 degrees C then determine the value of the pH 7 standard at 20 degrees C on the

look up table on the datasheet and fill it out in the pH standard line on the datasheet

- Press ESCAPE 3 times to go to the Main Menu
- Highlight **Calibrate** and hit ENTER
- Highlight **ISE1 pH** and press ENTER
- Highlight **2 point** and press ENTER
- Enter the temperature compensated value for the pH 7._ calibration standard for the first calibration point and hit ENTER.
- Wait at least 30 seconds until pH stabilizes and record the initial pH 7._ value onto the data sheet.
- Press ENTER to calibrate the sonde
- **DO NOT press enter or escape!**
- Record the final value of pH onto data sheet.
- Record pH mv onto data sheet and verify that the value ranges between -50 and +50
- Dump pH standard into rinse jar.
- Rinse two times with DI water.
- Rinse two times with pH 10._ standard.
- Fill calibration cup with fresh pH 10._ standard., ensuring that the pH probe is completely submerged
- Record the temperature of the pH 10.0_ standard and the temperature compensated value for the pH standard onto the datasheet
- Press ENTER once and enter the temperature compensated pH 10.0_ value as the second point and hit ENTER.
- Wait until pH stabilizes and record the initial pH 10 value onto data sheet
- Press ENTER to calibrate the sonde
- Record the final value of pH onto data sheet
- Record pH mv onto data sheet and verify that the value ranges between -130 and -230
- calculate the pH slope onto data sheet by subtracting the difference between the two numbers (using absolute value of the two numbers) and enter the value onto the datasheet, ensure the value ranges between 165 and 180
- Dump pH 10.0_ standard into rinse jar
- Rinse with two times with DI water

- **Next: IF YOU ARE AT THE WE, KAT or TC SITES THEN YOU NEED TO DO A 0 CHECK OF THE OPTICAL BGA PROBE.**
- Fill calibration cup ¾ of the way with DI water so that the BGA and temp probe are fully immersed.
- Be sure to engage only one thread on the calibration cup during this procedure to avoid a small interference from the cup bottom
- Highlight **Run** in the main menu and press ENTER, highlight **Discrete Sample** and press ENTER, highlight **Interval** and change it from 0.5 to 4 and highlight **Start Sampling** and press ENTER.

- On the 650 activate the wiper to clean the optics to remove any bubbles that may be present
- **After BGA has stabilized.** Record initial temperature and BGA on data sheet. Do not calibrate

- **Once BGA is present in the Klamath Riverdo a rhodamine dye check for the BGA probes.**
- Rinse two times with DI water
- Rinse two times with rhodamine dye standard that was prepared in the lab.
- Fill calibration cup with fresh rhodamine dye standard ensuring that the temp probe is covered with calibration standard
- Press ESCAPE twice to the main menu and highlight **Run** and hit ENTER
- Highlight **Discrete Sample** and hit ENTER
- Highlight **Start Sampling** and hit ENTER
- Wait until temp stabilizes and record the temperature of the rhodamine dye standard and the temperature compensated value for the rhodamine dye standard, this is done to determine the temperature compensation for the rhodamine dye standard, for example if the temp is 18 degrees C then determine the value of the rhodamine dye standard at 18 degrees C on the look up table on the datasheet and fill it out in the rhodamine dye standard line on the datasheet
- After BGA has stabilized record the BGA number on the datasheet, if BGA number does not stabilize on any one number record the range after you watch it carefully for a couple of minutes
- Dump the rhodamine dye standard into the waste jug and rinse two times with distilled water

- Disconnect the sonde and 650.
- Connect sonde to site datacable, attach carabiner, and insert into aluminum sonde box. Deploy sonde at least 5 minutes before it is set to take a measurement. Record the time of deployment
- Place the reference sonde next to the datasonde at least 5 minutes before it is set to take a measurement and record WQ parameters as close as possible to the half hour or top of the hour (+/- 2 minutes).
- Check logger to ensure that sonde is communicating with logger and logger is recording data.

H350 XL Datalogger Instructions

Klamath River at Weitchpec(WE) and Trinity River at Weitchpec (TR)

To Download Data

- Insert 256 MB Compact Flash Card with PC Card Adapter into Datalogger
- Scroll Down to ‘Data Options’
- Press Arrow →
- Scroll Down to ‘Copy .NEW to Card?’
- Press Enter
- Wait Until Datalogger reads ‘Done, Press Enter to Erase .NEW’
- Press Esc/Cancel to Main Menu
- Remove Data Card by pushing eject button next to card slot

H350 data download for the TC site

Data Download (Linear Flash card swap out)

1. Open Gaging Station by unlocking metal box.
2. Disconnect the two metal rings holding lid on display board.
3. Press**ON**.
4. Scroll Down to <**CHANGE DATA CARD>**and hit **ENTER**.
5. Hit **ENTER** for **YES**.
6. Pull card and hit **ENTER**.
7. Install new blank card (from office) and press **ENTER**.
8. Hit **ENTER** for **YES** to format card.
9. On the data logger, scroll down to **<FLASH MEMORY CARD>**, hit **ENTER**.
10. Scroll down to **<VIEW DATA FILE>**, hit **ENTER**. (If the data headings are there, it is accepting data.) Hit **ESCAPE**.
11. Scroll up to **<LOGGING PARAMETER>**, hit **ENTER.** (Screen should say **<LOGGING [ON]>**, if it doesn’t, it needs to be turned on.)
12. Close lid on data logger.
13. Lock door on Gaging Station.

<u>Method to remove and install a probe</u>

- First carefully unscrew the stainless steel probe nut with the provided tool. Carefully dry the base of the probe with a kim wipe. Tilt the probes to be pointing towards the ground. Firmly grasp the probe at its base and pull in a slow downward motion until the o-rings on the probe have cleared the probe port. Blow out the probe port with compressed air to dry it thoroughly.
- Prepare the new probe by lightly greasing the o-rings on the probe. Insert the probe into the correct port and gently rotate the probe until you feel the connector engage. Now push the probe in towards the bulkhead until you feel the o-ring seat in its bore. You will experience some resistance as you push the probe inward. Once you feel the o-ring seat, gently rotate the stainless steel probe nut clockwise with your fingers while you are holding the probe in place.
- **DO NOT USE THE TOOL! The nut must be seated by hand, if the nut is difficult to turn STOP back off and attempt again to prevent cross threading the threads on the sonde. The nut will seat flat against the bulkhead and rotate easily when the parts are properly aligned. Use the tool to snug up the nut so it cannot come loose. DO NOT OVER TIGHTEN!!!!!!**
- If you are removing probe from the spare sonde make sure to install a port plug in the same way you install a probe. (grease o-rings and hand screw in first then tighten with the tool)
- Document what you did on the data sheet

Sensor Settings for Datasonde that is used in mainstem monitoring activities
(does not matter if hooked up to a logger or not)

- **Time is on**
- **Temperature is on**
- **Sp. Conductivity is on**
- **ISE1 pH is on**
- **Dissolved Oxy is OFF**
- **Optic-T – Dissolved Oxy is ON**
- **Battery is OFF**
- **Pressure is OFF**
- **ISE-2 is off**
- **Optic C - BGA is ON (except for TR sonde that has turbidity probe keep it off)**

Report Settings for Datasonde that is Hooked up to a datalogger at WE,TC, KAT and TR:

- **Date and Time is OFF**
- **Temperature is on: °C**
- **Specific Conductivity is on: microsiemens μ**
- **pH is on**
- **pH mv is on**
- **ODO Sat % and mg/L is on**
- **Turbidity is OFF**
- **BGA is ON (at KR sites only)**

Report Settings for Datasonde that is **NOT** Hooked up to a datalogger:

- **Same as above but Date and Time is turned on**

To download data and create files on sondesthat are not hooked up to a datalogger

Before postcalibrating DO follow the below instructions to download data off of the internal datasonde memory.

- **If the sonde is not hooked up to the datalogger then this is a good time to download the data off of the sonde.**

- Turn the logging off by selecting run, unattended sample, and stop logging
- Download the data (page 55 in the 650 manual) by selecting the sonde menu in the 650 Main Menu
- Highlight File and hit enter
- Highlight Quick Upload and hit enter
- Select PC6000 for the File Type and hit enter
- Do the same process again for the same file but download it as a different data file, a ASCII Text file this time

- Create a file after you do your final calibration of pH or the BGA check

- Create a new file in the Sonde Run Menu unattended sample menu. Make sure the start time is two minutes before the half hour or top of the hour (i.e, 10:28 or 10:58). The interval is 30 minutes. The parameters to log should be date and time, temperature, conductivity, pH, pH mv, and battery voltage, ODO mg/L, ODO % Saturation (and BGA for KR sites). Set the stop time to run for 21 days. Set the file name to site id and start date, example-(TR061606). Scroll down to the bottom of the screen and start logging. To verify that logging is activated go to file status and it will say logging active.

Appendix B: Water Quality Grades

Water quality data from sondes is entered into the Yurok Environmental Data Storage System (YEDSS) where each water quality parameter is assigned a grade based on USGS criteria (Wagner et al., 2006) for each two week deployment (Table B-1). Any grade of 'D' or lower is considered "poor" data and is flagged as such. Low grades can be caused by instrument drift due to biofouling or aging of probes, or damage to datasonde. For more information regarding YEDSS and/or grading of data please contact YTEP.

During the 2011 monitoring year no grades of 'D' or poorer were generated (Tables B-2 through B-5).

Table B- 1. Water Quality Ratings for Raw Data

Quality Ratings For Raw Data				
Parameter	**A (excellent)**	**B (Good)**	**C (Fair)**	**D (Poor)**
Water Temperature	≤ ± 0.2 °C	> ± 0.2-0.5 °C	> ± 0.5-0.8 °C	> ± 0.8 °C
Specific Conductivity	≤ ± 3%	> ± 3 to 10%	> ± 10 to 15%	> ± 15%
pH	≤ ± 0.2 units	> ± 0.2 to 0.5 units	> ± 0.5 to 0.8 units	> ± 0.8 units
Dissolved Oxygen (% Sat)	≤ ± 0.3 mg/L	> ± 0.3 to 0.5 mg/L	> ± 0.5 to 0.8 mg/L	> ± 0.8 mg/L

Table B-2. KAT Grades: 2012

Table B-2 KAT Grades 2012				
Date	Water Temperature Grade	Specific Conductivity Grade	pH Grade	Dissolved Oxygen Grade
5/10/2012	A	B	B	A
5/22/2012	A	B	A	B
6/5/2012	A	A	A	A
6/20/2012	A	A	A	A
7/2/2012	A	B	A	A
7/16/2012	A	A	A	A
7/31/2012	A	A	A	A
8/15/2012	A	A	A	A
8/28/2012	A	A	A	A
9/12/2012	A	A	B	A
9/25/2012	A	A	A	B
10/16/2012	A	B	A	C
10/24/2012	A	A	A	A

Table B-3. TC Grades: 2012

Table B-3 TC Grades 2012				
Date	Water Temperature Grade	Specific Conductivity Grade	pH Grade	Dissolved Oxygen Grade
5/10/2012	A	A	B	B
5/22/2012	A	A	A	A
6/5/2012	A	A	A	A
6/20/2012	A	A	A	A
7/2/2012	A	A	A	A
7/16/2012	A	B	A	A
7/31/2012	A	A	A	A
8/15/2012	A	A	A	B
8/28/2012	A	A	A	A
9/12/2012	A	A	A	A
9/25/2012	A	A	A	A
10/16/2012	A	A	A	A
10/24/2012	A	B	A	A

Table B-4. WE Grades: 2012

Table B-4 WE Grades 2012				
Date	Water Temperature Grade	Specific Conductivity Grade	pH Grade	Dissolved Oxygen Grade
5/10/2012	A	B	A	A
5/22/2012	A	A	A	A
6/5/2012	A	A	A	A
6/20/2012	A	A	A	A
7/2/2012	A	A	A	A
7/16/2012	A	A	A	A
7/31/2012	A	A	A	A
8/15/2012	A	A	A	A
8/28/2012	A	A	A	A
9/12/2012	A	A	A	A
9/25/2012	A	A	A	A
10/16/2012	A	A	A	A
10/24/2012	A	A	A	A

Table B-5. TR Grades: 2012

Table B-5 TR Grades 2012				
Date	Water Temperature Grade	Specific Conductivity Grade	pH Grade	Dissolved Oxygen Grade
5/10/2012	A	B	A	A
5/22/2012	A	A	A	A
6/5/2012	A	A	A	A
6/20/2012	A	A	C	A
7/2/2012	A	A	B	A
7/16/2012	A	B	A	A
7/31/2012	A	A	A	A
8/15/2012	A	A	A	A
8/28/2012	A	A	B	A
9/12/2012	A	A	B	A
9/25/2012	A	A	A	A
10/16/2012	A	A	B	A
10/24/2012	A	A	A	A