CWA 106 Water Quality Assessment Narrative: Water Year 2009

Yurok Tribe Environmental Program:
Water Division

December 2009

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Yurok Tribe

II. Project Period

Water Year 2009: October 1, 2008 through September 31, 2009

III. Purpose of WQ Monitoring Program

The mission of the Yurok Tribe Environmental Program is to protect and restore Tribal natural resources through the exercise of aboriginal and sovereign rights and practices in coordination with the community, Tribal departments, Tribal Council and adjacent jurisdictions. YTEP monitors and assesses the conditions and trends of surface water, groundwater and coastal waters of the Yurok Indian Reservation (YIR) and those of watersheds draining on to the Reservation. YTEP uses the *YIR Water Quality Control Plan* (WQCP) (YTEP, 2004c) to:

> "restore, maintain and protect the chemical, physical, biological, and cultural integrity of the surface waters of the YIR; to promote the health, social welfare, and economic well-being of the YIR, its people, and all the residents of the YIR; to achieve a level of water quality that provides for all potential uses; and to provide for full protection of state and federally threatened and endangered species."

Understanding the range and patterns in data will inform the Yurok Tribe so that appropriate standards can be set to prevent water pollution and protect beneficial uses. Data may ultimately be used by many resource professionals within and outside the Tribal government for nutrient budgets, nutrient cycling and spiraling analysis, and tracking the abundance of toxic algae and associated algal toxins. These data generated from the assessment and monitoring activities will also be used to identify the types of projects that should be undertaken to restore and improve water quality.

IV. Collaboration with other groups addressing WQ concerns

The Yurok and Karuk Tribes have been collecting water quality samples throughout the Klamath River Basin for nutrient and algae analysis since 2001 (YTEP, 2004a; 2004b; 2005). Both Tribes initially cooperated with the United States Fish and Wildlife Service (USFWS) between 2001-2005 and collected samples according to USFWS' previously formulated sampling protocols. The Yurok and Karuk Tribes also coordinate to collect continuous water quality data using YSI datasondes. Since 2006 the Karuk and Yurok Tribes coordinate to manage the water quality sampling program in the Klamath River. The Tribes sample water quality in the Klamath River spanning over 190 river miles.

The Yurok Tribe coordinates with the USFWS to deploy and extract HOBO temp probes at four locations on the Klamath River.

Green Diamond Resource Company allows access to their property to study sediment dynamics, conduct hydrological, turbidity, and water temperature monitoring, and to collect macroinvertebrates. Data is made available to them through the dissemination of published reports.

The Klamath River Water Quality Monitoring Coordination Workgroup that includes Tribes and State and federal agencies. This workgroup is involved in coordinating water quality sampling in the Klamath Basin and helps to reduce redundancy and spread information on the most up to date sampling methods and equipment being used.

The YTEP works with the Yurok Fisheries Program in the collection of hydrological, turbidity, and water temperature data, and the study of sediment dynamics in the tributaries of the Klamath River. Yurok Fisheries Program performs instream restoration and YTEP assists in those restoration activities and monitors the effectiveness of these activities over time and space.

The YTEP works with the Yurok Watershed Restoration Program in the collection of hydrological, turbidity, and water temperature data, and the study of sediment dynamics in the tributaries of the Klamath River. Yurok Watershed Restoration Program performs upslope restoration projects, such as the removal of old logging roads and failing culverts. YTEP monitors the effectiveness of these activities over time and space by operating long term monitoring stations in the streams downstream of these restoration activities.

US BOR has in the past funded the collection of Klamath River and Trinity River mainstem nutrient, periphyton, algae, and cyanobacteria data, and continuous water quality data using YSI datasondes. They have also funded a wetland restoration feasibility project, in which our staff are working on, currently.

PacifiCorp has recently become a partner in the funding of collection of Klamath River and Trinity River mainstem nutrient, periphyton, algae, and cyanobacteria data, and continuous water quality data using YSI datasondes.

USEPA Region IX assists the Yurok Tribe and other sampling entities on the Klamath River in the analysis of water samples for the presence of microcystin at their Richmond lab.

V. Design of WQ Monitoring Program

5.1. Mainstem

The Klamath River is listed as an impaired water body under Clean Water Act (CWA) section 303(d) in both California and Oregon (CSWRCB, 2005; ODEQ, 2006). Total Maximum Daily Load (TMDL) studies related to pollution abatement are complete for Upper Klamath Lake and its tributaries in Oregon (ODEQ, 2002) but in progress for the Lower Klamath (Link River and Keno Reservoir to the ocean) (St. John, 2005). Nutrient pollution in the Lower Klamath River can be traced to several sources: agricultural activities, the nitrogen fixing blue-green algae species *Aphanizomenon flos-aquae* that flourishes in Upper Klamath Lake and Klamath Hydroelectric Project reservoirs, and from the Lost River and Lower Klamath Lake basin via direct winter pumping and the Straits Drain (Kier Associates, 2007).

Nutrient pollution in the Lower Klamath River causes elevated pH and dissolved ammonia and depressed dissolved oxygen. Recent studies related to Klamath

Hydroelectric Project (KHP) relicensing have brought to light linkages between nutrient pollution in the Lower Klamath River and fish health (YTEP, 2006a). Algae beds and deposits of benthic organic matter in the Klamath River just below Iron Gate Dam provide ideal habitat for a polychaete worm that plays host to one of the Klamath River's most deadly fish diseases, the protozoan *Ceratomyxa shasta* (Stocking and Bartholomew, 2004; Stocking, 2006). The combination of direct stress to fish from water pollution in combination with increased abundance of pathogens has lead to more than 40% of downstream migrant juvenile Chinook salmon dying before they reach the ocean in some years (Foott et al., 2003; Nichols and Foott, 2005).

Severe nutrient-related water quality problems are apparent just upstream of the YIR boundary (RM 43.5); consequently, concern over impacts on the YIR require further study. For example, the average daily maximum pH at Orleans (RM 66) in August 2004 was 8.5, which exceeds NCRWQCB (2005) *Basin Plan* standards, and created stressful conditions for salmonids (Wilkie and Wood, 1995). NCRWQCB samples for dissolved ammonia at Ikes Falls (RM 70) in June 1996 were as high as 0.050 mg/l, which is recognized as lethal for salmonids (Heisler, 1990). In August of 1997, U.S. Fish and Wildlife Service (USFWS) Arcata Field Office (Halstead, 1997) measured D.O. as low as 3.4 mg/l at Big Bar (RM 50), which was causing mortality of hearty, warmwater-adapted fish species such as suckers and dace, as well as salmonids.

A preliminary nutrient budget by reach for the Klamath River (Asarian and Kann, 2006) found insufficient quantity and quality of data to fully understand nutrient dynamics in the Klamath River. Problems included laboratory detection limits for nitrogen forms that were too high, insufficient temporal and spatial resolution of samples, and lack of periphyton/macrophyte data. Due to lower nutrient concentrations, detection limit issues were particularly important in the lower reaches of the Klamath River such as on the YIR.

5.1.1. Selection of Sampling Sites in Mainstem Klamath and Trinity Rivers

YTEP conducts nutrient, phytoplankton, and cyanobacteria grab sampling, collects periphyton samples, and operates continuous water quality datasondes for water temperature, pH, conductivity, and dissolved oxygen monitoring on 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.

Sampling sites (Figure 5-1) were selected based on the following criteria:

- WE (Klamath River upstream of Trinity River at Weitchpec) – Conditions of the Klamath River as it enters the YIR.

- TR (Trinity River upstream of Weitchpec) – Conditions of the Trinity River, an important tributary that enters the Klamath River near the border of the YIR. Water temperatures in the Trinity River are generally cooler than the Klamath River during summer months and less nutrient rich.

- TC (Klamath River above Tully Creek) – This site is downstream of the confluence of the Klamath/Trinity Rivers and is in a well-mixed region.

YTEP has conducted studies to ensure that water quality conditions at this location are homogeneous across the river channel, ensuring that samples are not biased and influenced more heavily by either the Klamath or Trinity rivers. Samples from this site capture the effect that Trinity River water quality has on flows from the mainstem Klamath.

- TG (Klamath River at Terwer Creek USGS Gage) – This site is near the lowermost USGS streamflow gauging station on the Klamath River near the town of Klamath. It is of interest how nutrients are assimilated as they travel down the mainstem Klamath at this site is approximately 31 miles downstream of TC.

- LES (Lower Klamath River Estuary) – This location was selected to monitor water quality in the estuarine environment and also as the last point before water from the Klamath River enters the Pacific Ocean. During periods of low flow, the mouth periodically partially closes, which inundates the estuary and creates a lagoon-like habitat. Sampling at this location would enable YTEP to determine if water quality differs when the estuary becomes inundated.

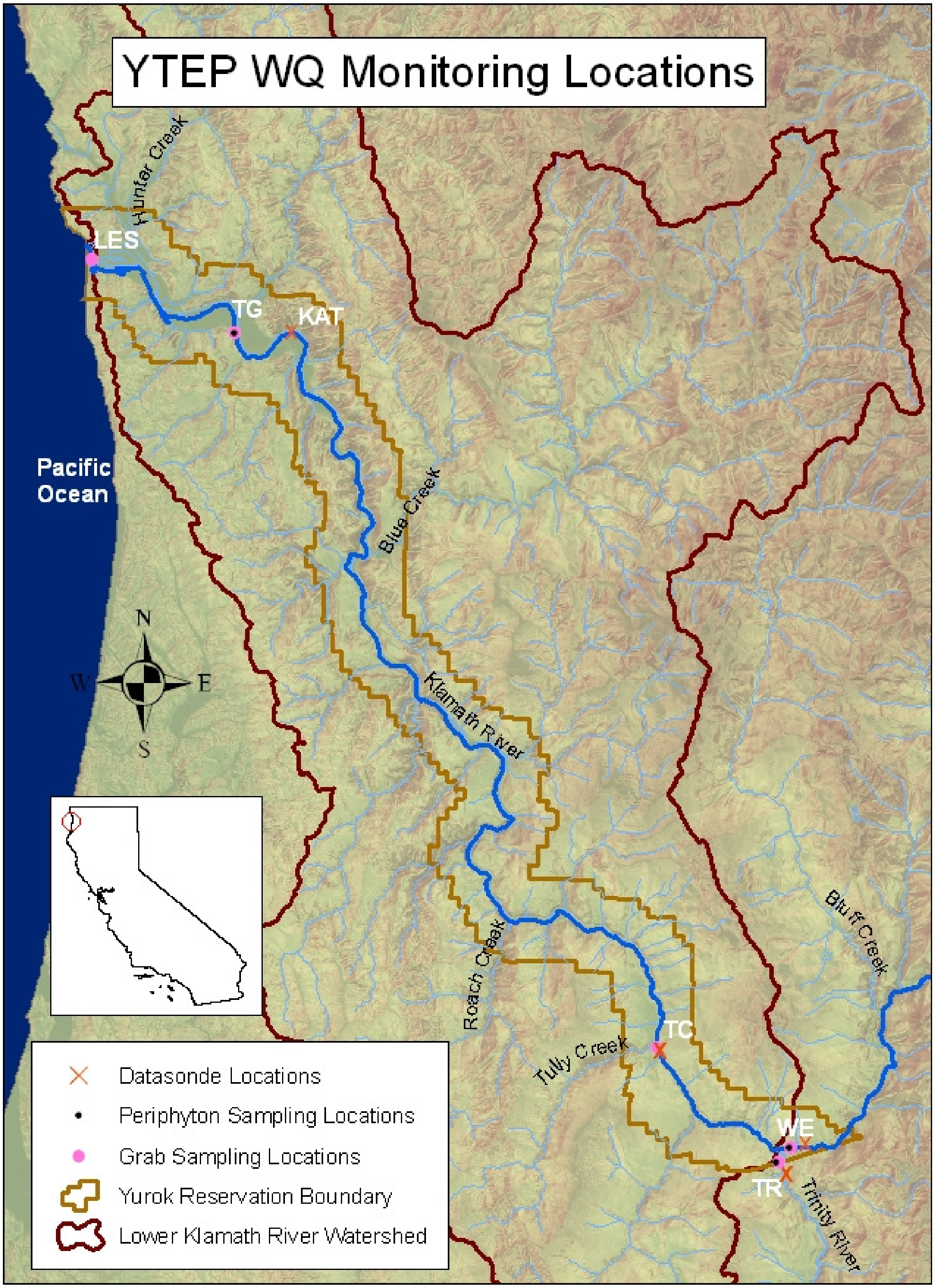

Figure 5-1. Location of water quality monitoring sites on the YIR.

5.1.2. Frequency of monitoring

YTEP collects bi-weekly (every other week) samples between May and October. This time period was selected because it is when nutrients and algae impair water quality in the mainstem Klamath River. Monthly samples have proved insufficient for fully understanding nutrient dynamics of the Klamath River (Asarian and Kann, 2006; Kann and Asarian, 2007).

Late spring through fall is also an important time for juvenile salmonid (chinook, coho, steelhead) emigration, adult spring and fall chinook migration into the Klamath basin, and migration of lamprey and green sturgeon, which are all of great importance to the Yurok People. Water quality conditions may impact these species of importance and may also impact the use of the river for recreation and subsistence fishing.

5.1.3. Bacteria Sites and Frequency of Monitoring

Surface water samples are collected as grab samples (independent, discrete samples) once per month. The sample points are a representative measure of good water mixing and represent the average water quality condition at sites regularly and habitually used by the Yurok people for recreation, ceremonial, or subsistence purposes. The locations for sampling were determined with public involvement, and are the mouth of the Klamath River, and points above and below the community wastewater treatment area. This data will be used to establish background levels and determine the appropriateness of the Tribe's standards and suggested reporting levels.

5.2. Tributaries

5.2.1. Turbidity and Suspended Sediment Sites and Frequency of Monitoring

YTEP's goal in operating gaging stations in tributaries to the Lower Klamath is to obtain a continuous record of streamflow, which can be estimated by creating a relationship, or rating curve, between gage height at the gaging station and discharge measurements taken at a range of water levels. In addition, data such as suspended sediment concentration (SSC) and turbidity are also monitored during the winter months, when most sediment transport occurs in watersheds. Watersheds can be impaired by excessive sediment loads, which can lead to changes in channel morphology, habitat degradation, loss of spawning habitat, and may influence salmonid migration.

The objectives for conducting this monitoring are:

1) establish baseline conditions and long-term trends
2) provide a basis for comparing inter-annual flow regimes as they relate to fisheries studies
3) to monitor long-term progress of restoration projects

YTEP operates real-time gaging stations in McGarvey Creek, Turwar Creek, Blue Creek, Tully Creek, and the Klamath River estuary (Figure 5-2). The gaging station in the Klamath River estuary is unique in that it is not used to monitor streamflow. Gage

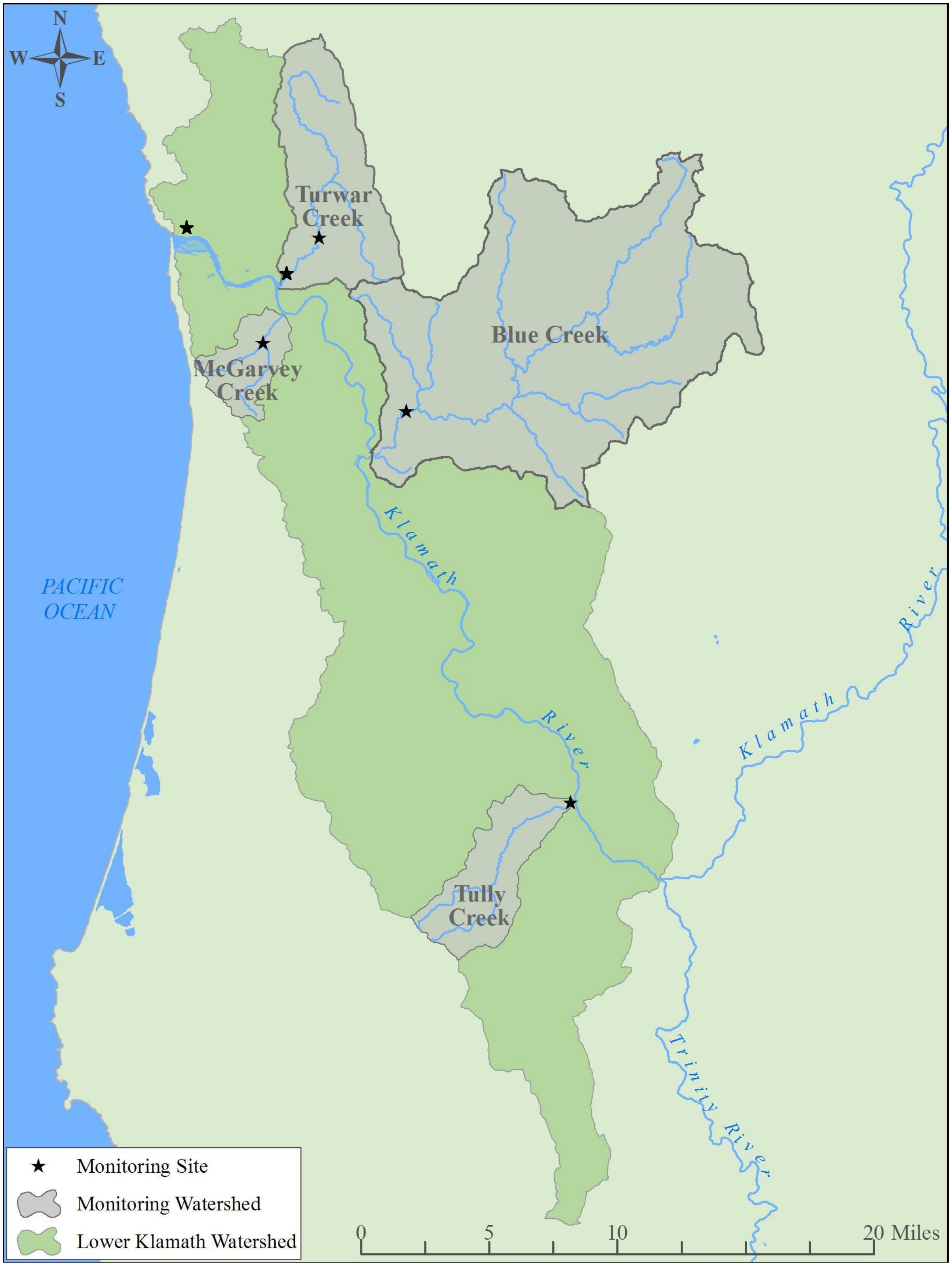

Figure 5-2. Location of hydrological monitoring stations on the YIR.

height in the estuary varies both seasonally and daily and is greatly influenced by tidal activity. YTEP's goal in operating this gaging station is to increase our knowledge of the estuary and investigate how tidal stage, river flow, and the location of the mouth affect the physical, chemical, and biological characteristics of the estuary.

Site selection criteria for gaging stations (Table 5-1) include spatial distribution, watershed restoration activities, proposed future development, and fisheries monitoring. Sites were located in the lower reaches of watersheds that characterize water quality and watershed health condition throughout the Lower Klamath. All tributaries currently monitored vary in size, geology, and geographic location and can potentially be used in the future to make inferences to neighboring watersheds. YTEP is in the process of developing baseline conditions to document the magnitude and duration of water quality impacts.

The following reasons were used as selection criteria for gaging station locations:

1. *Spatial Distribution* – Sites located in the lower reaches of watersheds that characterize the water quality and watershed health condition throughout the lower Klamath.

2. *Activity Specific* – Sites located above and/or below activities that may potentially impact water quality.

3. *Watershed Restoration Activities* – Sites located in watersheds that have active or proposed restoration activities.

4. *Proposed Future Development* – Sites near locations of resource and proposed resource development.

Table 5-1. Selection criteria priority matrix for gaging station locations.

Stream	Watershed	Primary Criteria	Secondary Criteria	Other
Blue	Blue	1	3	2
McGarvey	McGarvey	3	1	
Tully	Tully	4	1	2
U. Turwar	Turwar	1	3	2
L. Turwar	Turwar	3	1	2

5.2.2. Macroinvertebrate Sites and Frequency of Monitoring

The Klamath River is an important habitat for the endangered coho salmon and supports tribal trust anadromous species including coastal cutthroat and steelhead, coho, chinook, sturgeon, and lamprey eel. These species are vital to the Yurok people as they provide food, economic stimulus, and are the origin of many traditions and ceremonies.

Macroinvertebrates are the main food source for early stages of salmon and steelhead lifecycle as well as indicators of general water quality.

Evaluating biological communities within river systems through assessments of algae, macroinvertebrates, and fish provides a sensitive and cost effective mean to determine a stream's conditions. Macroinvertebrates (invertebrates large enough to be seen without magnification) are fairly stationary, and are responsive to human disturbances. In addition, the relative sensitivity or tolerances of many macroinvertebrates to water chemistry is well known. Assessing stream macroinvertebrate communities is essential to any comprehensive stream condition evaluation.

The object of studying macroinvertebrate communities is to monitor the general health and water quality of the Klamath River and its tributaries. Benthic macroinvertebrate communities indicate physical and habitat characteristics that determine the stream integrity and ecological health.

YTEP developed a site selection matrix to prioritize and identify areas where macroinvertebrate sampling would be valuable (Table 5-2).

1. *Spatial Distribution* - Sites located in the lower reaches of watersheds that characterize the water quality and watershed health condition throughout the Lower Klamath. Areas chosen to monitor baseline and long-term trends.

2. *Activity Specific* -Sites located above and/or below herbicide applications and other activities that may potentially impact water quality. Locations of interest are to monitor effects from non-point sources

3. *Watershed Restoration Activities*- Sites are located in watersheds and sub-watersheds that have active or proposed restoration activities. Sites are selected to monitor the long-term trends by tracking the watershed's recovery.

4. *Proposed Future Development*- Sites are chosen near locations of resource and proposed resource development. YTEP plans on developing baseline conditions to document the magnitude and duration of water quality impacts based on development.

5. *Klamath Mainstem Water Quality Characterization*- Sites are located in the main stem Klamath River in order to compliment the on going water quality studies and characterization.

Blue Creek (Bl1), McGarvey (Mc1), Tully (Ty1), and both Turwar sites (Tu1, Tu2) are sampled once per year, from early to late spring, after flows have diminished enough to enable safe and accurate data collection. All other sites are sampled every other year during the same time period (Figure 5-3).

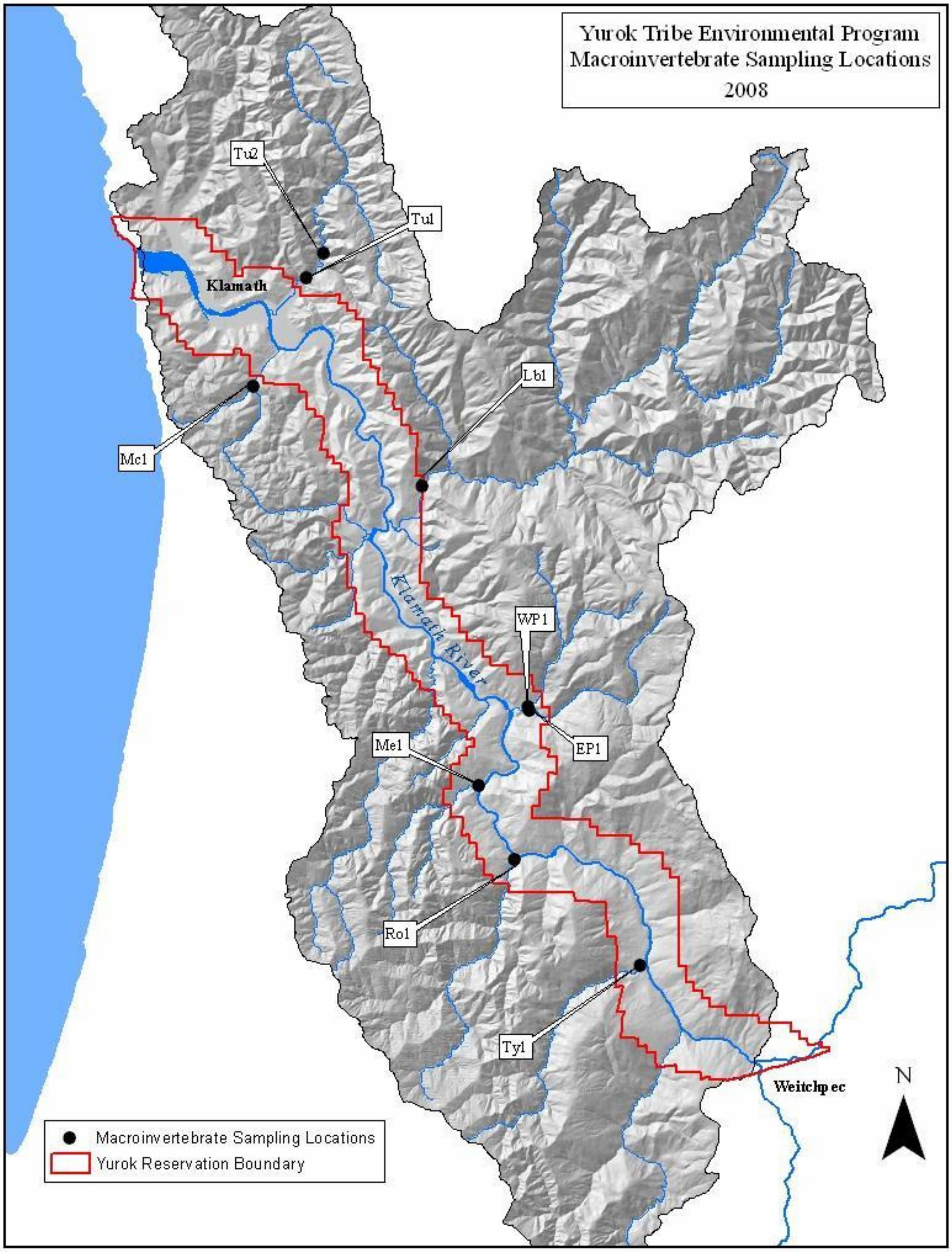

Figure 5-3. Macroinvertebrate sampling locations on the YIR, WY 2008

Table 5-2. Selection criteria priority matrix for macroinvertebrate sampling

				Site Selection Priority		
CREEK	WATERSHED	SUBWATERSHED	SITE_ID	Primary	Secondary	Other
Blue Creek	Blue	Lower Blue	Bl1	1	3	
West Fork Blue	Blue	West Fork Blue	Wb1	2		
Johnsons	Johnsons	Johnsons	Jo1	2	1	
Klamath River	Klamath	Lower Klamath	KJ1	5	1	
McGarvey	McGarvey	McGarvey	Mc1	1	3	2
Mettah	Mettah	Mettah	Me1	3	1	
East Fork Pecwan	Pecwan	East Fork Pecwan	EP1	1	4	
West Fork Pecwan	Pecwan	West Fork Pecwan	WP1	1	4	
Roach	Roach	Roach	Ro1	1		
Tectah	Tectah	Tectah	Te1	3	1	
Tectah	Tectah	NF Tectah	Te2	3	1	
Tectah	Tectah	SF Tectah	Te3	3	1	
Tully	Tully	Tully	Ty1	4	1	2
Turwar	Turwar	Turwar	Tu2	1	3	2
Turwar	Turwar	Turwar	Tu1	1	3	

VI. How WQ data is interpreted and managed

6.1. Laboratory Support

The laboratory participating in nutrient sampling analysis is Aquatic Research, Inc. (AR). Aquatic Research Inc. (AR) has processed Karuk Tribe samples for the reservoir studies from 2005-2007 (Kann and Corum, 2006) and provided reliable services for the Klamath Tribes in Oregon since 1990. AR has some of the lowest reporting limits for nitrogen related parameters on the West coast and has certified lab status from the states of Washington and California.

Phytoplankton samples are analyzed for species composition and cell counts by Aquatic Analysts (Friday Harbor, Washington).

Very low detection levels are being set for microcystin and other toxins because of the risk posed to human health; therefore, only laboratories specializing in detection of these substances are being used. The analysis for microcystin toxin using the enzyme linked immunosorbent assay (ELISA) method will be performed by the U.S. EPA Region IX Laboratory in Richmond, California.

The California Department of Fish and Game's Fish and Wildlife Water Pollution Control Laboratory in Rancho Cordova will perform the analysis of microcystin variants and anatoxin-a using liquid chromatography/mass spectrometry (LC-MS/MS). MSAE cell counts may not directly relate to toxin levels and high counts may lead to low levels of toxin or vice versa. YIR 2007 sampling results reported that toxicogenic cyanobacteria species other than MSAE were present, including *Aphanizomenon*, *Anabaena* and *Oscillatoria* (YTEP, 2008). Samples destined for the U.S. EPA lab and ELISA testing will be split and a duplicate sent to the California Department of Fish and

Game's Fish and Wildlife Water Pollution Control Laboratory in Rancho Cordova for LC-MS/MS testing. This will allow YTEP and cooperators to answer questions as to whether toxic algae pollution is restricted to microcystin-LR or if other forms (LA, YR, RR, LF, LW) or other toxins such as anatoxin-a are also present.

Macroinvertebrate laboratory processing is contracted to Jonathan Lee, a qualified local taxonomist and California Bioassessment Laboratories Network (CAMLnet) member. The CSBP has three levels of BMI identification. Level 3 is the professional level equivalent and requires identification of BMIs to a standard level of taxonomy, usually to genus and/or species

Sediment samples are analyzed by Graham Matthews and Associates (Arcata, California) following all USGS protocols to determine suspended sediment concentrations (SSC).

Bacteria samples are analyzed at the Humboldt County Public Health Laboratory in Eureka, California, using approved methods.

6.2. Interpretation of Results

All YTEP field personnel have been thoroughly trained in the protocols of data collection. Results they have collected over the last several years have been of high quality. Each field visit requires that staff fill out field data sheets, a field notebook with standard entries and label samples appropriately in the field. Sampling is always conducted by at least two staff for safety reasons and to maintain consistency. YTEP is the primary organization responsible for data review, although the professional laboratories analyzing water quality samples will also note potential problems with outliers or other anomalies in sample results. One hundred percent of laboratory-generated data will be checked on receipt by the Project Manager for consistency, including whether blanks, spikes and duplicates are within specified targets and meet DQOs. Once data are merged or entered into a database, charting tools will be used to further check for data anomalies or errors. Outliers will be defined as in U.S. BOR (2005).Any unusual values outside the range of norm will be flagged and all aspects of field data sheets, shipping handling and laboratory handling and testing will be reviewed. Water temperature, conductivity, pH and dissolved oxygen are measured in the field when samples are collected and values of these hand-held measurements can be used to check field conditions at the time of sampling.

The Project Manager will use the following information to evaluate data quality:

- Sample chain of custody documentation is complete and correct
- Sample preparation information is complete and correct
- Sample integrity has been maintained
- Instrument performance criteria have been met
- Calibration criteria have been met
- Holding times, sample preservation, and sample storage criteria have been met
- Analyte identification and quantification are correct
- QC samples and method blanks are within control limits
- Documentation (including the case narrative) is complete and correct

The data manager will visually inspect all entered data sets to check for inconsistencies with original field or laboratory 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. 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.

6.3. Data Organization

The Yurok Tribe has received funding under the Environmental Information Exchange Network Program and used it to develop the Yurok Tribe Environmental Data Storage System (YEDSS). Data will be captured in YEDSS, which has automatic QA/QC screening so that data entries that fall outside excepted ranges are automatically flagged. Raw data and data that have undergone further QA/QC are automatically archived separately and metadata associated with each data type are also stored within the system and can be easily accessed when questions arise. The data is transmitted periodically to USEPA's WQX/STORET database via the internet.

VII. Results of WQ monitoring during this Project Period

Data for Water Year 2009 is currently under review; however, data collected in the mainstem of the Klamath River from previous years shows that pH, temperature, algae, and dissolved oxygen are consistently impaired from June through October while total phosphorous and total nitrogen are impaired from May through October. Bacteria sampling reveals no impairment.

In the tributaries, macroinvertebrate samples indicate some water quality impairment, typically scoring in the good and very good categories according to the North Coast Index of Biotic Integrity (IBI) developed by the California Department of Fish and Game, while turbidity samples show that all tributaries are impaired for sediment during the wet season from November through May, specifically during high flow events.

The Yurok Tribe Environmental Program feels that at this point the existing network of sampling sites is nearly sufficient to monitor water quality within the YIR. An increase in monitoring sites within the estuary has been proposed and YTEP is currently seeking funding to expand in this area. YTEP has also increased the frequency of nutrient and algae monitoring in the Klamath River to year-round sampling. This monitoring directly relates to dam removal negotiations, of which the Yurok Tribe has been an integral part.

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