

Instream Habitat Enhancement of Tectah Creek, Lower Klamath River: Year 1



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Year 1 Technical Report - 2009

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Dave Weskamp and Delmer “Seagull” Jordan on the Bear Creek landing – October 2008

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Steven Nova - YTFP filming crew
Photo by Thomas Dunklin

Corky (Yurok Elder) with
Ty and Izzy (Col. Heli.)
Photo by Thomas Dunklin





Delmer "Seagull" Jordan (Yurok Tribal Fisheries Program) and Roger Lansden (Columbia Helicopters Inc.) conducting a field survey of Tectah Creek (April 2008).

Introduction

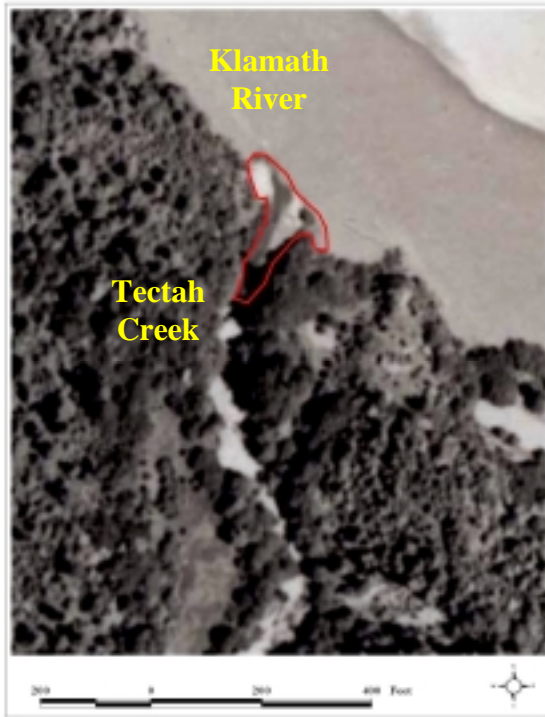
Yurok People inhabiting the Klamath Basin have relied on the areas resources for their subsistence, cultural, and economic livelihood since time immemorial. Anthropogenic activities over the past century have drastically altered or degraded fish habitat, resulting in substantial declines to Klamath River fish runs. Man-made dams and water diversions in the upper basin and diversions in several major tributaries have significantly reduced Klamath River flows and drastically altered the natural hydrograph. The combination of altered flows, impacts related to historic and current land use activities, and large flood events occurring over the last 150 years has greatly affected stream and riparian habitats of the Klamath River. The Klamath River and its major tributaries are all listed on California's 303(d) list as water quality impaired for supporting the propagation of fish and aquatic life.

In 2004, the Yurok Tribal Fisheries Program (YTFP) conducted a geomorphic assessment of tributary delta formation and subsurface flow conditions in several Lower Klamath River tributaries (Beesley and Fiori 2007). Degraded conditions at tributary confluences appeared largely due to interactions of several natural and anthropogenic factors: timing of rainfall and river flows; excessive sedimentation emanating from tributaries; and the interaction of sediment transport and backwater conditions between tributaries and the Klamath River. Continued sedimentation and the persistence of tributary deltas interrupt juvenile outmigration in the spring and adult immigration in the fall; limit the quality and quantity of salmonid rearing habitat; reduce available cool water refuge; increase competition and predation; thereby reducing overall salmonid survival from spawning to emigration. The tributary delta study also revealed that mobilization of channel stored sediment due to a lack of instream large wood was a significant and constant source of sediment for the deltas of many Lower Klamath River tributary confluences (Figures 1 and 2).

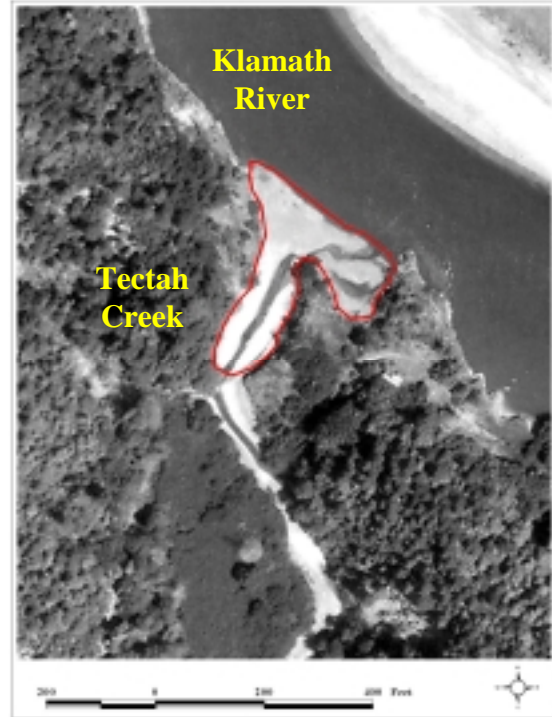
One of the primary restoration recommendations developed from the tributary delta study was to increase the amount of instream large wood within tributary habitats. The goals for this type of approach included metering sediment transfer through wood depleted reaches; improving tributary flood capacity to mobilize delta sediments; and enhancing riparian function to accumulate fine sediments. Tectah Creek was selected as the pilot watershed based on the salmonid populations it supports and because the confluence with the Klamath River provides a vital thermal refuge to salmonids migrating during summer low flows. Additionally, the timing of instream restoration took advantage of a reduction in upslope sediment sources following past decommissioning of all high priority roads by the Yurok Tribe Watershed Restoration Department (YTWRD). Due to access limitations, we did not consider mechanical removal of excess channel stored sediments and instead developed a process-based approach that relied on wood loading to alter sediment storage and delivery.

In 2008, YTFP worked with Columbia Helicopter Inc. (Col. Heli.) to transport more than 200 logs, a majority with rootwads intact, into channel and floodplain habitats of lower Tectah Creek using a chinook helicopter (Figure 3). Other partners vital to this project included the California Department of Fish and Game (CDFG), Bureau of Reclamation, Yurok Forestry,

1948



1969



1996



2004



Figure 1. Rectified aerial photographs of the Tectah Creek confluence with the Klamath River, California. The red boundary depicts the aerial extent of tributary delta sediments.



Figure 2. Panoramic photographs of the confluence of Tectah Creek and the Klamath River, California (2004 – 2005).



Figure 3. Photographs of Columbia Helicopter, Inc.'s chinook helicopter that was contracted to place wood in lower Tectah Creek, Lower Klamath River Sub-basin, California.

YTWRD, and Green Diamond Resource Company (GDRC). Primary objectives included increasing sediment storage capacity in this critically important tributary and reducing sediment delivery to Klamath River habitats. Adding instream and floodplain wood to Tectah Creek would also immediately improve salmonid spawning and rearing potential by facilitating the formation of critical instream and floodplain habitats, increasing habitat complexity, and improving spawning gravel quality (Figure 4). Other high priority objectives were establishing a comprehensive effectiveness monitoring program to allow for adaptive management; and providing high quality employment and training to Yurok Tribal staff.

Project Area

The project was located in Tectah Creek (Township 11 North, Range 3 East, Section 1, 11-14, and 22-24; Latitude 41.3664 North; Longitude 123.90263 West). Tectah Creek is contained within the Lower Klamath River Sub-basin in northern California and drains over 19 mi² of moderate to well dissected, high relief topography of the Klamath Mountains in the Coast Range Geomorphic Province (Figures 5 and 6). Tectah Creek supports anadromous populations of chinook salmon (*Oncorynchus tshawytscha*), coho salmon (*O. Kisutch*), steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarki clarki*), speckled dace (*Rhinichthys osculus*), threespine stickleback (*Gasterosteus aculeatus*), and multiple lamprey species. Other sensitive aquatic dependent species likely to inhabit Tectah Creek include the Pacific giant salamander (*Dicamptodon ensatus*), southern torrent salamander (*Rhyacotriton variegates*), foothill yellow-legged frog (*Rana boylei*), and tailed frog (*Ascaphus truei*).

Tectah Creek is a 3rd order stream with the majority of the watershed privately owned and managed for industrial timber harvest by GDRC (Figure 5). Elevations in the watershed range from 160 to 2,682 feet. The region has a Mediterranean climate, receiving as much as 90 inches of precipitation each year. Temperatures are moderated somewhat by the proximity of the watershed to the Pacific Ocean; however, snow can accumulate at elevations above 2,000 feet. YTFP conducted aquatic habitat and wood surveys in the anadromous reach of Tech Creek in the late 1990's. GDRC conducted aquatic habitat surveys of Tectah Creek in 2007. In addition to these data, GDRC established a long-term channel monitoring reach in lower Tectah Creek and has been collecting ~annual geomorphic information since 1997.

The project consisted of wood placement in the lower-most ~7.0 miles of Tectah Creek (Figure 7). Permission to access the project area must be granted by GDRC. To access the project area by vehicle from the town of Orick, California; travel north on US Highway 101 ~2.0 miles to Bald Hills Road (BHR); turn left onto BHR and travel for ~6.0 miles; turn left onto a gravel road and proceed forward to the T-100 gate (a GDRC south Klamath key is required for this gate); travel on T-100 for 6.0 miles; turn right onto T-200 and travel ~0.7 miles to the bridge that crosses Tectah Creek. Wood loading activities were conducted in habitats located downstream of this bridge. Jet boat launch sites located in the vicinity of Klamath, California, include the Requa Boat Ramp or the Roy Rook Boat Ramp. Tectah Creek is located on the south side of the Klamath River at River Mile (RM) ~22 (Figure 6).



Figure 4. Photographs of steelhead redds and a carcass located in the vicinity of existing wood (Top Photographs 2004); and of an existing wood jam providing high quality fish cover (Bottom Photograph 2008); Tectah Creek, Lower Klamath River Sub-basin, California.

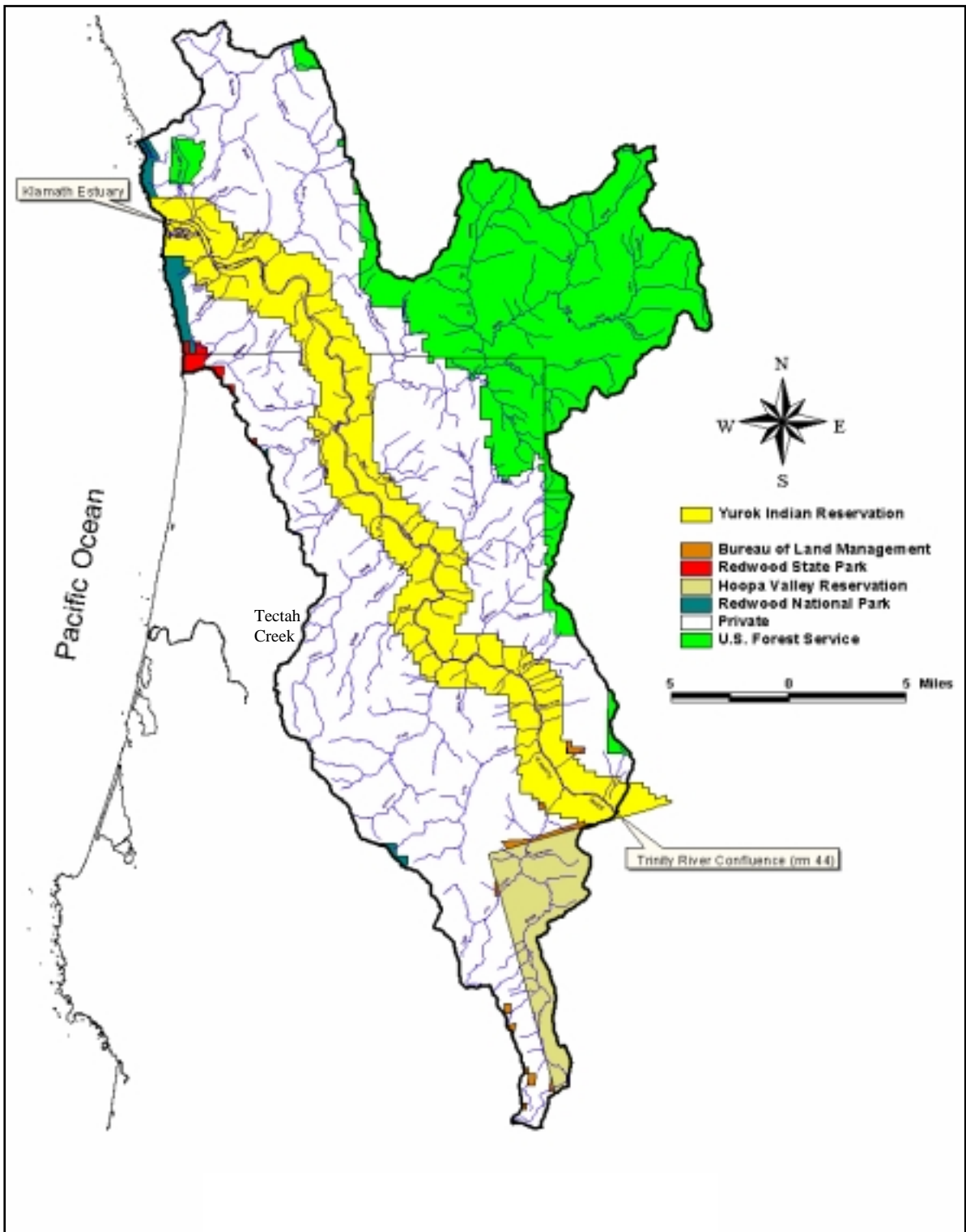


Figure 5. Map of the Lower Klamath River Sub-basin and Tectah Creek, California.

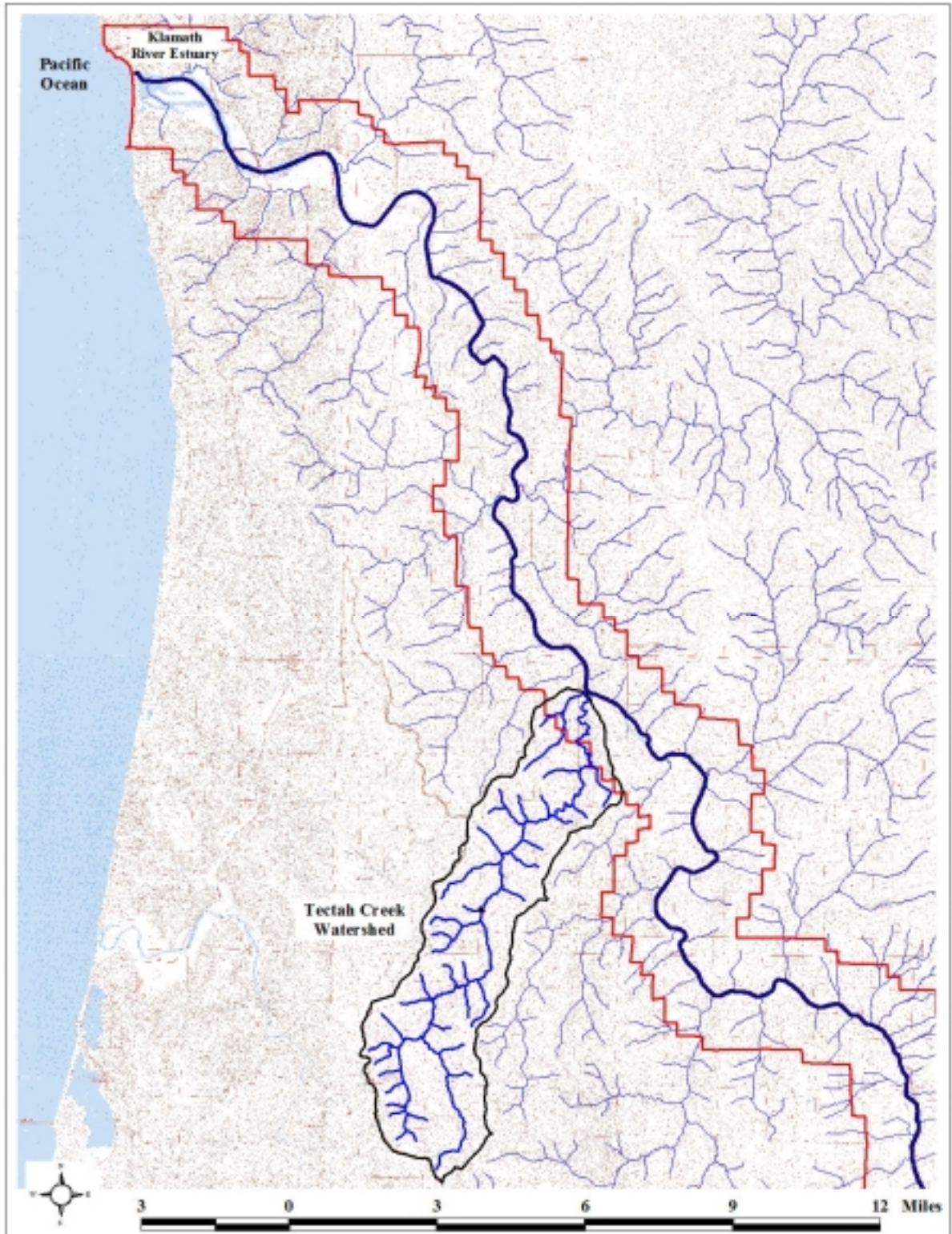


Figure 6. Map of the Tectah Creek watershed, Lower Klamath River Sub-basin, California.

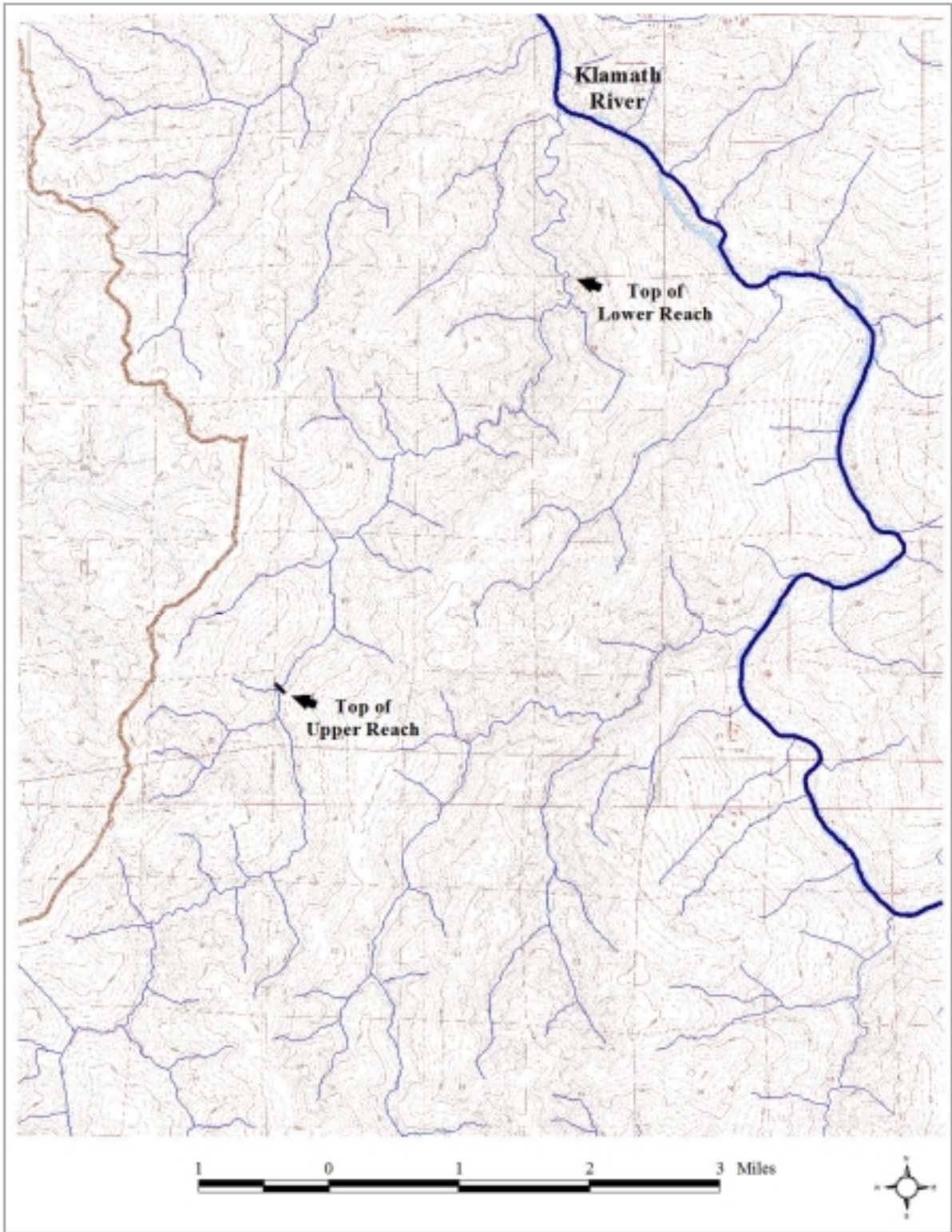


Figure 7. Map depicting wood loading reaches located in Tectah Creek, Lower Klamath River Sub-basin, California.

Methods

Wood Inventory and Staging

Yurok Forestry donated over 200 logs and whole trees from Yurok Tribal Timberlands located in upper Bear Creek (Figure 8). YTFP began coordinating with Col. Heli. early on in the project planning phase to ensure we fully understood what was possible with the chinook helicopter (i.e. cost per hour, logs per hour, weight capacity, landing and pick-up requirements, accuracy of placement). In spring 2008, YTFP worked with Col. Heli. to inventory the donated wood, determine what pieces were too heavy to transport, and outline the most cost-effective wood staging strategies. In early summer 2008, YTFP and YTWDRD used an excavator to re-position most of the donated wood on the landing in a manner that would maximize the efficiency of the chinook helicopter (i.e. minimize pick-up time, maximize the loads by doubling trees) (Figure 9). During this time YTFP marked a majority of the logs and trees with a numbered tag and recorded the information into field notebooks (Figure 10). Data collected for each numbered piece included tree species, log length, top and bottom diameters, and whether or not pieces had rootwads intact. The field data was then entered into a Microsoft Excel Database for planning and monitoring purposes.

Project Design and Implementation

YTFP divided the lower ~7.0 miles of Tectah Creek into two separate treatment reaches. The lower reach consisted of habitats located from RM 0 (Klamath River confluence) to RM 2.0; while the upper reach extended from RM 2.0 to RM 7.0 (Figure 11). Rocco Fiori (Licensed Geologist, Fiori GeoSciences) worked with YTFP to develop wood loading strategies and to identify geomorphically suitable installation sites in the lower treatment reach. Site selection was based on complementary use of digital elevation model analysis; field surveys and mapping; and hydro-dynamic modeling of the stability of proposed large wood structures. Techniques in the lower reach consisted of 1) creating complex wood structures capable of facilitating the geomorphic processes necessary for metering sediment and maintaining productive stream and riparian habitats; and 2) adding wood to floodprone surfaces to address poorly functioning riparian habitats and highly erodable banks. The strategy for the upper reach was to focus on wood loading to improve sediment storage and delivery dynamics.

On September 16 and 18, 2008; YTFP and FGS worked with Col. Heli. to construct multiple habitat improvement structures in the lower treatment reach of Tectah Creek (Figure 7). FGS directed the placement of wood in this reach based on the structure designs developed during our initial mapping efforts. The chinook pilots also built additional structures in the lower mile of the upper treatment reach. Col. Heli. returned to Klamath in October 2008; to complete wood loading activities in the upper treatment reach of Tectah Creek (Figure 7).

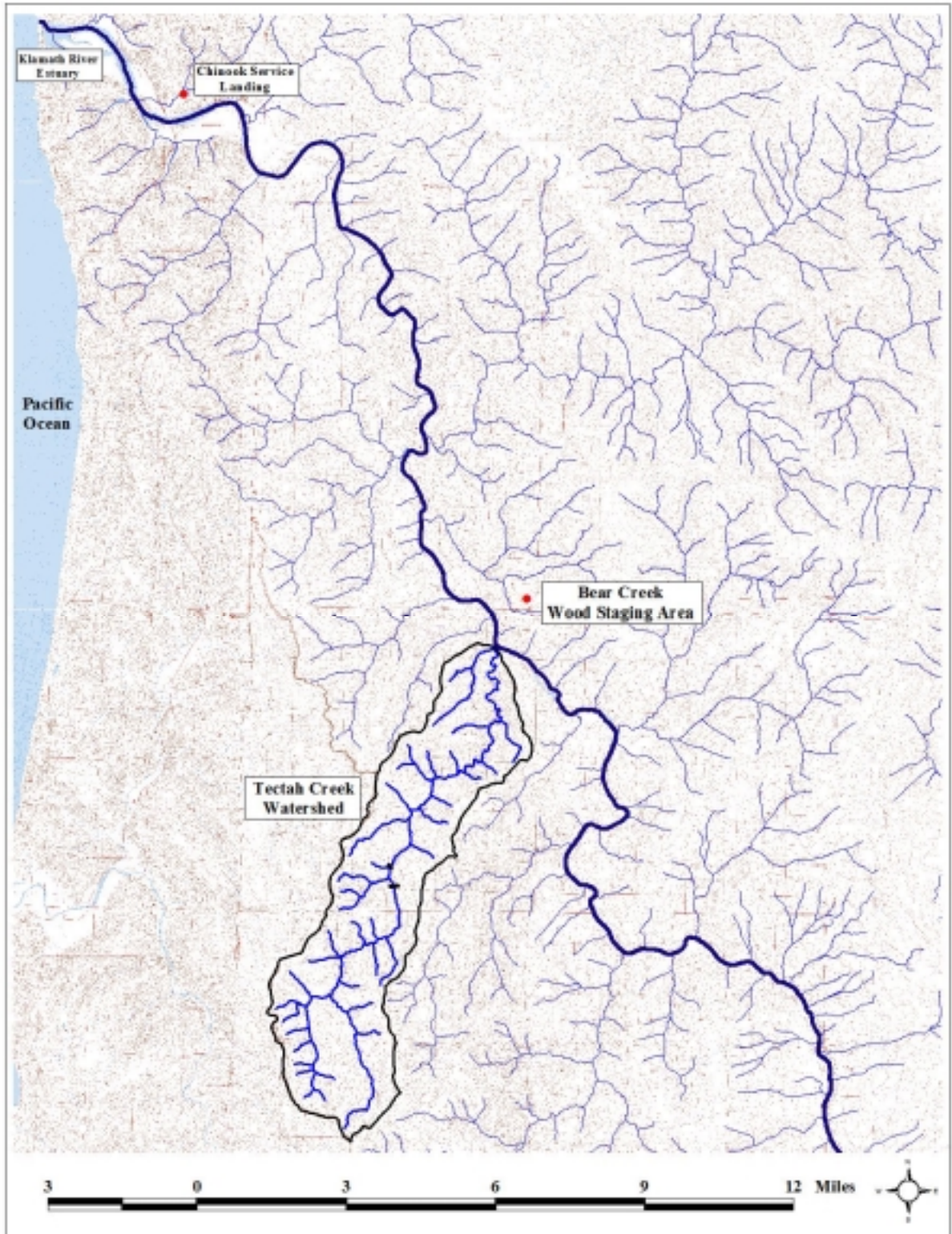


Figure 8. Map depicting Tectah Creek along with the wood source location in Bear Creek and the chinook helicopter service location, Lower Klamath River Sub-basin, California.



Figure 9. Photographs of wood staging activities on Yurok Tribal Timberlands in upper Bear Creek, Lower Klamath River Sub-basin, California (Summer 2008).

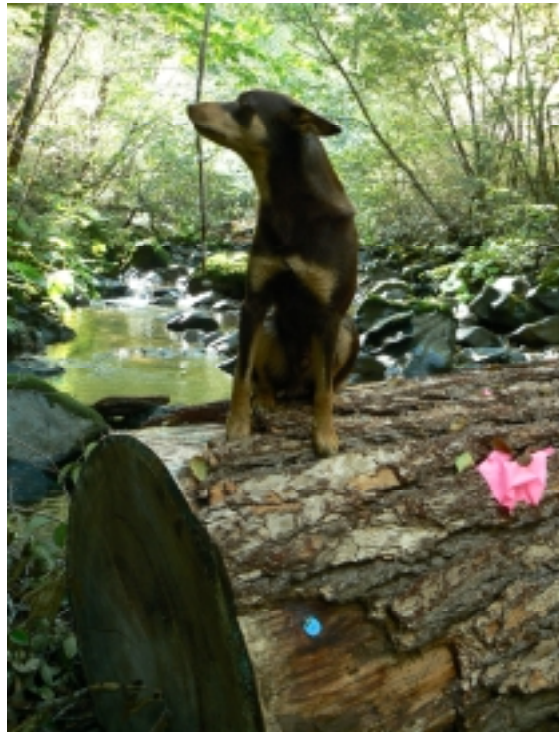


Figure 10. Photographs depicting flagging and individually numbered tags on large wood placed in lower Tectah Creek, Lower Klamath River Sub-basin, California (Fall 2008).

Effectiveness Monitoring

In summer 2008, YTFP established a network of permanent bench marks in the project reach using an optical total station (Nikon DTM522) and Survey Pro Software. Prior to wood placement, YTFP crews conducted three-dimension topographic surveys of stream and floodplain habitats in priority sections of the project reach in Tectah Creek. Several permanent cross sections were established throughout the project area during these surveys, especially within the lower treatment reach. YTFP surveys were tied to GDRC's long-term channel monitoring reach to improve our ability to assess project effectiveness. For this report, GDRC provided YTFP with their 2008 topographic survey data from Tectah Creek.

Following wood placement, structure locations were mapped in both treatment reaches and most sites were sketched in field notebooks and photographed. Total station surveys were conducted in the lower treatment reach to document the location and positioning of each log that was placed. Additional cross sections were established during this survey to collect more detailed baseline topographic information in the vicinity of wood loading sites.

Results

Wood Inventory

The majority of the wood placed in Tectah Creek consisted of tan oak with rootwads and/or limb structures attached (Table 1; Figure 11). Other species used for this project included Douglas fir and a limited number of chinquapin and madrone (Table 1). Most of the Douglas fir pieces consisted of old growth cull logs (Table 1; Figure 12). Over 1.5 million pounds of wood was flown and placed in the lower seven miles of Tectah Creek in fall 2008 (Table 2).

Table 1. Summary information for wood that was flown and placed in the lower seven miles of Tectah Creek, Lower Klamath River Sub-basin, California.

Tree Species	Rootwad (y/n)	Total No. Marked	Total No. Unmarked	Total No.
Douglas Fir	y	2	2	4
Douglas Fir	n	29	16	45
Tan Oak	y	91	56	147
Tan Oak	n	3	4	7
Chinquapin	y	8	3	11
Madrone	y	3	2	5
Lower Reach		107	34	141
Upper Reach		29	49	78
Totals		136	83	219



Figure 11. Photographs of tan oak that were flown and placed in the lower seven miles of Tectah Creek, Lower Klamath River Sub-basin, California (September 2008).



Figure 12. Photographs of Douglas fir cull logs flown and placed in the lower seven miles of Tectah Creek, Lower Klamath River Sub-basin, California (September - October 2008).

Table 2. Flight information provided by Columbia Helicopters, Inc. for the wood loading project conducted in lower Tectah Creek, Lower Klamath River Sub-basin, California.

Date	Total No. Turns	Total Weight (lbs)	Total No. Cycles
9/16/2008	40	406,280	3
9/18/2008	73	834,293	4
10/10/2008	34	534,900	4
Totals	147	1,775,473	11

Project Monitoring and Implementation

A total of ~51 multiple log structures were constructed in the two treatment reaches of lower Tectah Creek during fall 2008 (Figures 13). Over 7,000 feet of channel was surveyed in the upper treatment reach of Tectah Creek (Figures 14 and 15). The lower reach was surveyed more extensively relative to the upper treatment reach with just over 12,000 feet of channel surveyed in summer 2008 (Figures 14 and 16). A total of 26 wood loading sites and 18 permanent cross sections were surveyed in the lower treatment reach in fall 2008 (Figure 17). Structures were closely spaced in the lower treatment reach relative to those constructed in the upper reach (Figures 13 and 17). Although a majority of the pilot designed structures consisted of multiple logs; wood concentration was greater in the lower treatment reach relative to the upper treatment reach (Table 1). Sketches and photographs (pre- and post-implementation) of select wood loading sites in Tectah Creek are presented in Appendix A.

Year 2 Objectives

YTFP is currently working with Yurok Land Management survey crews to establish a highly accurate network of permanent bench marks in lower Tectah Creek (Figure 18). This control network will be established using a combination of GPS and optical total station equipment. The network will be used to tie existing and future surveys into a common GIS projection. Topographic surveys and wood inventories will be repeated in summer 2009 to document conditions following the first winter post-project implementation. Pre- and post-project monitoring data will allow us to assess short- and long-term changes in sediment storage, channel form, delta extent and elevation, and wood storage/transport dynamics. A priority objective was to learn from our wood loading activities in Tectah Creek and apply the information gained to future restoration efforts in the Lower Klamath River Sub-basin.

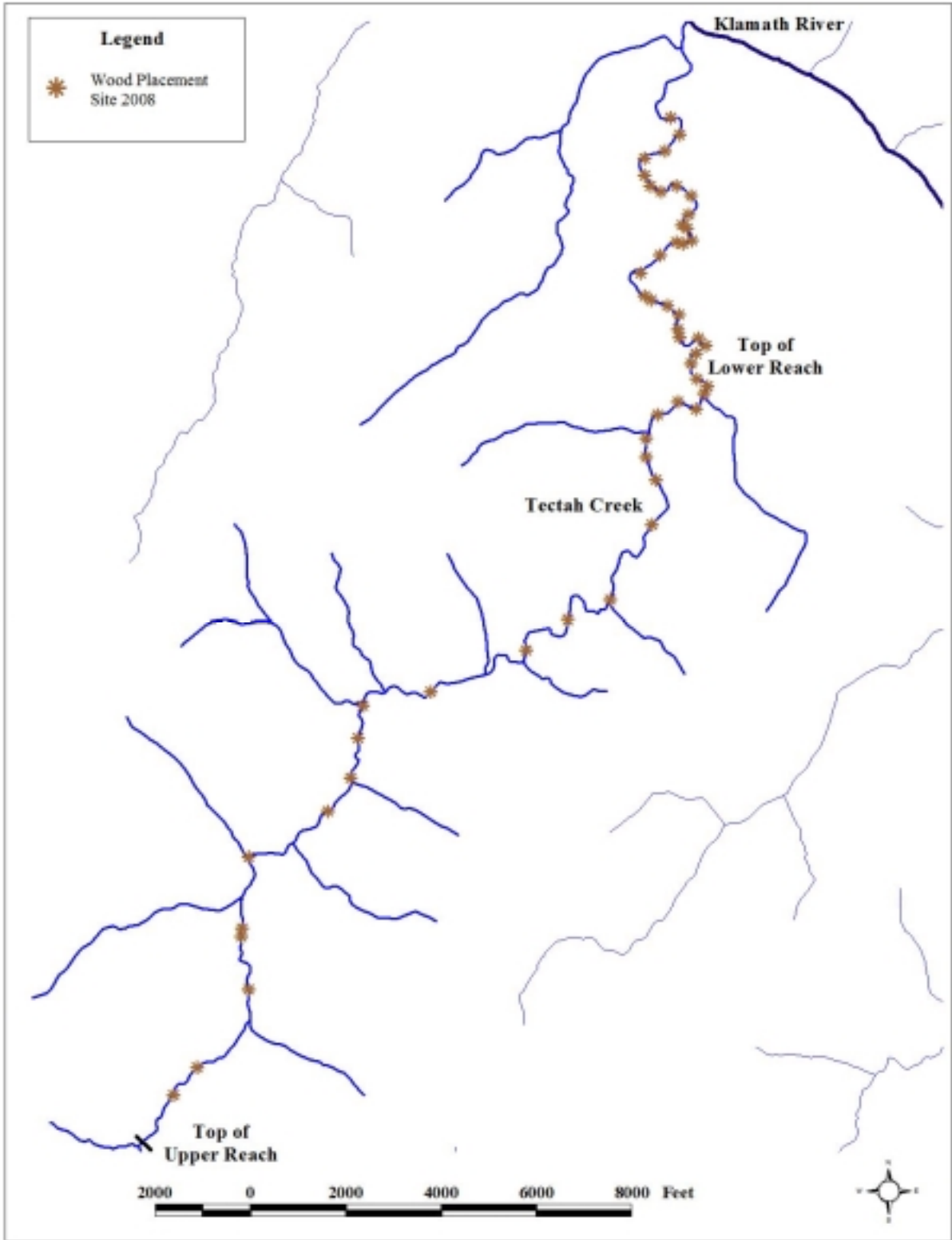


Figure 13. Map depicting wood placement sites located in the lower seven miles of Tectah Creek, Lower Klamath River Sub-basin, California.

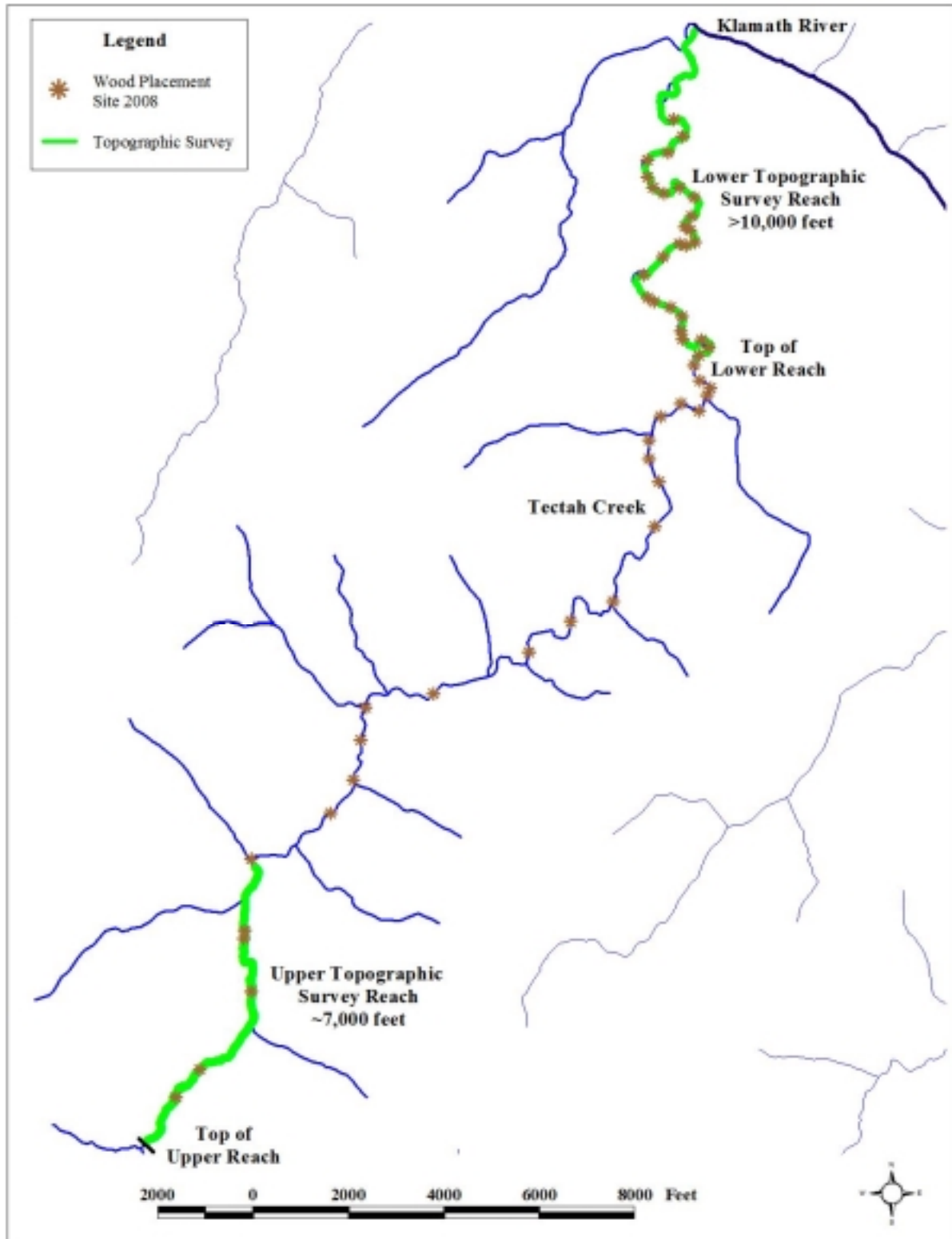


Figure 14. Map depicting the location of topographic surveys in relation to wood placement sites in Tectah Creek, Lower Klamath River Sub-basin, California.

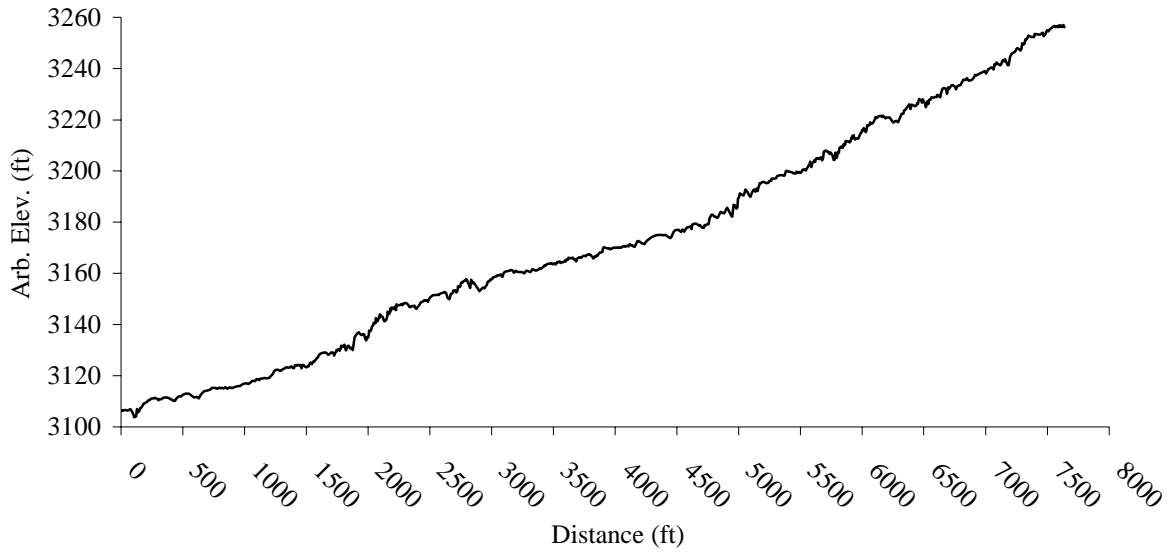


Figure 15. Longitudinal profile of Tectah Creek (~River Miles 5.7 – 7.1), Lower Klamath River Sub-basin, California.

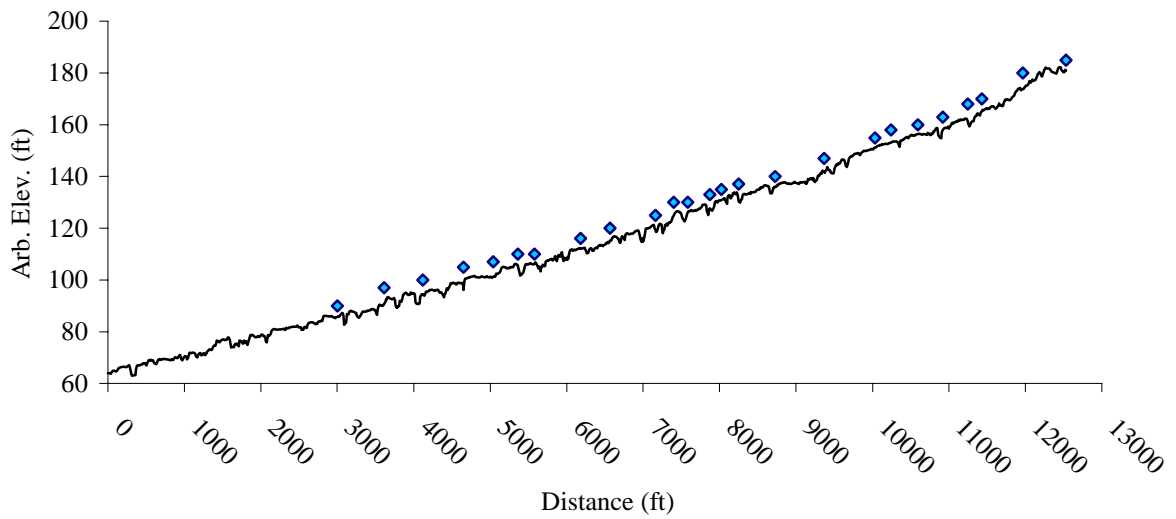


Figure 16. Longitudinal profile of Tectah Creek (~River Miles 0.0 – 2.1), Lower Klamath River Sub-basin, California. The blue diamonds depict large wood placement sites.

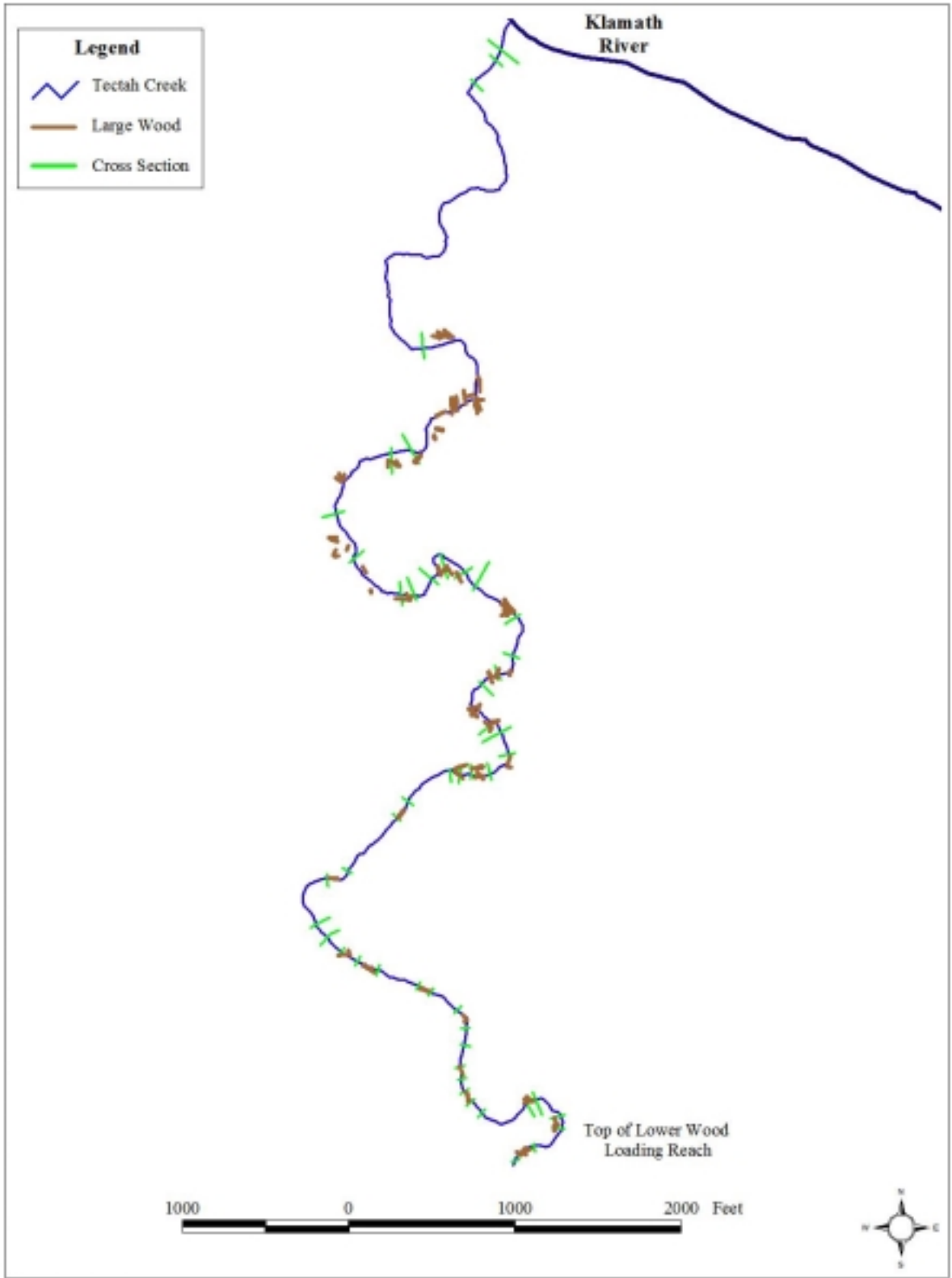


Figure 17. Map depicting 2008 wood placement sites and cross section survey locations in lower Tectah Creek, Lower Klamath River Sub-basin, California.



Figure 18. Photographs of a permanent bench mark (Left Photograph) and a survey bearing tree (Right Photograph) established in 2008 by Yurok Land Management survey crews in Tectah Creek, Lower Klamath River Sub-basin, California (September 2008).

Discussion

The long-term goal of the Yurok Tribe is to restore Lower Klamath River habitats to levels that support robust, self-sustaining populations of native anadromous fish. YTFP identified sedimentation of Lower Klamath tributary deltas as a critical limitation to salmonid production and water quality (Beesley and Fiori 2007). Therefore, priority objectives of this project included reducing sediment delivery to Tectah Creek delta and improving both tributary and mainstem water quality. Additional objectives included loading fluvial habitats with wood to facilitate improved spawning and rearing habitats for anadromous fish populations; and protecting highly erosive floodplains to promote soil and riparian forest development. This project also provided quality employment opportunities for Yurok Tribal members and staff.

The Lower Klamath River Sub-basin experienced a fairly large magnitude storm event in late December 2008 – early January 2009. YTFP conducted brief field surveys of the lower treatment reach and a portion of the upper treatment reach to obtain photographs of wood loading sites following winter flow events (Appendix A). Most of the wood placed in the lower treatment reach did mobilize; however, the wood appeared to facilitate the formation of complex instream habitats (i.e. pools, spawning beds) and protected vulnerable riparian habitats. Although more data is needed it appeared that pieces placed in the active channel weighing less than 20,000 pounds were mobilized to downstream or floodplain habitats; and that the Douglas fir cull logs only remained stable when placed at elevations at or above bankfull. A more comprehensive wood inventory will be conducted in both treatment

reaches during summer 2009 to improve our understanding of wood transport and retention dynamics and how wood placement influenced fluvial habitats of Tectah Creek.

Recommendations

Tectah Creek is ranked 5th out of 31 Lower Klamath tributaries for receiving watershed restoration (Gale and Randolph 2000). The main reasons for this high ranking is the number of native fish species present and the amount of anadromous habitat provided by the watershed. Therefore, we recommend that YTFP and YTWDRD continue pursuing funding to identify and treat existing upslope sediment sources and rehabilitate the fluvial corridor of lower Tectah Creek.

Priority recommendations for Tectah Creek include:

- Updating road inventories for the watershed and coordinating with GDRC to decommission priority road segments and crossings identified in Tectah Creek;
- Conducting more intensive, long-term geomorphic and topographic surveys throughout the treated reach of lower Tectah Creek;
- Identifying other quality wood sources and securing the funding required to conduct a second phase of wood loading in the lower seven miles of Tectah Creek; and
- Initiating a comprehensive native riparian restoration program in lower Tectah Creek to facilitate long-term watershed recovery.

YTFP also recommends that more extensive and consistent fisheries investigations be conducted within the anadromous reaches of Tectah Creek to document population trends as well as non-natal use of thermal refuge habitats located in the vicinity of the confluence with the Klamath River. Water quality monitoring, especially temperature and dissolved oxygen, should be incorporated into any future fisheries investigations. To improve our understanding of larger-scale trends in the Lower Klamath River Sub-basin, we recommend maintaining YTFP's long-term data sets: 1) tributary connectivity monitoring, 2) intensive subsurface flow monitoring, and 3) tributary water table monitoring (Beesley and Fiori 2007).

Another primary recommendation is to increase support and develop creative solutions so regulatory agencies and resource companies can partner with restorationists to provide the high quality wood necessary for successful wood loading projects. It is well known that complex wood jams are a fundamental habitat type associated with coho salmon. Given that most coastal streams have experienced nearly 100 years of wood depletion without significant replacement; the recovery of anadromous salmonids, especially coho, will require that a large volume of high quality wood become available for stream restoration purposes. Information gained from Tectah Creek during post-winter flow surveys indicated that many

of the best available trees used as complex jam key members were likely under-sized for flood levels common to watersheds of this size. To ensure the success of future wood loading projects (i.e. formation and maintenance of complex fish habitat, resilient and connected floodplains, and robust riparian forests) restoration efforts will be dependant on the availability of high quality wood.

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