YUROK TRIBE

Watershed Restoration Department

2001 BLUE CREEK WATERSHED RESTORATION IMPLEMENTATION FINAL REPORT

Prepared for:
U.S. Fish & Wildlife
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By:
Yurok Tribe

2001 BLUE CREEK
WATERSHED RESTORATION
IMPLEMENTATION AND TRAINING PROGRAM

EXECUTIVE SUMMARY

The purpose of this report is to summarize the watershed restoration work completed by the Yurok Tribe, as part of the Lower Klamath River Watershed Restoration Partnership's 2001 project. From August 2001 through the end of October 2001, the Yurok Tribe conducted a Watershed Restoration Implementation and Training Program within the Blue Creek drainage basin. Funding was obtained from the U.S. Fish and Wildlife Service, California Department of Fish and Game, and Simpson Timber Company. This is the first year of a multi-year restoration effort in Blue Creek, which is intended to remedy road related sediment sources from 30 tributary sub-basins, within the Lower Klamath River Basin.

This program is part of a long-term watershed restoration goal intended to fulfill two principal Tribal objectives:

1. Return the Klamath River fishery to the healthiest possible condition.
2. Create job training and employment opportunities for Tribal members.

The Blue Creek Watershed Implementation and Training Program employed four Tribal members within the Yurok Tribe's Watershed Restoration Department. First Aid and CPR training was provided by the Eureka Red Cross. Advanced training in road restoration layout, site supervision, and heavy equipment operation/coordination was also provided throughout the heavy equipment field season. The training included actual road decommissioning along prioritized roads and stream crossings within the Blue Creek watershed.

The roads decommissioned in the Blue creek watershed during the project include the B-922,B-922A,B-922C,& B-922D. In the Blue creek watershed, approximately 1.6 miles of road were decommissioned, preventing an estimated 38,699 yd^3 of road fill material from entering surrounding streams.

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INTRODUCTION

From August 2001 through October 2001, the Yurok Tribe conducted a watershed restoration program that was divided into two coordinated projects:

1. Implementation of the hydrologic decommissioning of Blue Creek roads located within the Yurok Reservation and/or ancestral Yurok territory.

2. Training of watershed restoration techniques to Tribal members (including heavy equipment operation and layout work).

This program was intended to fulfill two principal objectives:

1. To return the Klamath River fishery to its healthiest possible condition by:
    - Improving stream/riparian habitat in watersheds identified as immediate priority work areas.
    - Treating the most critical erosion and/or chronic sediment sources in each watershed in the most cost-effective way, by:
    - Hydrologic decommissioning/obliteration of road and skid trails.
    - Road upgrade/improvements for erosion control.
    - Slope stabilization.
    - Improvement of stream channel morphology.

2. Jobs training and employment opportunities.
    - Development of the technical skills and the long-term availability of watershed restoration jobs for Tribal members.

Location

The implementation and training program took place within the Blue Creek watershed, located in the lower portion of the Klamath River Basin (Figure 1). The Blue Creek mainstem lies in Humboldt/Del Norte County, California, (in Townships T12N-13N and Ranges R2E-3E on the USGS Klamath Glen & Ah Pah Ridge 7.5 Quadrangle).

Land Status

The Yurok Klamath River Reservation is approximately 56,000 acres, and was created by Federal actions between 1853 and 1891. The Reservation encompasses a strip of land one mile wide on each side of the Klamath River, from its confluence with the Trinity River at Weitchpec, California, to its mouth at the Pacific Ocean.

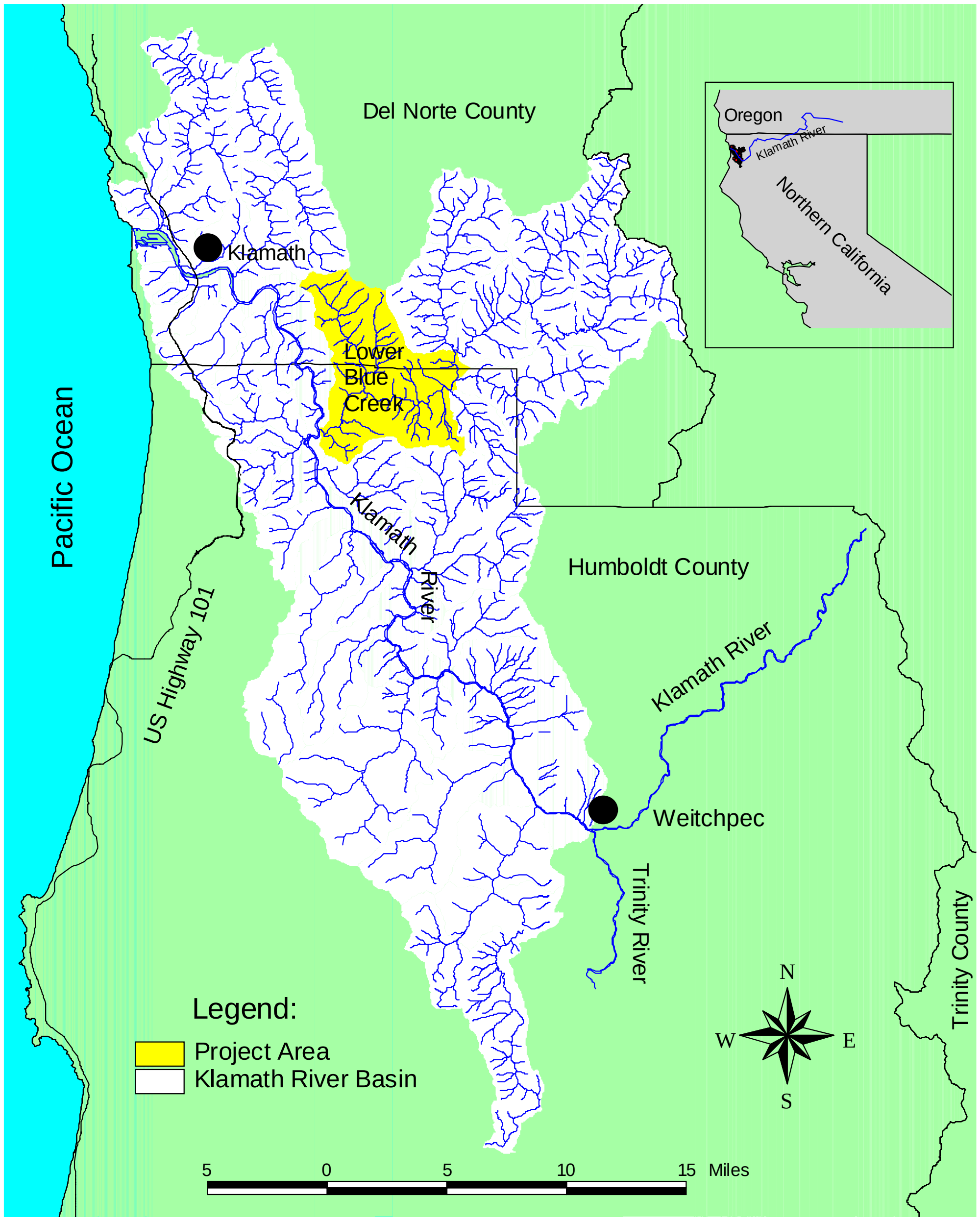


Figure 1: Location Map of Lower Blue Creek

Simpson Timber Company and a few other private landowners control more than 85% of the land within the Yurok Tribe's Lower Klamath River ancestral territory. A smaller portion of the Reservation consists of public lands managed by Redwood National/State Parks, the United States Forest Services, and the Bureau of Land Management.

Blue Creek is the most productive Lower Klamath River anadromous fish tributary. The Blue creek assessment area totals approximately 29.3 mi^2 (18,719 acres) and includes the entire hydrological watershed draining into Blue Creek. Simpson Timber Company manages 21.5 mi^2 of the Blue Creek watershed for the commercial production of timber.

Fisheries Background

Historically, Klamath River steelhead and spawning adult salmon, including spring and fall run Chinook and Coho species, once numbered more than a million each year. The total annual salmon harvest and escapement to the Klamath Basin averaged 300,000 to 400,000 fish between 1915 and 1928 (Rankel 1978). Now these fish are in serious decline, as their abundances have fallen significantly enough to warrant Federal listings of Coho salmon under the Endangered Species Act.

LAND USE HISTORY

Tribal Use

For centuries Yurok people have lived along the Pacific Coast and inland along the Klamath River. The river and the ocean were the central focus of Yurok Tribal life. In the early 1900's, anthropologist Alfred Kroeber noted that the Yurok language and oral history reflected the relationship between the people and the Klamath River. Yurok myths and legends are rich with references to the river. Indeed, nearly every aspect of Yurok life was, and continues to be, bound to the river's fisheries (Yurok Strategic Plan, 1999).

Fishing

Although the first impacts of immigrant settlers upon the valleys of the Klamath River Basin were related to gold mining and refining, those settlers quickly recognized the wealth and importance of the river's fisheries. Competition with the Yurok people over those resources soon began. By the 1930's, a booming commercial fishing industry was well established upon the river and its outlying ocean. Innumerable photographs and postcards from the '30's through the early 1960's hail Klamath, California as the "Salmon Fishing Capital of North America." Even as the commercial fishery began to decline in the 1970's and '80's, the Klamath River remained a recreational salmon fishing Mecca.

Timber Harvesting

The harvesting of timber has remained one of the main economic staples for the Lower Klamath River Basin's portion of the "Redwood Empire" for more than a century. Although logging only locally impacted the forests in the early days, the advent of powerful hydraulic technologies allowed timber cutting to quickly spread across the Klamath Basin.

By the mid-1950's, clear-cutting had begun within the Blue Creek basin, and by the mid -1970's approximately 50% of the drainage had been logged (Yurok Tribe, 1997). By 1994, essentially all old growth trees had been removed (see Harvest Unit Maps, Figures 2). Roads were constructed concurrent with harvest operations in the Blue Creek basin (see Road Construction History Maps, Figures 3). Most logging roads in the watershed were constructed with in-sloped or crowned prisms and with inboard ditches. These roads were built within steep inner gorge localities, as well as in gentler upland hill slope areas.

Tourism

With the dramatic decline in both the fishing and timber industries, tourism now remains the number one source of income for the Lower Klamath River region. Tourism is so intimately connected to the redwood forests and to recreational fishing that the protection and restoration of both is paramount to local economic well-being. Restoration of logged watersheds offers the greatest potential for restoration of the fisheries and revival of fishery related tourism.

PRIORITIZATION OF THE LOWER KLAMATH WATERSHEDS

Significant long-term improvement of the anadromous Klamath River fishery is dependent upon many factors, with two major components being:

1. In-stream water flows
2. Habitat restoration and slope stabilization

As efforts to address water flows in the mainstem Klamath River are focused on a basin-wide solution, the Yurok Tribe has worked with funding agencies and private landowners to develop a watershed restoration program in the Lower Klamath River Basin. The recommended course of action in implementing habitat restoration and slope stabilization is to assess the habitat condition, prioritize need, and then develop a restoration strategy for implementation.

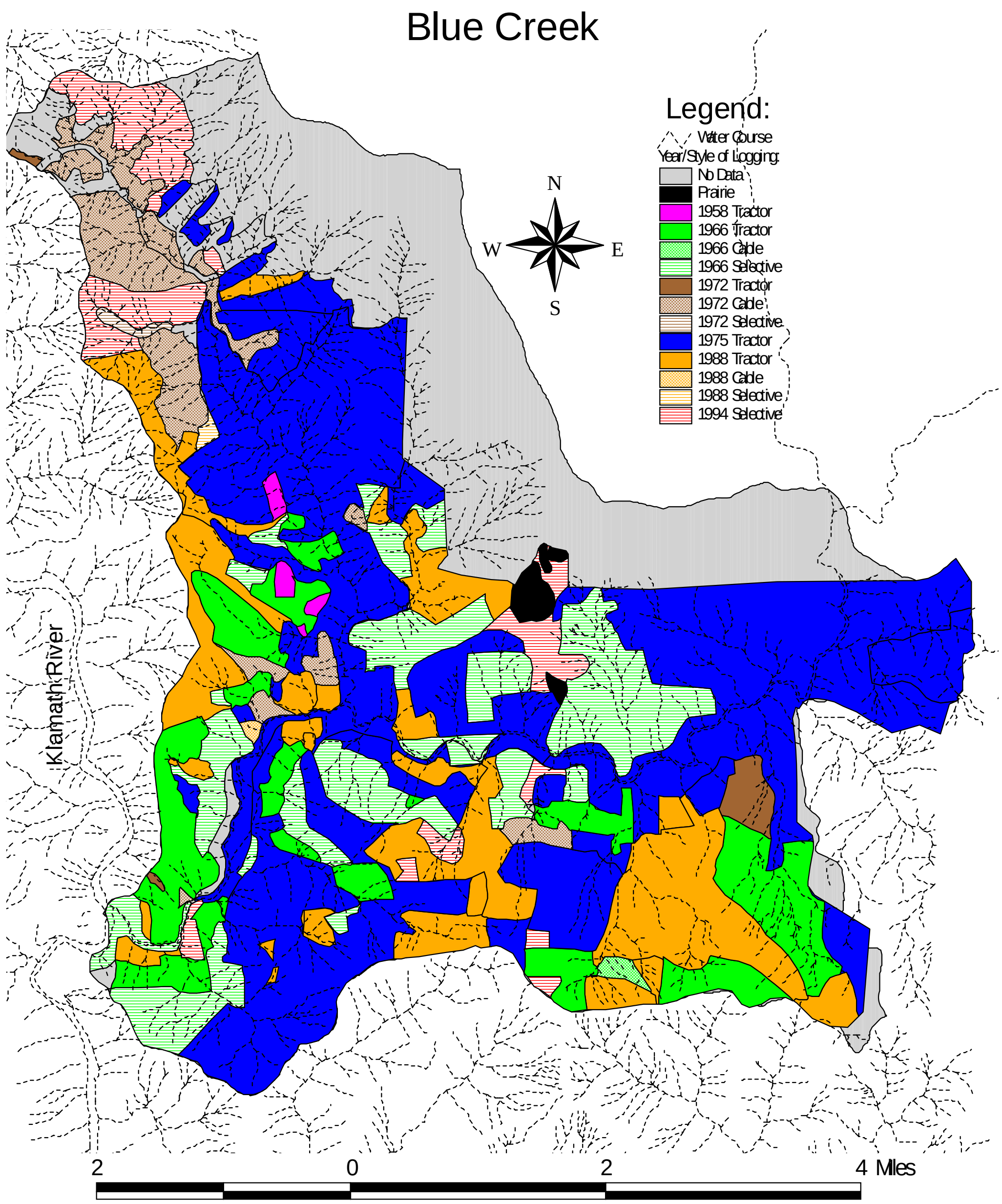


Figure 5: Land Use History Map

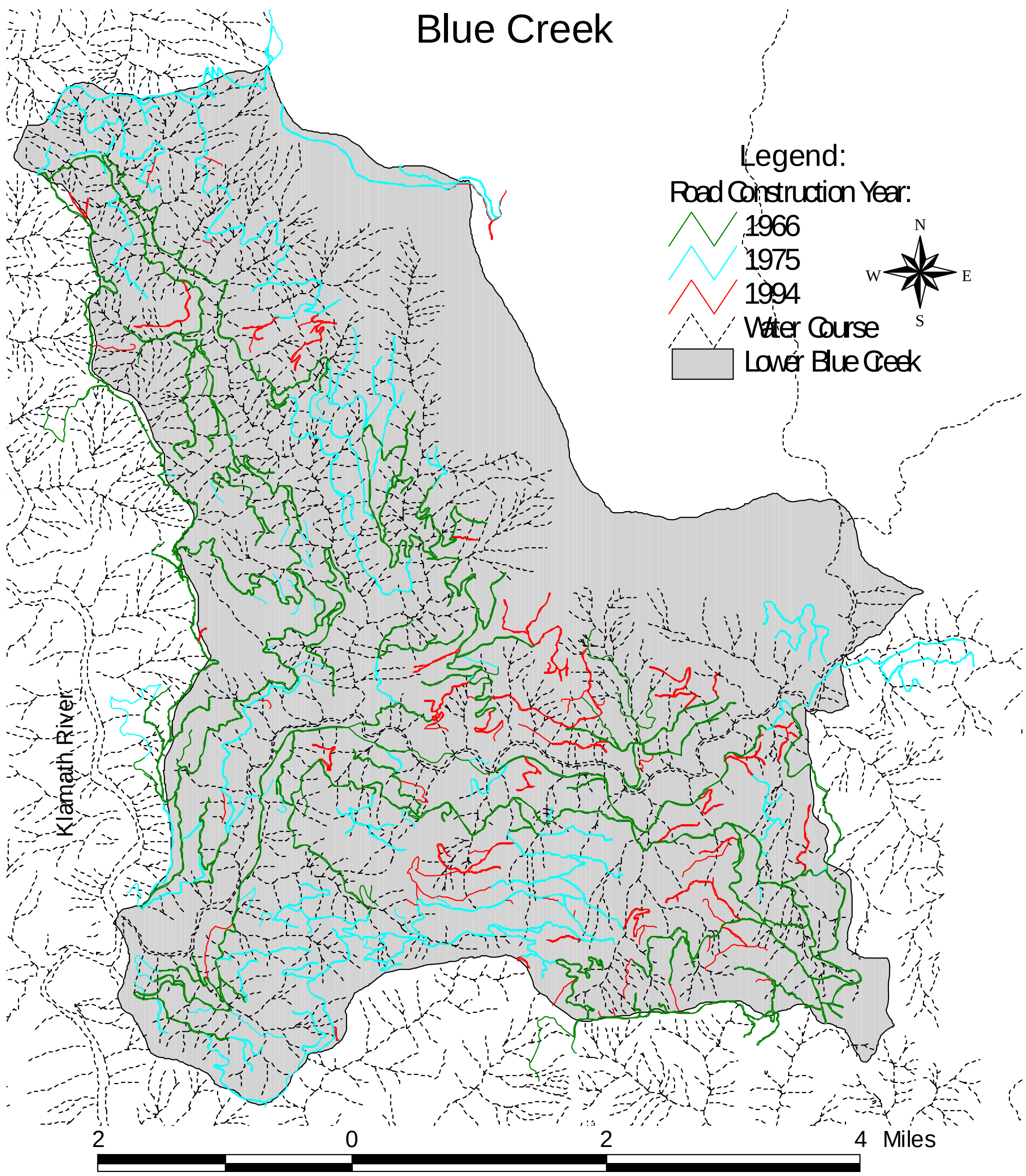


Figure 4: Road Construction History Map

Long-Range Planning

A Long-Range Plan for restoration of the Klamath River fishery was developed for the Congressionally created Klamath Restoration Program in 1991 (Public Law 99-552) that documents the need for watershed restoration. Pages 3-21 to 3-25 of the plan state that, “The low number of anadromous salmonids in the Lower Klamath tributaries is directly related to sediment problems. …Only changes in land use management and large-scale watershed stabilization efforts can effectively address these problems and begin the process of recovery of the Lower Klamath tributaries. …Only by reducing the sediment supply of the entire Klamath River Basin, and allowing time for natural recovery, can the current problems be fully resolved.”

In response to the recognized need to coordinate watershed restoration efforts in the Lower Klamath River Basin, the Lower Klamath Restoration Partnership (LKRP) was formed, composed of representatives of the Yurok Tribe, Simpson Timber Company, and the California State Coastal Conservancy. The Lower Klamath Restoration Partnership has developed a comprehensive “Lower Klamath River Sub-Basin Watershed Restoration Plan” (Yurok Tribe 2000). This plan reviews the general condition of Lower Klamath River tributaries and assigns a priority ranking to each tributary based on priority for fisheries and watershed restoration (Table 1).

Blue Creek ranks as the highest priority watershed for restoration within the Lower Klamath River Sub-basin Watershed Restoration Plan. The Blue Creek drainage basin has been prioritized for immediate restoration, having both a high restoration potential, and containing habitat that is relatively intact, with good connectivity and biologic diversity.

PHYSIOGRAPHY OF THE BLUE CREEK DRAINAGE

The lowest portion of the Lower Klamath River Basin, from the river’s mouth up to around Pecwan, is located within a belt of rocks known as the “Franciscan Formation”. Rocks of the “Franciscan (geological) Formation” underlie the Blue Creek drainage basin. This formation is a collection of rocks comprised predominantly of sandstones, shales, and minor conglomerates, which are composed of the fluvial/oceanic sediments that are commonly found along a continental shelf margin. These sediments were essentially thrust up onto the edge of North America by faulting, as part of the construction of the North Coast Ranges. This mountain building began around the end of the Jurassic Period (approximately 140 million years ago), and continues to this day.

“Splinters” of metamorphic rocks have become incorporated into the Franciscan Formation. These rocks were derived from the deep-sea volcanic and sedimentary rocks upon which the continental shelf sediments were

Table 1: Lower Klamath Watershed Restoration Plan Prioritization Table

Sub-Basin	Anadromous Salmonid Diversity (1-5)	Relative Biological Importance (1-5)	Channel & Riparian Condition (1-5)	Habitat Connectivit Y (1-5)	Road Density (1-5)	Stream Crossing Density (1-5)	Total (1-30)	Rank (1-30)
Salt Creek	2	2	2	2	2	1	11	26
High Prairie Creek	2	1	3	1	2	2	11	25
Hunter Creek	5	4	2	2	2	2	17	11
Hoppaw Creek	4	3	2	1	3	3	16	12
Waukell Creek	2	1	1	1	4	3	12	24
Saugep Creek	2	1	1	2	3	2	11	30
Terwer Creek	5	5	4	3	2	2	21	3
McGarvey Creek	4	4	3	4	3	2	20	5
Tarup Creek	4	2	2	1	3	2	14	22
Omagaar Creek	3	1	2	1	2	2	11	29
Blue Creek								
-Mainstem	5	5	5	5	2	2	24	1
-Westfork	3	3	3	4	2	3	18	8
-Slide Creek	1	3	4	4	1	1	14	20
-Nickowitz Creek	2	3	4	4	1	1	15	13
-Crescent City Fork	5	5	5	5	1	1	22	2
Ah Pah Creek								
-Mainstem	3	3	3	2	5	3	18	9
-North Fork	3	2	2	3	2	2	15	14
-South Fork	3	3	3	2	4	5	19	7
Bear Creek	3	2	2	2	3	3	15	15
Surpur Creek	3	1	1	2	4	3	14	21
Little Surpur Creek	1	1	1	2	3	3	11	28
Blue creek	4	5	3	3	2	3	20	4
Johnsons Creek	4	3	2	2	2	2	15	16
Pecwan Creek	3	2	3	2	2	2	14	18
Mettah Creek	4	4	3	4	2	2	19	6
Roaches Creek	3	3	3	3	2	3	17	10
Morek Creek	1	1	3	2	2	2	11	27
Cappel Creek	1	2	3	2	2	2	12	23
Tully Creek	1	3	3	3	2	2	14	19
Pine Creek	3	3	3	3	1	1	14	17

originally deposited. High pressures and temperatures associated with deep burial beneath the continental sediments have essentially “baked” these deep-sea rocks into denser forms. These denser metamorphic rocks are more resistant to weathering than surrounding sedimentary rocks, and are therefore being exposed (by erosion) as prominent monolithic knobs known as “knockers.” Since the rocks of the Franciscan Formation were generally uplifted along the continental rim by faults, they have been broken up and pulverized along fault zones. Shearing along these zones is typically so intense that the rocks are ground into clays, which form extremely unstable hill slopes. This, coupled with heavy seasonal precipitation, greatly increases the potential for landslides within the Blue Creek region.

PRIORITIZATION OF WORK SITES

During the winter of 2000, the Yurok Tribe conducted a watershed assessment survey of the Blue Creek watershed. Recommendations from the assessment report (Yurok Tribe, 2000) were considered in choosing the roads for decommissioning during the year 2001 Implementation/Training Program. Some of the factors that were considered were:

- Simpson Timber Company’s long-range management plans
- Erosion potential and associated volumes
- Potential delivery to a stream channel
- Location within the watershed
- Cost effectiveness of the work proposed

Based on the information assembled during the watershed assessment a proposal was written for watershed restoration and training in the Blue Creek watershed. When funding was received the training project was adapted by the recently hired program director for the year 2001 season.

TRAINING PROJECT

Introduction

On August 1, 2000, the Watershed Implementation and Training Program began. Prior to hiring heavy equipment operators, Watershed Restoration Department staff conducted a standardized skill test, to rank tribal applicants on their familiarity with the equipment and basic dozer or excavator operation. Watershed Restoration Department staff scored each applicant separately utilizing a standardized scoring system.

Based on the results of the skill test, the most qualified applicants were selected. Of the operators hired, two experienced heavy equipment operators who had performed work for the Watershed Restoration Department in Redwood National Park the previous year, were chosen to provided on site heavy equipment instruction to the remaining crew. In doing this, the Watershed Department choose not to hire a consultant to train the heavy equipment operators, but to rely on the experience of existing staff.

Advanced training in road restoration layout, site supervision, and heavy equipment operation/coordination was provided throughout the heavy equipment field season. The training included actual road decommissioning along prioritized roads and stream crossings within the Blue Creek watershed.

In preparation for program implementation, two dozers and excavators were transported into the B-922 road system in the Blue Creek Watershed. A fuel tanker and stationary refueling tank was transported to the project work area and all related equipment and supplies were purchased in preparation for project implementation. Once the applicants were hired, First Aid and CPR training was provided by the Eureka Red Cross.

Training and Evaluations

The Watershed Restoration Department felt that the experienced equipment operators who were hired, had enough experienced to train other operators in the use of heavy equipment and the removal of unstable fill. Less experienced heavy equipment operators were trained to perform restoration treatments, as prescribed by project coordinators. Thus, operators were taught how to physically effect road and skid trail decommissioning/obliteration; to excavate unstable fill in stream and/or “Humboldt” type crossings; to excavate unstable fill at potential and active slides and earth-flow locations; to scarify compacted surfaces for accelerated revegetation; and to eliminate any diversion potentials.

Operators were evaluated, utilizing a standardized performance evaluation form, by project coordinators. The performance evaluation measured the operator’s heavy equipment skill and personnel performance throughout the summer field season. Based on the performance evaluations, each participant’s original skill test score was adjusted to reflect their performance during the field season for potential rehire into the watershed restoration program. Layoff from the program occurred in the fall of 2001.

GENERAL TRAINING METHODOLOGY

The 2001 Blue Watershed Training and Implementation Program utilized the “Blue Creek Watershed Assessment” (Yurok Tribe, 2000) report to prioritize roads for hydrologic decommissioning. This report offers detailed descriptions of the assessment process that was used.

Step #1: Standard First Aid and CPR

During the summer of 2001, Standard First Aid, CPR and Safety Operations of heavy equipment were part of the hands on training. Standard First Aid and CPR training was provided by the Eureka Red Cross.

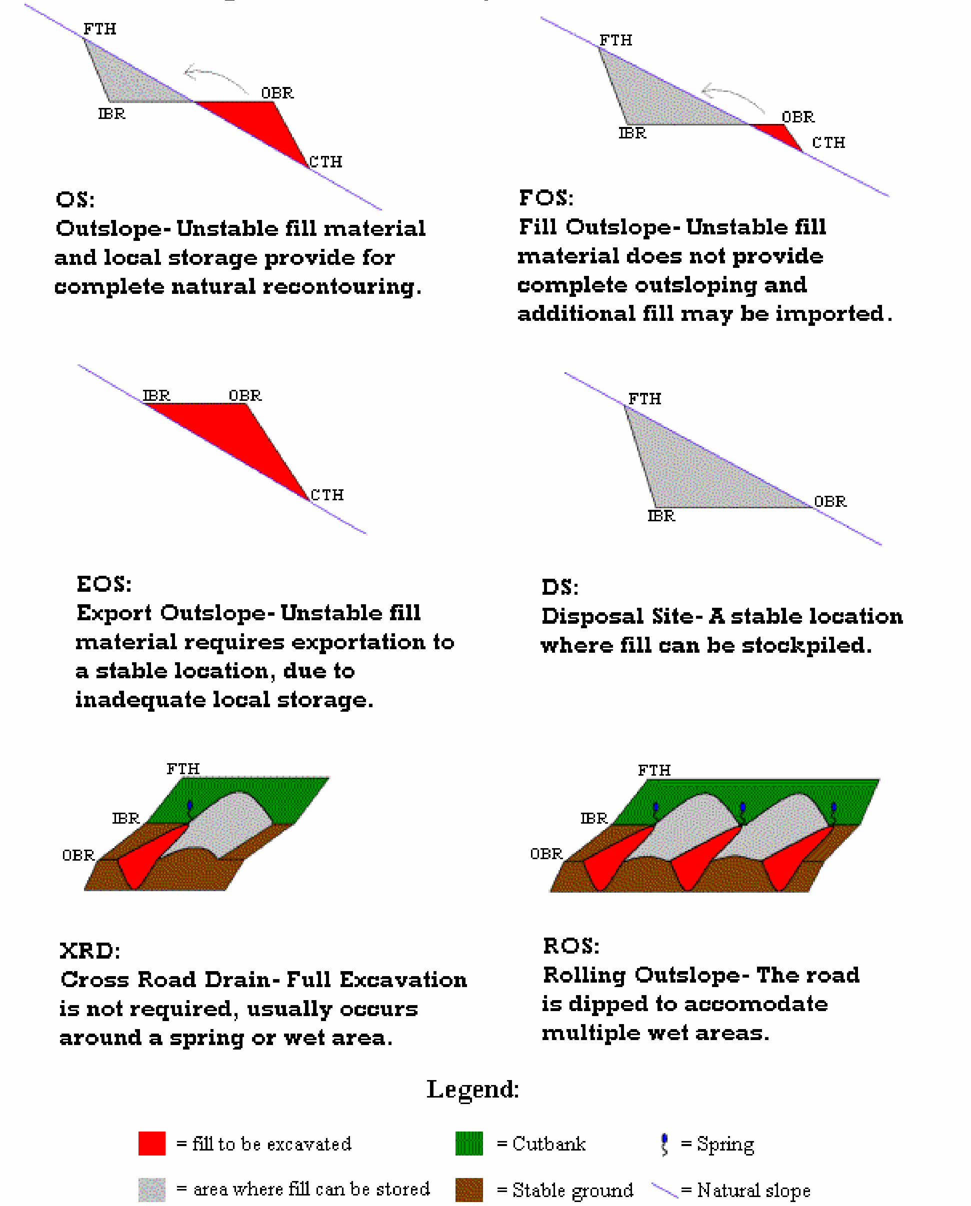
Step #2: Site Prescription and Layout

After the Standard First Aid, CPR and Safety Training was completed, the training participants were oriented to the site prescription and layout work that had been conducted by Watershed Restoration Department staff. Prior to the heavy equipment field season, Watershed Restoration Department staff went out into the field to identify corrective treatments for each problem site and then prescribed treatments in field notes (figure 4), and on survey flagging (at the site) for the heavy equipment operators to see. Rolling dip, cross road drain and outslope road treatments were some of the prescribed techniques noted for the operators. The limits of the excavation work were also flagged and given three-letter code designations to let the operator know his/her whereabouts within the site. For example, the top and bottom of an excavation were flagged as “TOP” and “BOT,” respectively. Other three-letter designations included IBR (in-board road), OBR (out-board road), OBF (out-board fill), LEC (left edge of cut), REC (right edge of cut), CTH (cut to here), and FTH (fill to here). This procedure is generally referred to as road “layout.”

The process of identifying treatment prescriptions for erosional problems begins at the end of the road where decommissioning would begin. Since heavy equipment cannot move across a road after it has been decommissioned (without damaging the work), decommissioning is essentially done while “backing out” of a road. Illustrations of the road prescriptions that were used during the training/implementation program are shown in Figure 4.

This year, during the heavy equipment field season, the Watershed Department utilized the site prescription and layout methodology of Redwood National Park. The field crew measured a profile across each excavation site, using either a survey tape/clinometer or a laser range finder, and a compass. The compass was used to determine the bearing of the designed cut area. A set of cross sections were then installed at each representative point throughout the top to bottom profile. This information was then entered into the Redwood National Park computer program specially designed to develop a pre-estimate of the amount of dirt that needed to be excavated during decommissioning.

Figure 4: Road Prescription Illustrations



Step #3: Implementation

Project coordinators are in charge of site management. This included overseeing the work done by heavy equipment operators. The project coordinators made certain that the operators excavated down to the original natural-ground surface. This surface was approximated by:

1. Locating excavated stumps and using them as indicators of original base level.
2. Identifying discolored (organic rich) soil horizons, presumably at the level of buried topsoil.
3. Imitating the contours of surrounding natural slopes.

Project coordinators were also responsible for correcting water diversions (e.g., across or along roadways) by ensuring that all diverted surface drainage was redirected into natural channels. Project coordinators monitored the work done by heavy equipment operators and their machinery. By tracking an operator's equipment work vs. downtime in their notebooks, project coordinators could perform comparative analyses of the relative efficiencies of each worker and operator team (i.e., a bulldozer and excavator working in tandem). Since heavy equipment time was the most expensive part of the project, each pair of dozer/excavator operators was taught to work as a coordinated unit, thus making them as cost-effective as possible. Both operators had to develop teamwork to ensure that they didn't move dirt more times than necessary, and to reduce the time lost waiting for each other to perform his or her respective tasks.

Initially, the bulldozers were used to brush open those roads that were chosen for hydrologic decommissioning. The dozer operators were generally sent to prepare the fluvial and mass movement work sites (by removing as much fill material as possible) ahead of the excavators. Next, each dozer/excavator team began working in tandem to remove all targeted fill from the site. The excavators would typically "switch-back" down to the bottom of the fill margin and then feed material up to the bulldozers. The dozer operators then pushed this material up a ramp-like road, to a disposal area off of the site. Disposal areas included the backsides of stable landings, proximal skid trails, through-cuts, and Full Out Slope sites (FOS).

Step #4: Post-Work Site Survey

At the end of the 2001 field season, a post-excavation volume inventory was conducted, utilizing the same Redwood National Park survey points that were installed before the heavy equipment entered the site. This "post-work site survey" was used to appraise the effectiveness and accuracy of the pre-volume estimate. The post-work survey results were entered into the Redwood National Park computer program and a final volume of actual dirt moved was calculated.

Step #5: Effectiveness Monitoring

The Blue Creek implementation project was photo-documented. Pre and post restoration photos were taken to evaluate the results of the work, and to monitor the recovery of the watershed through time.

PROJECT IMPLEMENTATION

Roads were chosen for implementation based upon:

1. The cost-effectiveness of the work required for their hydrologic decommissioning.
2. Their erosion/delivery potential.

Prior to initiating any work tribal staff and Simpson representatives determined what roads should be decommissioned based upon their location within the watershed, soil type, and future timber harvest plans (Figures 6). Roads designated for decommissioning would have their fill removed from all crossings, and from all fill failures noted to have delivery potential to a stream (Figure 7). Roads identified for retention would be maintained by Simpson Timber Company for future timber management.

Treatments

The Yurok Watershed Restoration Training Program decommissioned 1.6 miles of road in the Blue creek Watershed. The roads treated were B-922, B-922A, B-922C and B-922D road. Approximately 38,669 yd^3 of soil were removed. Roads were decommissioned using one or all of the following treatments:

- road decompaction,
- installation of cross-road drains,
- stream crossing excavation,
- outsloping.

Stream crossings were excavated to original width, depth and slope to expose natural channel morphology. Side slopes were excavated and filled to match original contours above and below the road.

When fill material was placed on road benches for permanent storage, the road bench was ripped or decompacted first. The fill was placed against the cutbank and shaped to blend with the surrounding topography that existed prior to road construction. Outsloping of the roadbed occurred as needed to

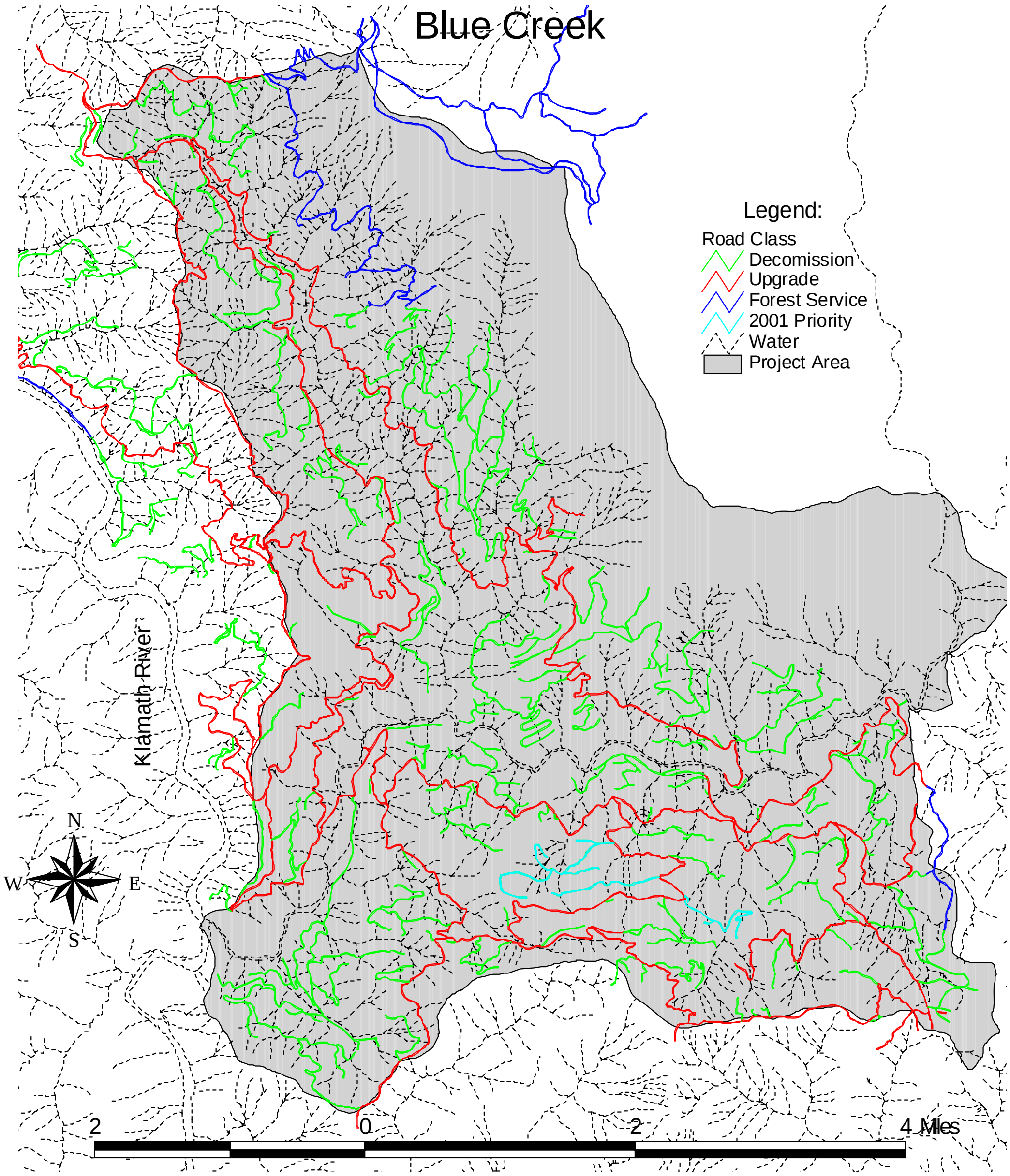


Figure 2: Road Management Plan (5 years)

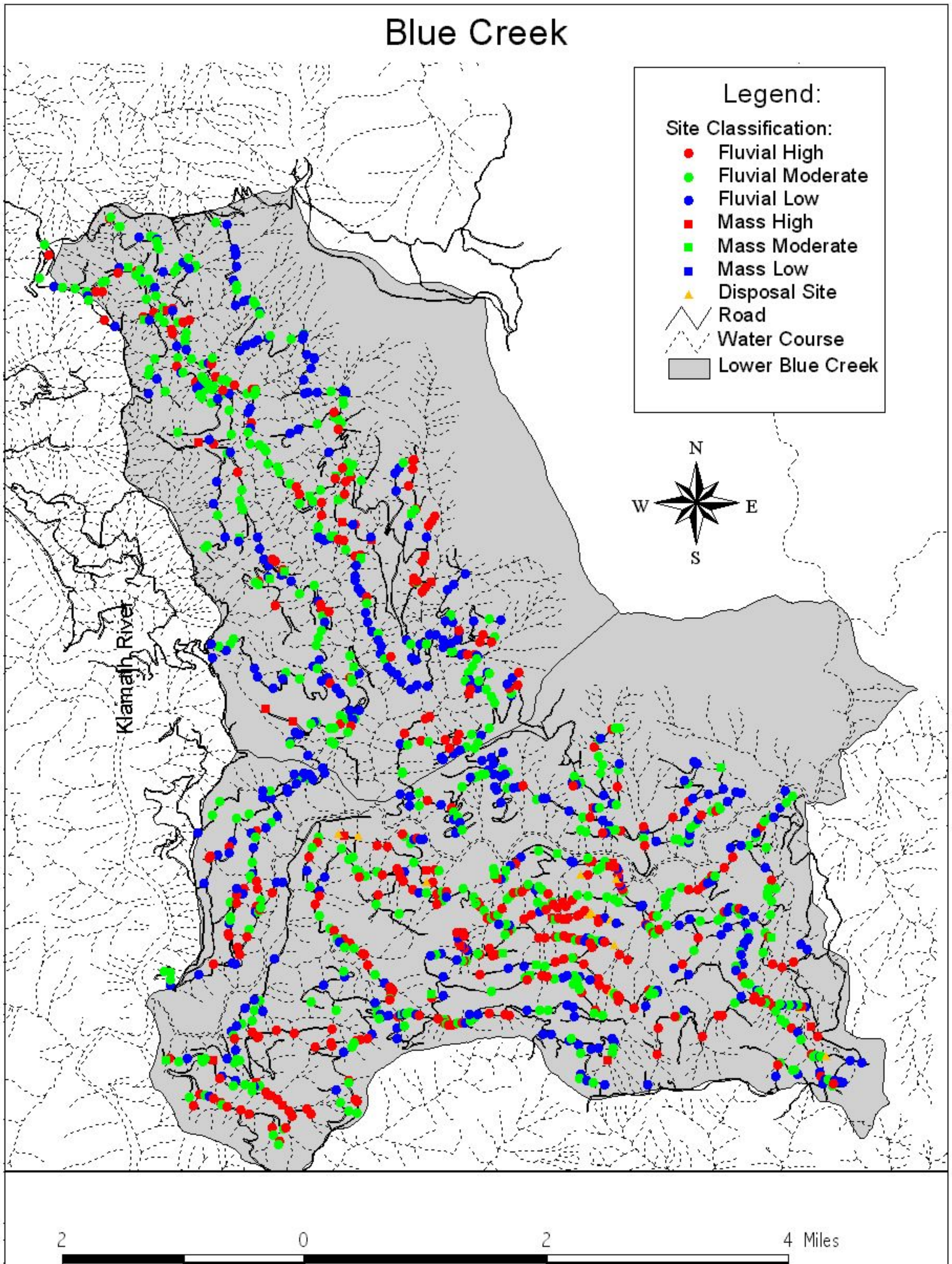


Figure 8: Site Location Map

reduce potential sediment delivery to the stream. Additional material was stored in stable locations where it would not erode. Woody debris was scattered over the surface as mulch upon completion of each site.

Blue Creek Road Priorities

The roads in the Blue creek Watershed that were designated as "high priority" for work during the watershed assessment process included the:

B-920 and spurs
B-921 and spurs
B-922 and spurs

2001 Road Work

Roads worked in the Blue creek Watershed during the 2000/2001 season are the B-922 and spurs shown in Figure 8. Fish & Wildlife funds were utilized to perform approximately 1/2 mile of the B-922 road. Additional road work was performed with Fish & Game and Simpson Timber Company contributions.

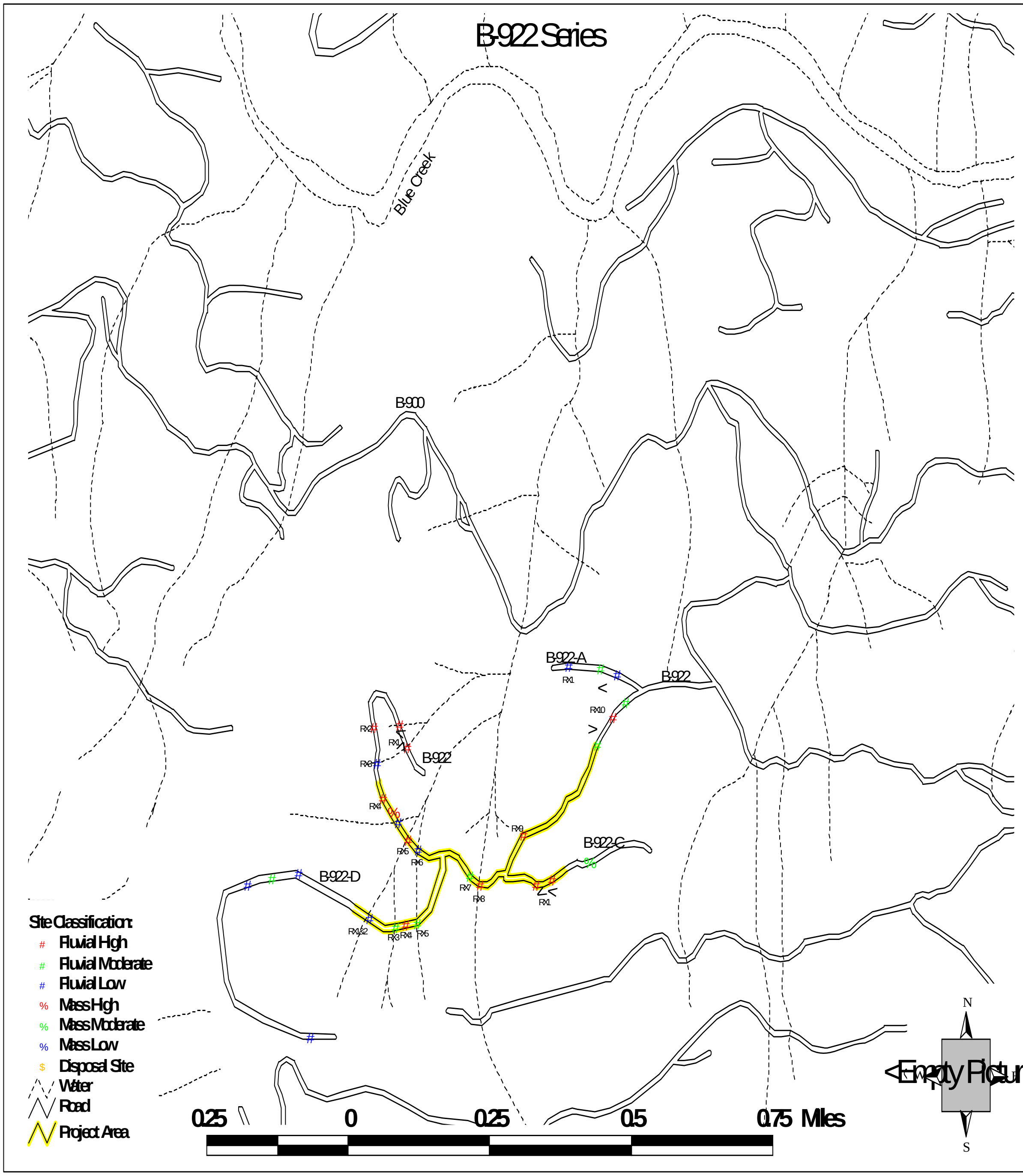
B-922

The B-922 road and spurs were constructed in 1994, constituting approximately 1 mile of road**.** The roadway is located above the Blue Creek mainstem. It was estimated there would be a total of 22,236 cubic yards of fill removed. A total of 38,669 cubic yards were actually removed during the implementation of the B-922 road decommissioning project.

The intended objective of 22,000 cubic yards was achieved by matching California Department of Fish and Game funds. With the two funding sources combined the cost per yard was reduced from $8/yard to $5.79/yard. Completion of each road segment would not have been possible without the funding assistance of the U.S. Fish and Wildlife Service, California Department of Fish and Game and Simpson Timber Company.

Future Work

Future work for the upcoming 2002/2003 field season will include projects in the Tectah and Blue Creek watersheds.



B-922 Series
Blue Creek
B-900
B-922-A
B-922
B-922-C
B-922-D
Site Classification:
Fluvial High
Fluvial Moderate
Fluvial Low
Mass High
Mass Moderate
Mass Low
Disposal Site
Water
Road
Project Area
0.25
0
0.25
0.5
0.75 Miles
N
S

BUDGET

Blue Creek Watershed Restoration Implementation and Training Project FY 2001 Budget				
Category	Requested Funds	Actual Expenses	Cal Fish & Game Match	Total Cost
a. Salaries	$ 38,704	$ 41,656	$ 91,645	$133,301
b. Expendable Materials and Supplies	$ 500	$ 417		$ 417
c. Heavy Equipment expenses			$ 34,362	$ 34,362
d. Operations and maintenance	$ 14,975	$ 12,151	$ 11,348	$ 23,499
e. General and Administrative Expenses	$ 14,143	$ 14,098	$ 12,645	$ 26,743
	$ 68,322	**$ 68,322**	**$150,000**	
				$218,322

The $68,322 provided by the U.S. Fish and Wildlife Service for this project did not include heavy equipment expenses or other related costs required to remove 22,000 cubic yards of sediment from the B-922 road system. The original proposal had identified the need for matching funds of $150,000 to complete the prescribed work. Although BIA matching funds did not become available, $150,000 of California Department of Fish and Game funds were utilized to match the U.S. Fish and Wildlife Service contributions in order to complete the project as originally planned.

Simpson Timber Company funds were utilized to begin work on the B-922 road in early August 2001 on road crossing 1, 2 and 3, but not needed as matching funds for this project. Road crossing 4, 5 and 6 on the B-922 road, along with road crossing 1, 2, 3 and 4 on the B-922-D road were decommissioned utilizing U.S. Fish and Wildlife Service funds. The remaining portions of the B-922, B-922-C and B-922-D were completed utilizing California Department of Fish and Game matching funds, resulting in moving the required 22,000 cubic yards.

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Yurok Tribe; 2000. Blue Creek Watershed Assessment.

Yurok Tribe; 2000. The Yurok Tribe Strategic Plan.

APPENDIX A: Photos
Photos of the 2001 field season

Pre-photo of Rx 4 (Stream crossing) on the B-922 road.

Post-photo of Rx4 (Stream crossing) on the B-922 road.

Pre-photo of Rx 5 (Stream crossing) on the B-922 road.

Post-photo of Rx5 (Stream crossing) on the B-922 road.

Pre-photo of Rx3 (Stream crossing) on the B-922-D road.

Post-photo of Rx3 (Stream crossing) on the B-922-D road.

Post-photo of Rx1 (Stream crossing) on the B-922-C road.

Post-photo of Rx1 (Stream crossing) on the B-922-C road.

APPENDIX B: Glossary

Abandoned Road: A road is considered “abandoned” when there is no evidence of maintenance or current use.
Anadromous: Fish that leave freshwater and migrate to the ocean to mature then return to freshwater to spawn.
Bottom Flag: A survey flag, which marks the bottom (BOT) of an excavation, at the lower extent of the fill slope at a stream crossing.
Cable Yarded: A modern type of power logging, where logs are attached to cables and dragged to a landing by means of a block-and-tackle, hung on a spar tree or steel tower or pole.
Channel Width: The estimated stream channel width during a 100-year flow event.
CLP: Refers to the “Centerline (of a) Profile”. At stream crossings, this line is concurrent with the stream profile.
Complexity: Based upon the amount of large organic material within a road fill, &/or how much vegetation surrounds a work site; this refers to the difficulty of the work needed from heavy equipment.
Conglomerate: A sedimentary rock type, which is composed predominantly of cemented gravels.
Continental Shelf: A gently sloping, shallowly submerged platform of sediments that extends from the shoreline to the edge of the continental slope.
Continental Slope: The steeply sloping continental margin, which extends from the edge of the continental shelf down into the oceanic abyss.
Cracks: A crack is a break or split, usually without a complete separation of parts. These may be continuous or discontinuous, within a road reach.
Cross-road Drain: A ditch-like channel, excavated across a road fill prism, to drain a spring or seep. The fill material is not entirely excavated for an XRD.
Culvert: A transverse drain, usually a metal pipe set beneath the road surface, which drains water from the inside of the road to the outside of the road. Culverts are used to drain ditches, springs, and streams across the road alignment.
Cutbank: A steep embankment located immediately above a road bench that was created during road construction.
CTH: Acronym for “Cut-to-Here.” This is a reference point, usually located at the bottom of the fill.
Debris Slide: A slow to rapid slide, involving down-slope translation of relatively dry and predominantly unconsolidated materials, with more than half of the particles being larger than sand size.
Debris Torrent: Rapid movement of a large quantity of materials (wood and sediment) down a stream channel during storms or floods. This generally occurs in smaller, steep stream channels and results in scouring of the streambed.

Decommissioned Road: A road along which those elements that unnaturally reroute hill slope drainage, or present slope stability hazards, have been removed.
Deep Seated: A fill failure that cuts into most of the road prism, and takes natural ground along with it.
Disposal Site: A stable location for the stockpiling of fill removed from a work site.
Ditch Relief: A drainage structure or facility that will move water from an inside road ditch to an area outside of the edge of the road fill.
Diversion Potential (DP): If a drainage structure is plugged, or could possibly become plugged, diverting water down a road and away from its natural channel, the stream is considered to have "diversion potential."
Drivable: A road that is passable to a standard four-wheel drive vehicle without having to clear any brush or make improvements.
DS: Acronym for "Disposal Site."
Earth-flow: A mass movement landform, and slow to rapid mass movement process, characterized by down-slope translation of soil and weathered rock, over a discreet shear zone at the base. Most of the included particles are actually smaller than sand.
EOS: Acronym for "Export Outslope."
Erosion Potential: This is the likelihood of a stream crossing or landslide to erode away road/slope material.
Excavation Production Rate: The rate of production at which dirt can be moved at a particular site, by a particular type of equipment.
Export Outslope: In areas where a road prism is composed entirely of unstable fill material (i.e., no dozer cut road bench) complete exportation to a stable storage location becomes necessary.
Fault: A fracture or zone of fractures within the Earth's crust, along which there has been
relative movement and resultant shearing.
Faulting the oppositional movement of 2 blocks of the Earth's crust, along a fracture.
Fill: The material that is placed in low areas, compacted, and built up to form a roadbed or landing surface.
Fill Failure: Unstable fill, along the outside edge of a road, which is considered active or waiting to move down-slope.
Fluvial: Anything pertaining to streams or rivers; also organisms that migrate between main rivers and tributaries.
Fluvial Erosion Site: Fluvial erosion sites are places where erosion by the action of water is likely, as at a stream crossing.
Future Fill Failure: The estimated volume of a mass movement along a road bench or landing, caused by gravitational erosion &/or diversion of water, and measured in cubic yards.
Future Hill Slope Failure: The estimated volume of a mass movement upon a hill slope, which is related to gravitational erosion &/or diversion of water. Generally based on observed dimensions of existing hill slope failures, in

nearby terrain, that have similar characteristics (e.g., slope position, geology, etc.).

Future Stream Erosion: The predicted volume of bank and/or bed erosion and streamside landslides, attributable to diversion at a crossing, and measured in cubic yards.

Future Percent Delivery to a Channel: The percentage of a volume of mass movement material reported in the field that will be transported to a stream channel.

Geomorphic Investigations: The overall study of a landscape and its drainage features.

Geomorphic Mapping: The mapping of drainage patterns along roads and their surrounding slopes.

Gully: An erosional channel that is formed by concentrated surface runoff, which is defined as larger than 1 $ft.^2$ in cross sectional area (i.e., 1 ft. depth by 1 ft. width). Gullies often form where road surface or ditch runoff is directed onto unprotected slopes.

Headwall Height: Headwall height is measured in inches, from the bottom of a culvert inlet, to the lowest point of the road fill at a crossing. This is the vertical distance between the point where water can enter a culvert and where water will flow over a road bench. Headwall height is used to assess the culvert capacity for each site.

Humboldt: A road-crossing drainage structure made out of logs laid in (and parallel to) streams channel and then covered over with road fill.

Hydrologic Decommissioning: The removal of those elements that unnaturally reroute hill slope drainage, or present slope stability hazards.

IBD: Acronym for “Inboard Ditch,” which generally runs along the IBR.

IBR: Acronym for “Inboard (edge of) Road” commonly located below a cutbank.

Igneous: Rocks formed by solidification of hot fluid material termed magma.

Inner Gorge: A stream reach bounded by steep valley walls that terminate up slope into a more gentle topography. Common in areas of rapid stream down cutting &/or geologic uplift.

Landing: Any place on or adjacent to a logging site (usually on a road), where logs are collected and assembled for further transport.

LEC: Acronym for “Left Edge of Cut:” refers to a field estimate (in feet) to the point at which the top of an excavation would extend to the left side of a CLP.

LES: Acronym for "Lower End Stake:” refers to the lowest ending point of a profile. This point is always shot downhill from the bottom of the fill.

Maintained: If a road shows evidence of recent maintenance, including grading, cleaning of culvert inlets, brushing, or upgrading, it is considered to be “maintained.”

Mass Movement Site: Mass movement sites are places where failure of a hillside or road prism (by land sliding) is likely.

Metamorphic: All rocks that have changed form (from their sedimentary or igneous origin) due to the effects of high pressure/temperature &/or associated changes in chemistry.

Natural Ground: Undisturbed native soil.
Photo Number: The frame number (along a flight line) of an aerial photograph.
Plug Potential: The likelihood for sediment or woody to plug a culvert inlet. Example: If a pipe is already partially filled with sediment, its gradient is substantially less than the natural channel, &/or if the upstream channel contains large amounts of organic material likely to move at high flows, a culvert is considered to have plug potential.
OBF: Acronym for "Outer Board (edge of the) Fill" slope, which extends beyond the OBR.
OBR: Acronym for "Outboard Edge (of a) Road."
Primary-Line: A surveyed line used to identify the locations/relationships of sites along a road and/or its strip map.
REC: Acronym for the "Right Edge of Cut": refers to the field estimate (in feet) to where the top of an excavation would extend to the right side of the CLP of a road.
Rill: An erosional channel, varying in size from a rivulet up to about 1 $ft.^2$ in cross section, that typically forms where rainfall and surface runoff is concentrated on fill slopes, cut-banks, and ditches. If the channel is larger than 1sq.ft. in size, this becomes a "gully."
Road Name: The name assigned to a road along which a potential erosion site is located. If no road name is available, then the field person will improvise, using conventional methods.
Road Reach: A stretch of road (excluding landings and/or stream crossings), which has been prescribed for a single treatment**.**
Rolling Dip: Rolling dips are broad, low road structures constructed to facilitate effective water drainage, while allowing passage of motor vehicles at a reduced road speed.
Rolling Outslope: An outsloped road receives a series "rolling dips" to accommodate multiple wet areas (i.e., springs/seeps)
ROS: Acronym for "Rolling Outslope."
Scarps: Cracks that show vertical displacement. These may be discontinuous and/or continuous within a road reach.
Sedimentary: Descriptive term for rock formed from sediment.
Seep: Wet areas of ground seepage; distinguishable from springs by lack of visible flow.
Shale: A sedimentary rock type that is composed predominantly of mud (a mixture of clay and silt), and which characteristically breaks into plates.
Shotgun: A pipe outlet that is elevated above the natural channel, and with no form of down spout. This time of outlet creates an erosional plunge basin.
Site: A numbered road locality that is considered to host erosional problems. Sites are numbered sequentially from one end of a road to the other.
Skid Trail: Generally a short, wide road-like trail over which tractors have dragged logs that were attached to cables.
Slope Stabilization: The removal of any and all features that may lead to slope instability and mass wasting.

Spring: A flow of water from the ground; often the source of a stream or pond.
Stream Channel Morphology: The various forms and shapes of a stream channel.
Stream Crossing: The location where a road crosses a stream channel, whether water is flowing or not. Drainage structures used in stream crossings include bridges, Humboldts, fords, culverts, and a variety of temporary crossings.
Swale: A channel-like linear depression, or small valley-like feature, that may, or may not contain any well-developed stream flow.
Top Flag: A survey flag hung at the top of an excavation site. This marks the upper limit that the excavation will extend to, and usually coincides with the upper extent of a stream crossing (including any stored sediment above a culvert inlet).
Total Fill Volume: The total volume of road fill at a potential erosion site, measured in cubic yards. At a stream crossing, this volume includes all road fill placed within the natural channel. Total fill volume is computed from field measurements made with a tape and clinometer (or Abney level). The computation requires measurements of slope angles and distance on upstream and downstream fill slopes, the width of the road surface, and the valley width at the upstream and downstream edges of the road surface. Volumes are generally computed from field measurements using scale drawings prepared in the office.
Total Volume Excavated: The amount, in cubic yards, to be excavated at a site.
Tractor Logged: A logging operation where cable-attached skidding is done with crawler tractor power.
Treatment Immediacy: The urgency of implementation of hydrologic decommissioning at a site.
Tribal Allotment: Trust lands granted by the Federal Government to individuals/families with a long-established history of occupation/ownership.
UES: Acronym for “Upper End Stake:” refers to the upper starting point of a profile line.
Underfit: Any drainage structure (e.g. a culvert, swale, floodplain, etc.) that is too small to accommodate runoff during a flood..
USGS: Abbreviation for the United States Geological Survey.
Watershed: The entire area that contributes both surface and underground water to a particular lake, river, or stream system.
XRD: Abbreviation for “Cross-Road Drain;” a ditch-like channel excavated across road fill to drain a spring or seep. The road fill prism is not entirely excavated for an XRD, as at a stream crossing.
Year of Construction: The year that a road was built. This information is usually extrapolated from historical air photo analysis.