Lower Klamath Sub-Basin Restoration Plan
GIS Support – FY 2001

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Abstract

The Lower Klamath tributaries have been subjected to substantial timber harvest and related road construction over the last 60 years. These activities, occurring in a region with steep, naturally erodible terrain and high annual rainfall, have contributed to widespread streambed sedimentation and associated habitat degradation and native fish run declines throughout the Sub-basin (Gale and Randolph 2000). The Yurok Tribal Fisheries Program (YTFP) has undertaken extensive watershed assessment efforts throughout all Lower Klamath tributaries to provide necessary physical and biological baseline data for restoration prioritization and planning, as well as preparing a long-term Watershed Restoration Plan for the Lower Klamath sub-basin. (Gale and Randolph 2000). In order to adequately present the data gathered through this multi-year effort, as well as provide the ability to analyze this data spatially, it was necessary to digitize all gathered information into GIS map layers.

All GIS base maps containing hand-drawn data from air photo analysis were scanned and overlayed in ArcView onto the original GIS base maps. Once the scanned image and the base map were properly aligned, all collected data on the scanned image was digitized to create three separate map layers: timber harvest history, road construction history, and landslide formation history. Base maps containing hand-drawn summaries of fish species presence and distribution, and dominant habitat and stream channel features were also digitized. The generated map layers were then queried and the resultant data used to create summary tables for inclusion into the Lower Klamath Sub-Basin Watershed Restoration Plan.

The results of this project are an invaluable addition to the Lower Klamath Watershed Restoration Plan and our watershed restoration planning and implementation efforts throughout the sub-basin. It is recommended that this effort be continued as future air photo flights are taken throughout the sub-basin. This will allow YTFP to maintain this land use database with the most current information available and further refine the data from which our watershed restoration efforts are based.

Acknowledgments

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Introduction

Historically the Klamath River Basin contained bountiful anadromous fish runs, supporting indigenous peoples throughout the region. Anthropogenic activities over the last 150 years, coupled with natural events, have resulted in substantial declines in these fish populations and widespread reduction and degradation of associated habitat. Concern over diminishing runs resulted in the 1997 listing of Klamath Basin coho salmon (*Oncorhynchus kisutch*) as threatened under the Endangered Species Act (ESA), Klamath River chinook salmon (*O. tshawytscha*), steelhead (*O. mykiss*) and coastal cutthroat trout (*O. clarki clarki*) populations were also petitioned for ESA listing, and despite the listings being determined "Not Warranted", concern continues to exist over their status and long-term trends.

The declining health and productivity of the Klamath River's anadromous fisheries is of great economic and cultural concern to the Yurok Tribe. To proactively address this decline, the Tribe has initiated a large-scale, coordinated watershed restoration effort in the Lower Klamath sub-basin. This sub-basin, as defined in the Klamath Restoration Program's Long Range Plan (Kier and Associates 1991), includes all Klamath tributaries downstream of the confluence of the Trinity River, encompassing a drainage area of approximately 450 square miles. These tributaries have been subjected to substantial timber harvest and related road construction over the last 60 years. These activities, occurring in a region with steep, naturally erodible terrain and high annual rainfall, have contributed to widespread streambed sedimentation and associated habitat degradation and native fish run declines throughout the Sub-basin (Gale and Randolph 2000). The Long Range Plan states 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" (Kier and Associates 1991).

The Lower Klamath Restoration Partnership (LKRP), composed of representatives of the Yurok Tribe Natural Resources Department, Green Diamond Resource Company (GDRC) (formerly Simpson Resource Company), and the California State Coastal Conservancy was formed in 1995. This Project Advisory Committee was formed in order to facilitate a coordinated approach to watershed restoration planning and to find innovative solutions to resource management issues between private landowners, Tribal interests, and public agencies. The Yurok Tribal Fisheries Program (YTFP) has undertaken extensive watershed assessment efforts throughout all Lower Klamath tributaries to provide necessary physical and biological baseline data for restoration prioritization and planning, as well as preparing a long-term Watershed Restoration Plan for the Lower Klamath sub-basin. (Gale and Randolph 2000). In order to adequately present the data gathered through this multi-year effort, as well as provide the ability to analyze this data spatially, it was necessary to digitize all gathered information into GIS map layers.

Timber harvest activities currently account for the greatest percentage of erosion-related problems within the Lower Klamath sub-basin. According to Balance Hydrologics, Inc.

(1995), "erosion related to poorly designed, abandoned or poorly maintained logging roads may be equal to or greater than the all sum of natural erosion processes occurring elsewhere in the basin." The most logical way to begin remediation of these problems was to study the scope and history of previous damage. Information about the problems and failures of the past aided our ability to understand, forecast, plan for, and prevent potential failures and problems in the future. A comparison of these details, over differing years of aerial photography, allowed YTFP to recreate the land management history of an evolving landscape.

This study satisfied ten informational objectives that were targeted for inclusion in the Lower Klamath Sub-basin Watershed Restoration Plan:

1. To identify all areas of timber harvest within each watershed.
2. To differentiate the method(s) of timber harvest used for each cut unit (e.g., clear-cutting vs. selective harvest; tractor skidding vs. cable yarding).
3. To differentiate each cut unit by its approximate year of harvest.
4. To identify the core road network for each watershed.
5. To differentiate roads and road-reaches by their approximate year(s) of construction.
6. To identify all landslides within each watershed.
7. To differentiate landslides by their approximate years of development.
8. To compile all of this information onto maps, at a scale of 1:24,000, for practical review.
9. To compare/contrast the histories of timber cutting, road development, and landslide development, in an attempt to identify cause-and-effect relationships.
10. To analyze road densities and associated stream-crossing densities for input into the Restoration Potential Prioritization Matrix.

In order to adequately present the extensive amount of data gathered through this mapping effort, it was necessary that YTFP digitize onto GIS map layers all of the manually drawn information interpreted from the air photos. This not only provided a means to graphically display the results of this air photo interpretation effort but also allowed YTFP to conduct GIS-based data analysis for each map layer created. Once this information was digitized into GIS, quantitative calculations became possible and interpretability was greatly enhanced. This included quantitative assessments of timber harvest, road construction, and landslide formation by year and tributary, providing the ability to quantitatively compare conditions throughout each of the 24 Lower Klamath tributaries.

Methods & Materials

This study was based on interpretation and mapping of GDRC's extensive archive of Lower Klamath aerial photographs, dating back to the 1930's. This mapping effort detailed evidence of timber cutting, road building, and landslides exactly as they appeared when the photos were originally taken. The interpreted data from this study was manually transferred onto paper GIS base maps as each set of air photos was reviewed via stereoscope.

All GIS base maps containing hand-drawn data from air photo analysis were provided to the Yurok Tribe's GIS specialist. These maps were scanned into the computer and overlayed in ArcView onto the original GIS base maps. Once the scanned image and the base map were properly aligned, all collected data on the scanned image was digitized to create three separate map layers: timber harvest history, road construction history, and landslide formation history.

All timber harvest units were digitized as polygons, with consistent color and texture formatting to identify the year, harvest type (i.e. clear-cut, selective cut etc.), and harvest prescription (i.e. tractor skidding, cable yarding etc.). All constructed roads were digitized as lines, with consistent color formatting to identify year of construction. All observed landslides were digitized as polygons, with consistent color formatting to identify year of occurrence.

Base maps containing hand-drawn summaries of fish species presence and distribution, and dominant habitat and stream channel features were provided to the Yurok Tribe's GIS specialist. The information on these maps was then digitized in ArcView to create GIS map layers.

Results & Discussion

The Tribal GIS Specialist digitized all hand-drawn maps as detailed above and the corresponding ArcView GIS layers were created. The generated map layers were analyzed in ArcView using this software's data querying features. Analyses included:

- Total timber harvest area within each tributary by year, harvest type and harvest prescription (Table 1).
- Total miles of road constructed and number of stream crossings created within each tributary by year (Table 2).
- Total number of landslides originating by year within each tributary (Table 3).
- Percentage of landslides originating from the road prism by tributary and year (Table 3).
- Total miles occupied by fish species within each tributary and throughout the sub-basin (Table 4).
- Total miles of available fish habitat by channel type within each tributary (Table 5).

This project has allowed YTFP to digitize the results of the extensive air photo analysis effort undertaken during 1999, as well as digitize and summarize data on fish presence and stream channel typing from throughout the sub-basin. The results of this project are an invaluable addition to the Lower Klamath Watershed Restoration Plan and our watershed restoration planning and implementation efforts throughout the sub-basin. It is recommended that this effort be continued as future air photo flights are taken throughout the sub-basin. This will allow YTFP to maintain this land use database with the most current information available and further refine the data from which our watershed restoration efforts are based.

Literature Cited

Gale, D.B., and D.B. Randolph. 2000. Lower Klamath River sub-basin watershed restoration plan. Yurok Tribal Fisheries Program, Klamath California.

Table 1. Timber harvest history by air photo year and tributary, Lower Klamath River Tributaries, California.

Tributary	Drainage Area (mi^2)	% Total Sub-basin Area	% Watershed Logged Per Year — Years of Available Air Photos																			% Total Sub-basin Logged	%Cable Yarded	Tributary
			1948	1954	1955	1956	1958	1960	1962	1966	1968	1969	1972	1975	1978	1981	1984	1988	1991	1994	1997			
Mainstem Ah Pah	6.7	2.2%	0%	66%	0%	3%	12%			0%		12%	1%	0%	0%	5%		0%		0%		99%	3%	**Mainstem Ah Pah**
North Fork Ah Pah	6.7	2.2%	0%	13%	0%	28%	3%			0%		14%	1%	13%	0%	14%	1%	0%		0%		87%	68%	**North Fork Ah Pah**
South Fork Ah Pah	2.5	0.8%	0%	35%	0%	12%	65%			0%		71%	0%	17%	1%	3%		0%		0%		204%	1%	**South Fork Ah Pah**
Bear	9.2	3.0%	0%	0%	0%	15%	0%			0%		22%	0%	22%	13%	0%		21%		6%		99%	2%	**Bear**
Blue (Lower)	39.6	12.9%	0%	0%	0%	0%	0%			14%		0%	0%	29%	0%	0%		19%		1%		63%	1%	**Blue (Lower)**
Blue (West Fork)	13.6	4.4%	0%	0%	0%	0%	1%			8%		0%	0%	36%	0%	0%		10%		7%		62%	12%	**Blue (West Fork)**
Cappell	8.5	2.8%	0%	0%	0%	0%	10%			0%		0%	8%	59%	1%	0%		21%		12%		111%	0%	**Cappell**
High Prairie	3.5	1.1%	0%	0%	0%	0%	0%			0%		11%	0%	25%	0%	0%		0%		16%		52%	63%	**High Prairie**
Salt	2.3	0.8%	0%	0%	0%	0%	0%			0%		23%	0%	36%	0%	0%		0%		0%		59%	0%	**Salt**
Hoppaw	4.3	1.4%	10%	0%	0%	0%	0%			0%		12%	0%	32%	0%	0%		0%		16%		70%	38%	**Hoppaw**
Hunter/Mynot	23.4	7.6%	0%	0%	0%	0%	0%			0%		33%	0%	44%	0%	0%		0%		14%		91%	50%	**Hunter/Mynot**
Johnsons	2.8	0.9%	0%	0%	0%	52%	0%			19%		0%	0%	0%	0%	0%		58%		0%		129%	2%	**Johnsons**
McGarvey (incl. W. Fk.)	8.9	2.9%	11%	1%	0%	0%	5%		10%	5%		32%	20%	0%	0%	2%	10%	3%	2%	2%		103%	1%	**McGarvey (incl. W. Fk.)**
Mettah	10.4	3.4%	0%	0%	0%	34%	0%	40%		0%		0%	23%	0%	0%	0%		8%		4%		109%	1%	**Mettah**
Morek	4.0	1.3%	0%	0%	0%	0%	80%			0%		0%	0%	0%	84%	0%		0%		4%		168%	5%	**Morek**
Omagaar	2.3	0.8%	0%	0%	0%	0%	14%			0%		54%	0%	12%	0%	0%		14%		5%		99%	8%	**Omagaar**
Pecwan	27.5	9.0%	0%	0%	0%	0%	22%			0%		42%	0%	8%	0%	13%		0%		5%		90%	2%	**Pecwan**
Pine (Non-Hoopa Portion)	13.3	4.3%	0%	11%	0%	0%	18%			8%		0%	3%	0%	0%	3%		0%		1%	1%	45%	2%	**Pine (Non-Hoopa Portion)**
Roaches	29.3	9.6%	3%	19%	0%	0%	0%			10%		45%	0%	0%	0%	2%		2%		4%		85%	10%	**Roaches**
Saugep	1.1	0.4%	0%	0%	0%	0%	0%			0%		0%	39%	0%	61%	0%		0%		0%		100%	0%	**Saugep**
Surpur	5.8	1.9%	0%	0%	0%	0%	41%			63%		0%	31%	0%	0%	0%		19%		0%		154%	0%	**Surpur**
Little Surpur	2.6	0.8%	0%	0%	0%	0%	37%			55%		0%	0%	0%	0%	0%		12%		14%		118%	0%	**Little Surpur**
Tarup	5.1	1.7%	0%	0%	0%	0%	12%			0%		66%	0%	26%	0%	0%		0%		1%		105%	0%	**Tarup**
Tectah	20.1	6.6%	0%	4%	0%	0%	11%			77%		0%	0%	0%	0%	0%		0%		0%		92%	12%	**Tectah**
Terwer	31.9	10.4%	1%	0%	0%	0%	0%			0%		21%	0%	23%	0%	0%		0%		27%		72%	51%	**Terwer**
Tully	17.6	5.7%	5%	0%	0%	0%	82%			1%		0%	0%	0%	0%	52%		0%		5%		145%	0%	**Tully**
Waukell	3.2	1.0%	6%	0%	30%	0%	0%			0%	44%	0%	4%	0%	20%	0%		0%		0%		104%	0%	**Waukell**
Sub-Basin Totals[1]:	**306.2**		**1%**	**5%**	**0%**	**3%**	**12%**	**1%**	**0%**	**11%**	**0%**	**17%**	**3%**	**16%**	**2%**	**5%**	**0%**	**6%**	**0%**	**7%**	**0%**	**90%**	**15%**	

[1]Lower Klamath Sub-Basin Weighted Averages

Table 2. Road construction history by air photo year and tributary, Lower Klamath River Tributaries, California.

Tributary	Drainage Area (mi^2)	% Total Sub-basin	Miles of Roads	Road Density (mi/mi^2)	# Stream Crossings	Stream Xing Density ($\#/mi^2$)	% Road Construction by Air Photo Year																Total %
							1948	1951	1954	1955	1956	1958	1960	1966	1968	1969	1972	1975	1978	1981	1984	1988	1994	
Mainstem Ah Pah	6.7	2.2%	77.6	11.6	201	30			64%		18%					13%	5%						100%
North Fork Ah Pah	6.7	2.2%	43.2	6.4	216	32			45%		15%					32%	8%						100%
South Fork Ah Pah	2.5	0.8%	19.8	7.9	109	44			36%		33%					12%	17%			1%			99%
Bear	9.2	3.0%	61.5	6.7	337	37					16%					44%		19%				20%	99%
Blue (Lower)	39.6	12.9%	143.1	3.6	439	11								54%				31%				15%	100%
Blue (West Fork)	13.6	4.4%	36.7	2.7	456	34								61%				32%				7%	100%
Cappell	8.5	2.8%	41.7	4.9	156	18										70%		23%		7%			100%
High Prairie	3.5	1.1%	19.7	5.6	67	19	9%									31%			31%			29%	100%
Salt	2.3	0.8%	11.4	5.0	46	20	31%									50%			14%			5%	100%
Hoppaw	4.3	1.4%	29.4	6.8	153	36	5%									59%		12%	5%			19%	100%
Hunter/Mynot	23.4	7.6%	134.3	5.7	585	25	2%									49%		4%	28%			18%	101%
Johnsons	2.8	0.9%	12.1	4.3	81	29					60%			37%							3%		100%
McGarvey (incl. W. Fk.)	8.9	2.9%	65	7.3	308	35	10%		20%			20%		30%		1%	15%		3%		1%		100%
Mettah	10.4	3.4%	62.8	6.0	353	34					28%		70%								2%		100%
Morek	4.0	1.3%	22.6	5.7	74	19						24%							60%	17%			101%
Omagaar	2.3	0.8%	12.7	5.5	61	27						20%				30%		39%				11%	100%
Pecwan	27.5	9.0%	124.6	4.5	590	21	15%									45%		10%				30%	100%
Pine (Non-Hoopa portion)	13.3	4.3%			241	18						24%				34%				33%		10%	101%
Roaches	29.3	9.6%	150.9	5.2	671	23			29%					56%						7%		5%	3%	100%
Saugep	1.1	0.4%	8.8	8.0	27	25				3%									97%				100%
Surpur	5.8	1.9%	68.2	11.8	146	25						41%		59%									100%
Little Surpur	2.6	0.8%	20	7.7	86	33						67%		31%								2%	100%
Tarup	5.1	1.7%	37.7	7.4	161	32										51%		33%				16%	100%
Tectah	20.1	6.6%	112.5	5.6	566	28			21%			12%		49%				11%	4%	1%		2%	100%
Terwer	31.9	10.4%	174.4	5.5	737	23	4%									37%			25%				34%	100%
Tully	17.6	5.7%	98.9	5.6	273	16			32%			42%		7%						18%			1%	100%
Waukell	3.2	1.0%	33.7	10.5	109	34	2%			1%					15%		30%		51%					99%
Sub-Basin Totals[1]:	**306.2**		**1,623.3**	**5.3**	**7,249**	**24**	**3%**	**0%**	**9%**	**0%**	**3%**	**7%**	**2%**	**21%**	**0%**	**20%**	**1%**	**10%**	**7%**	**4%**	**0%**	**1%**	**12%**	100%

[1]Lower Klamath Sub-Basin Weighted Averages

Table 3. Landslide history by air photo year and tributary, Lower Klamath River Tributaries, California.

Tributary	Drainage Area (mi ^{2})	Erosion Hazard Rating	Number of interpreted Slides (* = Number of interpreted anthropogenic slides) Years of Available Air Photos																		Totals/Watershed	% Road Related
			1948	1951	1954	1955	1956	1958	1960	1966	1968	1969	1972	1975	1978	1981	1984	1988	1994	1997		
Mainstem Ah Pah	4.9	H			7 (6*)			2 (1*)		15 (14*)		1*	0	5*	1*	0	0				31 (28*)	90%
North Fork Ah Pah	9.4	H			0			1*		2*		6 (2*)	0	4*	0	0	0				13 (9*)	69%
South Fork Ah Pah	1.6	H																				
Bear	9.2	H	0									14 (6*)		37 (21*)					0		51 (27*)	53%
Blue (Lower)	31.8	M-H	14 (4*)							34 (15*)				63 (37*)					4 (3*)		115 (59*)	51%
Blue (West Fork)	11.1	H	5 (3*)							38 (18*)				87 (50*)					6 (4*)		136 (75*)	54%
Cappell	8.5	M-H		1								7 (5*)		13 (6*)		3			0		24 (11*)	46%
High Prairie/Salt	5.6	H	0									4 (2*)		17 (9*)	0				17 (6*)		38 (17*)	45%
Hoppaw	4.33	H	1									4*		24 (10*)	7 (5*)				19 (12*)		55 (31*)	56%
Hunter/Mynot	23.75	H	7 (1*)									4*		59 (34*)	5*				96 (30*)		171 (74*)	44%
Johnsons	2.9	H					1			3 (1*)			1*					1*			6 (3*)	50%
McGarvey (incl. W. Fk.)	8.9	H																				
Mettah	10.1	H					0		13 (5*)									13	7 (1*)		33 (6*)	18%
Morek	4	M-H						0							4	3 (2*)			0		7 (2*)	29%
Omagaar	2.25	H	1									3*		1*				3 (1*)	2		10 (5*)	50%
Pecwan	27.6	M-H	0									19 (6*)		28 (6*)					3 (2*)		50 (14*)	28%
Pine (Non-Hoopa portion)	~11	H						4 (3*)		0	0					29 (5*)			0	0	33 (8*)	24%
Roaches	29.4	H	7 (2*)		83 (55*)					Incl. in '69		131 (78*)		42 (17*)					8 (4*)		271 (156*)	58%
Saugep	1.1	H	0			0					0		0		0				3		3	0%
Surpur	5.8	H						2*		5 (3*)			9 (3*)			1					17 (8*)	41%
Little Surpur	~2.6	H						0		1			0			0					1	0%
Tarup	5.1	H	0									22 (9*)		10 (5*)				1	6 (4*)		39 (18*)	46%
Tectah	20.1	H	13		17 (7*)			24 (7*)		27 (14*)				34 (20*)	16 (5*)			24 (9*)			155 (62*)	40%
Terwer	31.9	H	18 (3*)									93 (42*)		135 (52*)	0				105 (46*)		351 (143*)	41%
Tully	17.6	H			11			117 (4*)		0						0			0		128 (4*)	3%
Waukell	3.2	H	0		1						0		0		0				1		2	0%
Sub-Basin Totals[1]:	~293.73		66 (13*)	1	119 (68*)	0	1	150 (18*)	13 (5*)	125 (67*)	0	308 (162*)	10 (4*)	559 (277*)	33 (16*)	36 (7*)	0	42 (11*)	277 (112*)	0	1,729(760*)	T=44%/A=39%

[1]Lower Klamath Sub-Basin Weighted Averages

Table 4. Total stream length utilized by salmonid species, Lower Klamath River Tributaries, California.

Tributary	Drainage Area (mi^2)	% Total Sub-basin	Stream Length Utilized by Salmonid Species (miles)				
			Chinook Salmon	Coho Salmon	Steelhead Trout	Coastal Cutthroat Trout	Resident Rainbow Trout
Salt Creek	**2.3**	**0.5%**	0.00	1.80	1.80	2.55	0.00
High Prairie Creek	**3.5**	**0.7%**	0.00	1.76	1.76	4.02	0.00
Hunter Creek	**23.8**	**4.8%**					
- Mainstem	16.1	3.2%	9.64	9.64	9.82	11.28	0.00
- East Fork	4.1	0.8%	1.34	1.78	2.53	3.02	0.00
- Mynot	3.6	0.7%	0.23	0.23	0.23	2.22	0.00
Richardson Creek	**1.6**	**0.3%**	0.00	0.00	0.00	1.19	0.00
Hoppaw Creek	**4.3**	**0.9%**					
- Mainstem	3.1	0.6%	1.17	2.60	2.60	4.40	0.00
- North Fork	1.2	0.2%	0.00	0.62	0.62	0.62	0.00
Saugep Creek	**1.1**	**0.2%**	0.00	0.30	0.58	0.78	0.00
Waukell Creek	**3.8**	**0.8%**	1.16	1.16	1.16	3.74	0.00
Terwer Creek	**31.8**	**6.4%**					
- Mainstem	23.8	4.8%	8.44	11.12	13.10	14.71	0.00
- East Fork	8.0	1.6%	0.00	1.32	2.94	0.00	0.00
McGarvey Creek	**8.9**	**1.8%**					
- Mainstem	6.0	1.2%	3.28	3.28	3.28	5.57	0.00
- West Fork	2.9	0.6%	1.25	1.25	1.25	2.95	0.00
Tarup Creek	**5.1**	**1.0%**	2.07	2.07	2.07	5.74	0.00
Omagaar Creek	**2.3**	**0.5%**	0.00	1.30	1.80	2.59	0.00
Blue Creek	**125.5**	**25.3%**					
- Mainstem	45.3	9.1%	15.12	15.12	16.90	15.12	11.14
- East Fork	22.5	4.5%					
- Mainstem	17.4	3.5%	0.00	0.00	0.00	0.00	10.81
- East Branch East Fork	5.1	1.0%	0.00	0.00	0.00	0.00	1.34
- Crescent City Fork	22.6	4.5%					
- Mainstem	17.7	3.6%	5.35	7.26	7.56	0.00	0.00
- "Doctor Rock Trib"	4.9	1.0%	0.00	1.46	1.46	0.00	0.00
- Nickowitz Creek	15.0	3.0%					
- Mainstem	13.0	2.6%	0.41	0.00	7.23	0.00	0.00
- Soapstone Gulch	2.0	0.4%	0.00	0.00	1.73	0.00	0.00
- Slide Creek	6.5	1.3%	0.00	0.00	2.41	0.00	0.00
- West Fork	13.6	2.7%					
- Mainstem	9.2	1.9%	0.85	2.35	4.11	0.00	0.00
- Potato Patch Creek	4.4	0.9%	0.18	0.00	0.32	0.00	0.00
- Pularvasaar Creek	1.4	0.3%	0.67	0.67	0.67	0.67	0.00
Ah Pah Creek	**15.9**	**3.2%**					
- Mainstem	6.7	1.3%	0.11	2.12	2.12	4.76	0.00
- South Branch Middle Fork	4.8	1.0%	0.00	0.00	0.00	0.96	0.00
- North Fork	6.7	1.3%	0.74	0.74	2.84	4.71	0.00
- South Fork	2.5	0.5%	0.00	0.75	1.62	2.59	0.00
- Moon Creek	1.8	0.4%	0.00	0.42	0.00	2.80	0.00
Bear Creek	**9.2**	**1.9%**					
- Mainstem	4.8	1.0%	1.10	1.10	2.68	2.68	0.00
- East Fork	2.6	0.5%	0.00	0.00	1.07	1.21	0.00
- North Branch East Fork	1.8	0.4%	0.00	0.00	0.50	1.17	0.00
Surpur Creek	**5.8**	**1.2%**	0.00	0.00	0.63	4.24	0.00
Little Surpur Creek	**2.6**	**0.5%**	0.00	0.33	1.09	0.00	0.00
Tectah Creek	**20.1**	**4.0%**	2.40	2.40	10.59	15.06	0.00
Johnsons Creek	**2.8**	**0.6%**	0.42	0.42	0.68	2.54	0.00
Pecwan Creek	**27.5**	**5.5%**					
- Mainstem	0.3	0.1%	0.60	0.60	0.60	0.00	0.00
- West Fork	14.1	2.8%					
- Mainstem	12.3	2.5%	0.25	0.25	0.25	0.00	8.58
- Buzzard Creek	1.8	0.4%	0.00	0.00	0.00	0.00	1.74
- East Fork	13.1	2.6%	0.45	0.45	0.45	0.00	8.96
Mettah Creek	**10.4**	**2.1%**					
- Mainstem	7.6	1.5%	0.39	0.39	2.77	6.98	0.00
- South Fork	2.8	0.6%	0.00	0.00	0.00	0.42	0.00
Clirliah Creek	**0.7**	**0.1%**	0.00	0.00	0.07	0.00	0.00
Roaches Creek	**29.3**	**5.9%**	0.37	0.37	16.41	0.00	0.00
Morek Creek	**4.0**	**0.8%**	0.00	0.00	0.77	0.00	0.00
Cappell Creek	**8.5**	**1.7%**	0.00	0.14	0.75	0.00	0.00
Miners Creek	**4.5**	**0.9%**	0.00	0.00	0.00	0.00	0.81
Tully Creek	**17.6**	**3.5%**					
- Mainstem	14.0	2.8%	0.00	0.15	8.56	0.00	0.00
- Robber's Gulch	3.6	0.7%	0.00	0.00	1.51	0.00	0.00
Pine Creek	**49.1**	**9.9%**	- No Data Upstream of Yurok Indian Reservation Boundary -				
Bens Creek	**1.3**	**0.3%**	0.00	0.00	0.00	0.00	0.21
Gist Creek	**1.4**	**0.3%**	0.00	0.00	0.00	0.00	0.19
Sub-Basin Totals:	**496.9**		**57.99**	**77.72**	**143.89**	**131.29**	**43.78**

Appendix A

Project Budget

Personnel Costs:

Level of Staff	# of Hours	Hourly Rate	Total
GIS Specialist	1000	$14.00	$14,000
		Staff Benefits @ 32%:	$4,480
Total Personnel Costs:			**$18,480**

Materials and Supplies:

GIS/Computer Supplies, Photocopying	$500
Total Materials and Supplies:	**$500**

Operating Expenses:

Vehicle & Travel Expenses	$500
Total Operating Expenses:	**$500**

Project Subtotal:	$19,480
Administrative Overhead @20.2%:	$3,935
Total Funding Requested:	**$23,415**

In-kind Contribution:

Personnel Costs:

Level of Staff	# of Hours	Hourly Rate	Total
Senior Fisheries Biologist	160	$22.50	$3,600
Fisheries Biologist	240	$14.00	$3,360
Personnel Sub-total:			$6,960
		Staff Benefits @ 32%:	$2,227
Total Personnel Costs:			**$9,187**

In-Kind Subtotal:	$9,187
Administrative Overhead @20.2%:	$1,856
Total In-Kind Contribution:	**$11,043**