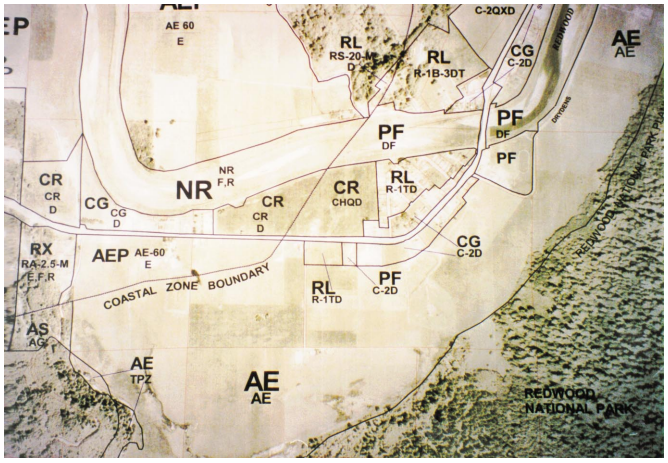
Humboldt 2025 General Plan Update

Natural Resources and Hazards

Volume II: Detailed Watershed Characteristics and Regulatory Framework Analysis



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HUMBOLDT 2020 GENERAL PLAN

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Introduction

This volume is intended as a companion to the Natural Resources and Hazards Report. Volume II includes more detailed treatments of each planning watershed, as well as detailed discussions of the regulatory framework and the watershed management approaches by various agencies. This volume, as well as the three discussion papers, "Building Communities", "Natural Resources and Hazards" and "Moving Goods and People", are part of Phase II of the Humboldt County General Plan Update process. Phase II is comprised of gathering data, examining the changed situation since the last General Plan update, and preparing to plan for land uses and resource conservation through the year 2025.

As stated in the Executive Summary of the Critical Choices Report (Phase I), the public desires a solid information base for General Plan decision making. This volume will assist this effort by providing greater detail on the planning watersheds and the related regulatory framework and management approaches. The following information is summarized in the Natural Resources and Hazards Report, however, this volume allows for a more detailed discussion.

Each planning watershed is presented with information on its physical and biological setting and characteristics, land uses and ownerships, fisheries, Total Maximum Daily Load (TMDL) targets, and water quality concerns. The regulatory framework which impacts watersheds in Humboldt County is presented with information on Federal, State, and Local government regulations and agencies. Finally, a discussion of the watershed management approaches of various agencies, in particular the Watershed Management Initiative is presented.

As is discussed in the Natural Resources and Hazards Report, the primary purpose of the Phase II reports and plans is to inform and solicit public review and comment. After public input, information in the various individual reports and plans will ultimately be incorporated into one comprehensive Phase II report, which will provide policy options for each of the General Plan themes. The Phase II report will be presented to the public and County decision makers.

1 South Fork of the Eel River Watershed

1.1 GENERAL DESCRIPTION OF WATERSHED

Physical and Biological Setting

The 1999 U.S. EPA Total Maximum Daily Load (TMDL) study summarized the physical and biological setting in the South Fork of the Eel River planning watershed as follows.
"The South Fork Eel River watershed covers northern Mendocino and southern Humboldt counties in northern California. The 689 square mile basin stretches approximately 58 miles from the Laytonville area in Mendocino County, up U.S. highway 101 through Humboldt Redwoods State Park and the famed Avenue of the Giants in Humboldt County. The river itself winds for nearly 100 miles, flowing northward joining the Eel River near Weott. The Eel then meets the Pacific Ocean in 40 miles, about six miles south of Humboldt Bay.

The watershed is known for its recreational opportunities: State Parks, white water kayaking, fishing and summer festivals draw international and local visitors alike. The landscape is varied - from gentle grassland areas and open oak woodlands removed from the coastal fog to steep slopes with deep and dense forests of redwood and fir."

Using the Strahler stream order classification system, there are 1,527 miles of streams in the South Fork Eel River (SFER) Planning Watershed with 838 miles in Mendocino County and 689 miles in Humboldt County. In Humboldt County, approximately 79% of the streams fall in orders 1 or 2: (the smallest tributaries). Only 14% of the streams are classified in orders 4-6. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75% of the streams in orders 1 and 2, and 12% in orders 4-8. The smallest planning watershed in Humboldt County, the Jacoby Creek Watershed, has 35 miles of streams in Humboldt County with 78% in orders 1 and 2, and the remaining 22% in order 3: (*Note: as an order 1 stream connects with another order 1 stream, the stream becomes an order 2 stream; as an order 2 stream connects with another order 2 stream, the stream becomes an order 3 stream, and so on*).
Vegetative cover within the watershed in Humboldt County consists primarily of Timberlands and Oak Woodlands: (64% in Fir and Redwood, and 19% in Oak Woodland). The remaining vegetative cover is in Annual Grass (14%) and other vegetative cover types (3%). 99% of the bedrock underlying the watershed is Sedimentary and Metasedimentary.

The EPA report goes on to say that: "The amount of sediment washed through the Eel River is legendary, a process known as sediment production or yield. Most geology students are acquainted with the 1971 Brown & Ritter study that found that the Eel River was one of the highest sediment producing rivers in the world, carrying fifteen times as much sediment as the notoriously muddy Mississippi (Brown & Ritter, 1971). While the Brown & Ritter study calculated that the South Fork Eel had proportionally less sediment than other Eel tributaries, the levels calculated are substantial. The study measured sediment yield during a time of widespread soil disturbance from road building and highly erosive timber harvest practices.

The geology of the area is naturally unstable and is generally thought to produce high natural rates and great sensitivity to human disturbance (DWR, 1983.) As in much of northern California, the large winter storms in 1955 and 1964 led to widespread flooding, landsliding and extreme changes in the rivers and streams. In the South Fork Eel, these same processes led also to the loss of old growth redwoods in the Bull Creek area (now Humboldt Redwoods State Park.) Studies conducted since then have concluded that certain timber harvest practices and road building activities exacerbate the natural condition. This led the State Park System to acquire the entire Bull Creek watershed."

The following table summarizes the dominant physical characteristics within the SFER planning watershed.

Table 1-1: South Fork Eel River Planning Watershed
Physical and Biological Characteristics

Miles of Road by Type		
Road Type	*Total in Humboldt County*	*Total in Watershed*
Improved	203	382
Primary	37	78
Secondary	26	59
Unimproved	644	1,522
Miles of Streams by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	423	921
2	119	275
3	48	124
4	41	114
5	18	53
6	40	40
Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	343	790
Annual Grass	27,225	46,900
Barren	2,041	3,358
Chaparral	103	2,214
Coastal Scrub	227	912
Fir Forest	82,539	174,238
Oak Woodlands	37,910	95,802
Pine Forest	3,331	14,583
Redwood	45,437	96,242
Riparian	219	487
Urban	700	855
Water	322	4,828
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	1,070	8,310
Cenozoic Sedimentary	107,741	129,899
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	91,583	302,969
Water and/or Unclassified	0	36

Table 1-1: South Fork Eel River Planning Watershed
Physical and Biological Characteristics

	Acres of Public Lands
Public Land	*Total*
Humboldt Redwoods State Park	48,884
Richardson Grove State Park	1,713
Other BLM	1,307
Benbow Lake State Recreation Area	936

**Source: Humboldt County GIS System.*

Land Use

The land ownership is also varied. Approximately 25% of the watershed area is publicly owned by the California State Park system and Bureau of Land Management. Large timber companies own a relatively small percent of the watershed compared with many other north coast watersheds, mainly west of highway 101. Ranches, dispersed rural residential areas make up the bulk of the area east of highway 101. There are over 2,000 miles of improved and unimproved roads within the SFER planning watershed. In Humboldt County, there are 266 miles of improved roads and 644 miles of unimproved roads.

The Humboldt County GIS mapping system identifies the following land use and ownership in the South Fork of the Eel River Watershed.

Table 1-2: South Fork Eel Planning Watershed Land Use In Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
timber production	61,565	30.72%
open space/parks	53,365	26.63%
grazing/timber	39,957	19.94%
rural residential	28,643	14.29%
rural residential - vacant	13,491	6.73%
public	638	0.32%
single family residential	504	0.25%
commercial	230	0.11%
church	192	0.10%
single family residential - vacant	144	0.07%
camp	77	0.04%
multi family residential	66	0.03%
golf course	53	0.03%
light industrial - vacant	46	0.02%
vacant	40	0.02%
commercial - vacant	18	0.01%
gravel mining	6	0.00%
cemetery	3	0.00%
multi family residential - vacant	3	0.00%

Table 1-2: South Fork Eel Planning Watershed Land Use In Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
heavy industrial - vacant	2	0.00%
heavy industrial	2	0.00%

Table 1-3: South Fork Eel Planning Watershed Characteristics in Humboldt County

Characteristic	*Value*
Total Acres	441,213
Total Acres in County	200,395
% of Total in County	45%
Average Parcel Size (Acres)	43.87
Largest Watershed	South Fork Eel River
Dominant Land Uses	timber producrtion & open space/parks
Largest Private Land Owner	Barnum Timber

Table 1-4: South Fork Eel Planning Watershed Private Ownership over 640 acres

Private Land Owner	*Total Acres*	*% of Watershed**
Barnum Timber	12,216	6.10%
Buck Mountain Ranch	7,835	3.91%
Pacific Lumber	6,419	3.20%
E Johnson	6,091	3.04%
F & P Hurlbutt	6,043	3.02%
Eel River Sawmills	5,559	2.77%
N Satterlee	3,421	1.71%
L Chapman	3,205	1.60%
G Tosten	2,576	1.29%
Wagner Land Company	2,544	1.27%
V Marshall	2,262	1.13%
S Kahn	1,770	0.88%
Coombs Tree Farms	1,699	0.85%
P Webster	1,628	0.81%
K Wallan	1,562	0.78%
G Wallan	1,219	0.61%
E Tosten	1,176	0.59%
T Dimmick	1,145	0.57%
F Hurlbutt	1,050	0.52%
J Dimmick	1,019	0.51%
Dorn Family	909	0.45%
Teiche Family	875	0.44%

Table 1-4: South Fork Eel Planning Watershed Private Ownership over 640 acres

Private Land Owner	*Total Acres*	*% of Watershed**
Wheeler Lumber	867	0.43%
F Marshall	837	0.42%
J & D Mitchell	700	0.35%

Figure 1 illustrates current land use and ownership in the South Fork Eel River Watershed.

Fisheries

According to the 1999 US EPA study:

"The South Fork Eel River is part of the Eel River system, the third largest river system in California. Two phases of declines have befallen the Eel River salmon. Historically, Eel River salmon production equaled that of the Sacramento River in 1857 (Lufkin, 1996) possibly exceeding 500,000 fish (DFG, 1997); in 1904 345,800 Eel River salmon were taken (Lufkin, 1996.) The fish harvest techniques of the era – no restrictions on harvest and netting salmon in the rivers as they returned to their spawning grounds -- were disastrous. Already by 1910, there was concern about salmon population declines and calls to limit harvest. After crashing salmon populations made it economically difficult to compete with Sacramento salmon, the commercial
inland fishery died. In 1922 the State of California officially closed the industry, albeit after the fishery was depleted. A recreational fishery still exists; however, both declining populations and the corresponding protections for endangered species allow for only a fraction of the past fishery.

It is believed that fish populations recovered somewhat during the 1930-50s. However, a second wave of population declines followed. The Department of Fish and Game estimates that the entire Eel system, including the South Fork Eel, produced around 160,000 salmon & steelhead in 1964. By the late 1980s, only 30,000 fish were estimated to exist in the entire Eel River basin (Department of Fish and Game, 1997). Some of most reliable fish population trend numbers in all of northern California come from a South Fork Eel location. The Department of Fish and Game had a fish counting station from the 1940's to 1975 at Benbow, just south of
Garberville. These fish abundance numbers would be a minimum population for the entire South Fork Eel watershed given that the Benbow location would not include salmon bound for more northern tributaries of the South Fork Eel. Coho salmon show the most serious declines. Approximately 17,000 coho were counted in 1945-46, but only 509 were counted in 1975, the last year the station was funded (Steiner, 1998.)

Despite the decline, the Department of Fish and Game considers the South Fork Eel to have a significant remnant population of coho salmon (DFG, 1996.) University of California fisheries experts (Brown, 1994) found that the South Fork Eel population is important because it has little hatchery influence and thus is important for the genetic integrity of the stock. Small hatcheries like the Cedar Creek facility existed but their size was small relative to overall native populations (Downie, 1999). Many biologists believe that native stocks are more resilient over time in their native habitats.

This TMDL for the South Fork Eel focuses on sediment and temperature. Fish populations are influenced by many other factors, such as ocean and estuary conditions, adequate dissolved oxygen in the water column, adequate food, and adequate cover (CDF, 1994.) While this report is concerned with only sediment and temperature constraints, each limiting factor should be improved to increase fish populations. Limiting factors such as large woody debris may additionally need to be addressed,

however, the existence of problems with large woody debris do not negate better understood problems of sediment and temperature."

The 1999 U.S. EPA study summarized water quality concerns based on three identified basins: Lower, Middle and Upper.

"The main channel of the South Fork Eel River has filled with sediment substantially since 1964, a process known as stream aggradation. The U.S. Army Corps of Engineers measurements of aggradation show four sections of the river increased in elevation from 1.6 feet to approximately 11 feet between 1968 and 1998 (USACE, 1999.). The elevation at one cross section decreased by 1.3 feet. The Army Corps report states that channel widening also appears to be continuing (1992 compared to 1996) although the trend is less evident. These types of channel changes result from both local and upstream sediment inputs.

Sedimentation of tributary streams in the South Fork Eel has also reached notable levels. Sediment from Cuneo Creek, a tributary of Bull Creek, has buried two bridges with more than 10 meters of sediment and the channel widened from 10s to 100s of meters (LaVen, 1987 and Short, 1987.) The 1964 flood resulted in widening of Bull Creek by up to 400 feet (Jager and LaVen, 1981.) Because such precise historical measurements of stream changes are rarely undertaken, there is uncertainty about the spatial extent of similar channel changes within tributaries of the South Fork Eel. DFG observers (DFG, 1996 and DFG, 1996-1998) find that some channel changes (e.g. filling of pools with sediment) that reduce the habitat complexity needed by salmon, are frequent.

With or without changes in the channel from increases in coarse sediment, salmon are negatively affected by the additions of fine sediment. Fine sediment smothers spawning sites, reducing the ability of salmon to reproduce successfully.

Temperature Problems

Temperature directly governs almost every aspect of the survival and life history of Pacific salmon (Berman, 1998.) Temperature is such as an important requirement of fish that coho and chinook salmon, and steelhead are known as "cold water fish". Many physiological processes of salmon are affected by temperature including metabolism, food requirements, growth rates, developmental rates of embryos and young, timing of life-cycles such as adult migration, emergence from gravel nests, proper life stage development and sensitivity to disease (Spence et al, 1996.)

In general, the types of effects are usually divided into lethal and sublethal effects. These effects are relevant for all the life stages of salmon. However, in the South Fork Eel, the most sensitive period is the summer rearing period, when young coho and steelhead stay in freshwater streams while they mature.

Stream temperatures have been measured at many locations in the South Fork Eel. It is well documented that many locations in the South Fork Eel have summer temperatures that exceed the tolerances of cold water species. Prior to this TMDL, neither the natural geographic extent of cool temperatures nor the role of human activities in reducing the amount of good cool water habitat for salmon had been established. The role of shading in preventing stream temperature increases is well established for forested ecosystems in the Pacific Northwest. However, prior to this TMDL, the role of changes in riparian vegetation has not been widely investigated for the South Fork Eel. For the South Fork Eel, given that many streams have become wider and shallower and many riparian areas have been cleared for roads or timber production, human induced changes are thought to play a large role. This TMDL evaluates the role of vegetation changes in altering natural stream temperatures for the South Fork Eel.

1.2 TMDL TARGETS AND RECOMMENDATIONS

The 1999 EPA TMDL study established the following TMDL targets for temperature and sediment.

Temperature

The load allocations in this TMDL are expressed as percent effective shade for individual stream segments. Oregon Department of Environmental Quality introduced the approach of using effective shade requirements in several proposed and final TMDLs (ODEQ, 1999.) Effective shade is a function of vegetation height, stream width and/or topographical barriers. Effective shade is measurable and site specific variables, such as potential riparian vegetation, can be determined during implementation.

Effective shade allocations meet the legal requirement to set pollutant load allocations. The South Fork Eel TMDL incorporates measures other than "daily loads" to fulfill the requirements of the Clean Water Act 303(d). Alternative measures to mass/time are known as "other appropriate measures" and are allowed under EPA regulations (40CFR 130.2.)" Although a loading capacity for heat is derived, it is of limited value in guiding management activities needed to solve identified water quality problems. Therefore, the load allocations are expressed as effective shade, which can be measured with various devices, such as solar pathfinders or fish eye lenses. Table 3 indicates the effective shade allocations for the South Fork Eel. As Table 3 illustrates,
narrow streams need to be almost totally shaded (1-2 meter streams at 95-96% shade), in order to meet water quality standards, while wider streams would not be totally shaded even under natural vegetation conditions.

Table 1-5: Effective shade allocations by vegetation type and stream width

	Effective Shade Allocations - percent of stream shaded on each stream segment					
Vegetation Type	1-2 meter stream width	2-5m	5-10m	10-15m	15-20m	20-30m
Mixed Conifer	96	91	82	68	52	37
Mixed Hardwood/Conifer Conifer dominated	96	90	79	67	49	33
Mixed Hardwood/conifer Hardwood dominated	96	90	79	66	49	33
Mixed Hardwood	95	90	78	65	47	33
Mixed Oak Woodlands	95	89	78	64	44	26

The effective shade allocations are for the entire basin, not just the three representative subbasins. In response to several comments, EPA is defining stream width here in the TMDL as bankful width. Although EPA understands that the measurement of bankful width has some field variability, we defer a more precise measurement to the Regional Board implementation process.

Sediment

The load allocation portion of a TMDL is intended to identify the maximum allowable loads from individual sediment source categories that are necessary to meet the TMDL and loading capacity. For sediment in the South Fork Eel, the major sources of sediment were found to be road-related, including roads associated with timber harvest. The load allocations in the South Fork Eel clarify the

relative emphasis and magnitude of erosion control programs that need to be developed in the implementation phase.

However, as we discuss further in the implementation recommendations section, EPA recommends that actual sediment reduction programs, as implemented by the Regional Board, utilize field-based assessments of sediment sources, conducted by individual landowners on their properties, which are consistent with the load allocations. In the South Fork Eel, load allocations emphasize erosion from roads. The load allocation for roads is 41 t/km2/year, based on an 80% reduction from current levels (205 t/km2/year * 0.2 = 41 t/km2/year). The roads category includes road surface erosion, road crossing failures and gullies, and skid trails. Landslides, the remaining source of anthropogenic sediment, would then need a 55% reduction from the levels calculated here (121 t/km2/year * 0.45 = 54 t/km2/year). This includes landslides from roads and landslides from harvest. Together these types of programs will result in the South Fork Eel loading capacity of 1:4 human to natural sediment production (or 473 t/km2/year)[1]. The waste load allocation is zero as there are no permitted point sources of sediment discharge to the watershed.

EPA considered the potential for decreasing erosion, based on the availability of improved practices for reducing erosion from roads and unstable areas. Based on methods for storm-proofing roads (Weaver and Hagans, 1994), as well as the professional judgment and experience in North Coast watersheds by Pacific Watershed Associates (as referenced in EPA, 1998), the South Fork Eel TMDL uses a 80% reduction in erosion from roads. EPA has established similar levels of controllability for roads on other North Coast watersheds, such as the South Fork Trinity and Van Duzen. The remaining load was allocated to landslides, which resulted in a 55% reduction."

[1] 473 t/km2/year = 378 t/km2/year + 41 t/km2/year + 54 t/km2/year (total allocations = natural + roads + landslides)

Figure 1-1 South Fork Eel Planning Watershed

2 Lower Eel River Watershed

2.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The Eel River is the third largest river system in California, encompassing approximately 3,684 square miles and 3,488 miles of streams within Humboldt, Mendocino, Trinity, and other Northern California counties. The Eel River system's major watersheds within Humboldt County are the mainstem (1,477 square miles), Middle Fork (753 square miles), South Fork (690 square miles), Van Duzen (428 square miles), and the estuary and delta (50 square miles). Mean annual discharge is approximately six million acre-feet. The Eel Basin covers much of the southern half of Humboldt County, excepting the southeast coast. Public landholdings include part of Six Rivers National Forest in the eastern Van Duzen and Middle Main Eel watersheds, the Eel River Wildlife Area in the Lower Eel watershed, and Humboldt Redwoods State Park in the South Fork Eel watershed.

Climate. The Eel River Basin experiences a basic Mediterranean climate. Summer is characterized by cool coastal temperatures and hot dry weather in the interior mountain valleys. Winter months are characterized by frequent precipitation but seldom freezing along the coast. Inland areas experience more severe weather. Above 2,500 feet snow is likely to fall, but only above 5,000 feet does it remain for any period of time. Only in the area of the Middle Fork of the Eel River does the snow accumulation become great enough to affect streamflow run-off. The California coast is unique in that it has a submergent coast. The steep drop off of the ocean floor makes the deep water cold. The surface water heats up and evaporates into fog which is sucked inland. The fog is then captured from the air in the tremendous branches of the grand redwoods. The trees transport the moisture to the ground where it is utilized by many other life forms. This phenomenon of moisture transport is known as "fog drip."

Geology. About 100 million years ago the ocean floor pushed slowly up and against the continental margin along the coast of California. The shifts pushed the marine sandstone from the ocean floor which dried and metamorphosed into rock. Much of the streams and tributaries feeding the Eel are carved out of franciscan rock; a name applied collectively to crumpled sea floor sediments first closely studied around San Francisco. It is dark, slippery-looking rock, harshly infertile to growth. The disintegration and weathering of this rock becomes residual soil. Residual and Alluvial are the two distinct types of soil found in the watershed region. Alluvial soils are the stream sediments washed off from nearby mountains. These deposits are porous and form soil rich for agriculture with good surface drainage.

Serpentinite rock is found all throughout the watershed basin. It is always green and seamed with closely-spaced fractures. Some have a soapy feel and are soft enough to whittle with a knife. This is the kind that is often called " soap stone." Manganese is found in trace amounts around the watershed. Small deposits were mined during the two world wars, but there was never enough to support any large mines. It is easy to overlook because it appears to be a black stain on rocks, or fills in small cracks. Limestone, copper and chromite are other minerals found in minor significance throughout the watershed. Serpentinite often contains rare beautiful rocks called "bluechist," which are heavy blueish-black rock liberally flecked with intense blue crystals. Jade is another unusual rock found alongside serpentinite and in the watershed of the Eel in minimal proportions. Found in streams and beach gravels, jade is not easy to recognize because it is the same color as the surrounding serpentinite. Jade is noticeably heavier than serpentinite and much harder to break.

The geology of the Eel River is well known and contains a complex system of Franciscan type rocks related to landslides which tend to cause the watershed to generate some of the highest suspended loads of any river in the world. For example, from one of the main sub-basins following the 1964 flood, the suspended sediment production rate was 9,759 tons per square mile from 1966 to 1976. The Eel River basin is a mountainous area uplifted in recent geologic time (post-Miocene) and underlain by a deformed, faulted, locally sheared, and, in part, metamorphosed accumulation of subducted continental margin deposits. The deposits consist of mixed units of melange and coherent sandstones.

The Lower Eel River Delta was heavily influenced by sea level. The Eel River Basin has subsided at a rate of 2.8 meters/1,000 years through the late quarternary. The average rate of uplift for the Cape Mendocino coast just to the south is 1.0 meters/1,000 years. The high rate of uplift of the upper watershed combined with a crushing force from the west due to the subducted Gorda plate, creates a highly erodible landscape. This geological setting, combined with the high rate of precipitation, produces high quantities of water flowing down steep narrow canyons, thus generating large amounts of sediment. Ultimately large amounts of sediment are deposited in the flatter delta region in the Lower Eel River basin.

Table 2-1: Acres of Bedrock Type

Rock Type	*Total in Humboldt County*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	333
Cenozoic Sedimentary	105,764
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	80,204
Water and/or Unclassified	4,768

Habitats. Vegetation can be defined as the collection of plant species found in a given region in a given arrangement. This is how we make our general differentiation between grasslands, forests, riparian areas, etc. The watershed is approximately 60% forested. The predominant vegetative cover types are: redwood forest (35.5%), fir forest (15.5%), oak woodlands (10.16%), annual grasslands (11.2%), and agriculture crops (12.6%).

Table 2-2: Percentage by Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*Percent*
Agriculture-Crops	24,200	12.60
Annual Grass	21,411	11.21
Barren	5,260	2.75
Chaparral	30	0.01
Coastal Scrub	423	0.22
Fir Forest	29,509	15.47
Oak Woodlands	19,411	10.16
Pine Forest	3,316	1.73
Redwood	67,888	35.54
Riparian	7,888	4.13
Urban	2,625	1.37
Water	4,149	2.17
Wetlands	4,908	2.56

The California Natural Diversity Database CNDDB provides information on rare species and natural community locations, condition, dates of observation, precision of sighting, and comments regarding habitat associations, threats, population sizes, as well as state and federal legal status. A valuable tool for conservation, the NDDB provides government agencies and the private sector with information so that informed land-use decisions and resource management can occur. Developers, county and city planners, state and federal agencies, and conservation groups use the NDDB information to determine where declining species and natural communities are located and if planned projects will affect them. The information also is used to identify biologically rich areas that can be targeted for protection through land conservation actions. The following 17 special status species are listed in the CNDDB for the Lower Eel River Watershed:

Table 2-3: 17 Special Status Species

17 Special Status Species from the Natural Diversity Database (NDDB)

Common Name:	Scientific Name:	Global Rank:	State Rank:	Federal Listing:	State Listing:
Baker's Meadowfoam	*Limnanthes bakeri*	G1	S1.1	Federal Species of Concern	California-listed as Rare
Foothill Yellow-legged Frog	*Rana boylii*	G3	S2S3	Federal Species of Concern	None-No State classification
Humboldt Bay Owl's-clover	*Castilleja ambigua ssp humboldtiensis*	G4T2	S2.2	Federal Species of Concern	None-No State classification
Kneeland Prairie Pennycress	*Thlaspi californicum*	G1	S1.1	Candidate for Federal Listing	None-No State classification
Northern Goshawk	*Accipiter gentilis*	G4	S3	Federal Species of Concern	None-No State classification
Northern Red-legged Frog	*Rana aurora aurora*	G4T2?	S2?	Federal Species of Concern	None-No State classification
Northern Spotted Owl	*Strix occidentalis caurina*	G3T1	S1	Federally listed as Threatened	None-No State classification
Northwestern Pond Turtle	*Clemmys marmorata marmorata*	G4T4	S3	Federal Species of Concern	None-No State classification
Oregon Fireweed	*Epilobium oreganum*	G2	S2.2	Federal Species of Concern	None-No State classification
Southern Torrent (=seep) Salamander	*Rhyacotriton variegatus*	G4	S2S3	Federal Species of Concern	Candidate-Officially recognized by Fish & Game
Tailed Frog	*Ascaphus truei*	G3G4	S2S3	Federal Species of Concern	None-No State classification
The Lassics Lupine	*Lupinus constancei*	G1	S1.2	Federal Species of Concern	None-No State classification
The Lassics Sandwort	*Minuartia decumbens*	G1	S1.2	Federal Species of Concern	None-No State classification
Tracy's Sanicle	*Sanicula tracyi*	G3	S3.2	Federal Species of Concern	None-No State classification
Tricolored Blackbird	*Agelaius tricolor*	G2	S2	Federal Species of Concern	None-No State classification
Two-flowered Pea	*Lathyrus biflorus*	G1	S1.1	Candidate for Federal Listing	None-No State classification
Western Lily	*Lilium occidentale*	G1	S1.2	Federally listed as Endangered	California-listed as Endangered

Table 2-4: NDDB Global Rank Explanation

NDDB Global Rank Explanation

The global rank reflects overall condition (rarity and endangerment) of an element throughout its range. Ranks are assigned by the NDDB biological staff following review of all available information.

Global Rank	Meaning
G1:	Less than 6 Element Occurrences (EO) OR less than 1,000 individuals OR less than 2000 acres
G2:	6 - 20 EOs OR 1,000 - 3,000 individuals OR 2,000 - 10,000 acres
G3:	21 - 100 EOs OR 3,000 - 10,000 individuals OR 10,000 - 50,000 acres
G4:	Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat.
G5:	Population or stand demonstrably secure to ineradicable due to being commonly found in the world.
GnTn:	Subspecies receive a T-rank attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies; where n = 1,2,3,4,5 as described above.

Table 2-5: NDDB State Rank Explanation

NDDB State Rank Explanation

The state rank reflects condition (rarity and endangerment) of an element within the State of California. Ranks may be combined e.g. S1S2

State Rank	Meaning
S1:	Less than 6 Element Occurrences (EO) OR less than 1,000 individuals OR less than 2000 acres
S1.1:	Very threatened
S1.2:	Threatened
S1.3:	No current threats known
S2:	6 - 20 EOs OR 1,000 - 3,000 individuals OR 2,000 - 10,000 acres
S2.1:	Very threatened
S2.2:	Threatened
S2.3:	No current threats known
S3:	21 - 100 EOs OR 3,000 - 10,000 individuals OR 10,000 - 50,000 acres
S3.1:	Very threatened
S3.2:	Threatened
S3.3:	No current threats known
S4:	Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. NO THREAT RANK.
S5:	Demonstrably secure to ineradicable in California. NO THREAT RANK.

The CNDDB also list the following 16 fish species as native to the Lower Eel Watershed: Chinook Salmon *Oncorhynchus tshawytscha,* Coastrange Sculpin *Cottus aleuticus,* Coho Salmon *Oncorhynchus kisutch,* Cutthroat Trout *Oncorhynchus clarki,* Pacific Lamprey *Lampetra tridentata* , Pacific Staghorn Sculpin *Leptocottus armatus,* Prickly Sculpin *Cottus asper,* Rainbow Trout *Oncorhynchus mykiss,* River Lamprey *Lampetra ayresi,* Sacramento Sucker *Catostomus occidentalis,* Shiner Perch *Cymatogaster aggregata,* Starry Flounder *Platichthys stellatus,* Surf Smelt *Hypomesus pretiosus,* Threespine Stickleback *Gasterosteus aculeatus,* Topsmelt *Atherinops affinis,* and Western Brook Lamprey *Lampetra richardsoni*.

At the western end of the watershed lies the 33,000 acre Eel River Delta. Over 200 different species of birds have been observed utilizing the Eel River Delta, and it is considered a vital link of the coastal flyway. Additionally, riparian corridors attract may types of land birds, including song birds, upland game birds and raptors.

Forty different species of mammals have been observed in the Eel River Delta. Those that could be expected to utilize portions of the riparian corridor include: black tailed deer, beaver, mink, otter, gray fox, ring tailed cats, raccoons, skunks, weasels, coyote, bobcats, rabbits, squirrels, gophers, and mice.

Land Use

Land cover is similar to the Klamath River Watershed: mostly forested with a variety of conifers and hardwoods, though the presence of red alder and willow are also notable.

Table 2-6: Lower Eel Planning Watershed Characteristics

Characteristic	*Value*
Total Acres	191,052
Total Acres within County	191,052
% of Total in County	100%
Average Parcel Size (Acres)	38.53
# of Sub-Watersheds	18
Largest Watershed	Eel River
Dominant Land Use	Timber Production
Largest Land Owner	Pacific Lumber

The entire watershed lies in Humboldt County and the dominant land use is timber production. Average parcel size is 38.53 acres, with Pacific Lumber Company being the largest single land owner.

Table 2-7: Lower Eel Planning Watershed Land Use

Existing Land Use	*Total Acres*	*% of Watershed*
timber production	99,445	52.05%
grazing/timber	33,014	17.28%
agriculture	32,652	17.09%
rural residential	5,700	2.98%
city	5,083	2.66%
open space/parks	4,858	2.54%
rural residential - vacant	2,701	1.41%
public	789	0.41%
heavy industrial	644	0.34%
gravel mining	255	0.13%
commercial	241	0.13%
vacant	235	0.12%
single family residential	220	0.12%
multi family residential	73	0.04%
single family residential - vacant	66	0.03%
commercial - vacant	30	0.02%
heavy industrial - vacant	18	0.01%
church	7	0.00%

Table 2-7: Lower Eel Planning Watershed Land Use

Existing Land Use	*Total Acres*	*% of Watershed*
school	5	0.00%
multi family residential - vacant	2	0.00%

Timber production, grazing and agricultural land uses represent over 86% of the land use and ownerships in terms of acreage in the watershed.

Table 2-8: Lower Eel Planning Watershed Private Ownership over 640 acres

Private Land Owner	*Total Acres*	*% of Watershed*
Pacific Lumber	61,921	32.41%
A Fearrien	5,549	2.90%
R & G Barnwell	5,415	2.83%
E Lucas	4,405	2.31%
M & G McLean	4,064	2.13%
Hackett Timber & Livestock	3,239	1.70%
W Dunn	2,812	1.47%
Simpson Timber	2,771	1.45%
G Brightman	2,540	1.33%
Bertha Russ Lytel Foundation	2,425	1.27%
E Fearrien	2,196	1.15%
Russ Ranch & Timber Company	2,081	1.09%
A & C Nylander	1,824	0.95%
Diamond R Ranch	1,485	0.78%
A Grandy	1,344	0.70%
J Silva	1,272	0.67%
T Eggel	1,249	0.65%
J Braun	1,216	0.64%
A Genzoli	1,083	0.57%
T Connick	1,007	0.53%
P & P Hrynkiewicz	860	0.45%
Perry Ranch	835	0.44%
F & M Barry	741	0.39%
J & W Philbrick	740	0.39%
Beal Family Trust	696	0.36%

Table 2-9: Acres of Public Lands

Public Land	*Total*
Humboldt Redwoods State Park	3,263
Eel River Wildlife Area	1,390
Other State Lands	967

Figure 2 illustrates current land use and ownership in the Lower Eel River Watershed.

Fisheries

The Eel River supports the largest remaining native coho salmon population in California, as well as fall-run Chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey.

According to National Marine Fisheries Service, the Eel was once the largest producer of Chinook and Coho Salmon in the state, and second largest of Steelhead Trout. Commercial fishing along the Eel was once a million dollar industry. The canneries of the lower Eel reported 100,000 salmon per year with a maximum annual harvest estimated at 500,000 fish in the early 1900's. In 1988 the Department of Fish and Game estimated there were 31,000 fish in the entire Eel river System. They are now listed as threatened under the Endangered Species Act.

The Lower Eel portion of the watershed is of little significance as spawning ground for anadromous fishes, and is important primarily as a migration route to upstream spawning grounds and as a return route to the ocean for surviving adult steelhead, juvenile trout and salmon. In addition, salmon utilize the downstream pools as holding areas until there is sufficient flow from the fall rains to permit upstream passage. It is also likely that some downstream juvenile migrants use the estuary as a nursery area throughout much of the year, since juvenile king salmon and steelhead have been found there during fall, winter and spring months.

King salmon (Chinook) enter the estuary in late August and September, lie in the pools below Fernbridge until the first late storm raises the river sufficiently to permit them to move upstream. Peak migration of adult king salmon occurs in October and early November, and they utilize the main stem Eel River, Van Duzen River, the north, south and middle forks, and large and small tributaries for spawning. Young king salmon move downstream soon after they emerge from the gravel, and downstream migration reaches a peak in April or May and is normally completed by late July. King salmon spawn at the head of ripples in gravel six inches in diameter or a little smaller. Adequate water flow through the gravel and sufficient dissolved oxygen are necessary for survival. Mortality is high when excessive erosion has deposited fine materials over the stream bed resulting in compaction.

Silver salmon (Coho) spawning run begins in September to mid-October and tapers off in December. Spawing is predominantly confined to the South Fork and lower tributaries of the Eel River main stem as far down as the Van Duzen River.

Steelhead enter the Eel River in varying numbers throughout the year, with an early run of "half pounders" in late summer. Larger steelhead migrate from October onward. Another run of spring run steelhead starts in April or May. Steelhead spawn in many of the areas used by Silver salmon, but can also ascend stream with steeper gradients and utilize smaller gravel. Juvenile steelhead migrate downstream at all times of year, but most of the migrate in the spring or early summer.

The abundance of salmon and steelhead in the Eel River system had been declining over the past 60 years. Factors contributing to the declines are habitat loss caused by timber harvesting practices, associated road building following World War II, as well as certain types of grazing practices, water diversion, and over-fishing.

2.2 WATER QUALITY CONCERNS

The EPA has classified the Middle Fork and South Fork Eel as having "less serious problems"; the Lower Eel, however, received a rating of "more serious problems." Presumably this is due to the aggregate strain of the sedimentation loads of the tributaries as well as the regulation of flows by human means.

High seasonal rainfall combined with a rapid runoff rate on unstable soils delivers large amounts of sediments to the river. As a result, The Eel River may transport more sediments than any other river of its size in the world, due to heavy winter rainfall running through highly unstable soils. These sediments are deposited throughout the lower gradient reaches of the system.

The amount of sediment washed through the Eel River is legendary, a process known as sediment production or yield. In 1971 Brown & Ritter found that the Eel River was one of the highest sediment producing rivers in the world, carrying fifteen times as much sediment as the notoriously muddy Mississippi (Brown & Ritter, 1971). While the Brown & Ritter study calculated that the South Fork Eel had proportionally less sediment than other Eel tributaries, the levels calculated are substantial. The study measured sediment yield during a time of widespread soil disturbance from road building and highly erosive timber harvest practices.

With or without changes in the channel from increases in coarse sediment, salmon are negatively affected by the additions of fine sediment. Fine sediment smothers spawning sites, reducing the ability of salmon to reproduce successfully.

The *Water Quality Control Plan for the North Coast Region* (Basin Plan) contains specific water quality objectives and implementation programs to protect and enhance identified beneficial uses of water. Over-arching regulatory provisions of the Basin Plan are the discharge prohibitions section, which prohibits direct waste discharge to all freshwater surface waters in this management area except during the winter and at specific dilution rates. The State's Nonpoint Source Pollution Control Program also is referenced in the Basin Plan and forms the basis for addressing non-timber nonpoint source pollution, such as from agricultural operations. Likewise, there are regulations within the implementation section of the Basin Plan addressing waste discharges from logging, road building, and associated construction activities. The policies regarding individual wastewater systems contained in the Basin Plan provide guidelines for local agency jurisdictions to prevent water quality degradation from septic systems.

The state *Water Quality Control Policy for the Enclosed Bays and Estuaries of California* provides water quality guidelines for the prevention of water quality degradation and to protect the beneficial uses of bays and estuaries in the state.

The California Department of Fish and Game developed an Eel River Salmon and Steelhead Action Plan (final draft, August 1997) that identified ten general actions to address problems in the Eel River watershed. The primary actions recommended are reducing watershed erosion and improving fish habitat and riparian areas. Additionally, the US Bureau of Land Management and US Forest Service completed watershed analyses for four sub-watersheds (South Fork, North Fork, Middle Fork and Van Duzen River) and compiled information for a preliminary assessment for the main stem Eel River. The State Department of Parks and Recreation also evaluated sediment problems in the Bull Creek watershed. The RWQCB will use these sources of information in refining actions and goals, as well as in the development of TMDL waste reduction strategies for sediment in the Eel Watershed Management Area (WMA).

In the lower Eel River area, the town of Scotia has a municipal runoff problem and Pacific Lumber Company has a permitted ash dump where Regional Water Board staff is currently taking enforcement action. There are also upland and in-stream quarries near Scotia that need investigation. At Rio Dell there are discharge problems from the municipal treatment plant in the summer and a sludge disposal problem. Eel River Saw Mill, which is being sold, has a NPDES storm water permit.

The towns of Scotia, Ferndale, and Rio Dell will get Phase II NPDES storm water permits. At the town of Redcrest there is an underground tank that is leaking MTBE to the river and a failing onsite disposal system that needs investigation. In the Ferndale and Fortuna areas there are about 85 dairies many with manure management problems and some where cows have direct access to streambanks.

Pacific Lumber Company (PALCO) is harvesting heavily, above quantities in the Sustained Yield Plan, in the lower Eel River and Van Duzen River watersheds including Bear, Stitz and Jordan Creeks. PALCO is currently conducting a watershed analysis in this area and there is extensive Regional Water Board oversight. There is also cattle grazing on PALCO land and many roads that are poorly maintained and are contributing sediment to local creeks which are aggrading and causing flooding and domestic water supply problems. The Regional Water Board is conducting a watershed analysis in the lower Eel River area and conducting effectiveness monitoring downstream of where PALCO has installed BMPs.

Table 2-10: Lower Eel River Planning Watershed
Physical and Biological Characteristics

Miles of Road by Type	
Road Type	*Total in Humboldt County*
improved	404
primary	38
secondary	33
unimproved	487
Miles of Streams by Order	
Stream Order	*Total in Humboldt County*
1	394
2	151
3	59
4	31
5	2
6	2
Acres of Vegetative Cover	
Cover Type	*Total in Humboldt County*
Agriculture-Crops	24,200
Annual Grass	21,411
Barren	5,260
Chaparral	30
Coastal Scrub	423
Fir Forest	29,509
Oak Woodlands	19,411

Table 2-10: Lower Eel River Planning Watershed
Physical and Biological Characteristics

Pine Forest	3,316
Redwood	67,888
Riparian	7,888
Urban	2,625
Water	4,149
Wetlands	4,908
Water	4,149
Wetlands	4,908

Acres of Bedrock Type

Rock Type	*Total in Humboldt County*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	333
Cenozoic Sedimentary	105,764
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	80,204
Water and/or Unclassified	4,768

Figure 2-1: Lower Eel Planning Watershed

3 Middle Fork Eel River Watershed

3.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The Eel River is the third largest river system in California; the Middle Fork of the Eel River encompasses approximately 482,136 acres and 1,067 miles of streams within Humboldt and Mendocino counties. Mean annual discharge is approximately six million acre-feet. Average precipitation per year is 56.86 inches. The Eel Basin covers much of the southern half of Humboldt County, excepting the southeast coast. Public landholdings include part of Six Rivers National Forest in the eastern Van Duzen and Middle Main Eel watersheds, the Eel River Wildlife Area in the Lower Eel watershed, and Humboldt Redwoods State Park in the South Fork Eel watershed.

Climate and geology of the Middle Fork of the Eel River is very similar to that described for the Lower Eel River. The Eel River Basin experiences a basic Mediterranean climate. The geology of the Eel River is well known and contains a complex system of Franciscan type rocks related to landslides which tend to cause the watershed to generate some of the highest suspended loads of any river in the world. Approximately 45.57% of the watershed is above 15% slope.

Table 3-1: Acres of Bedrock Type

Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	882	2,531
Cenozoic Sedimentary	18,656	18,656
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	118,970	312,157

Habitats. Within Humboldt County, the Middle Fork Eel River watershed is approximately 76% moderate to heavily forested, with some patches of annual grassland, pine forest and chaparral. Much of the watershed has been used for timber production and harvested at various times in the recent past. The predominant vegetative cover types include: fir forest (33.28%), oak woodlands (31.5%), annual grasslands (21.3%), and redwood forest (9.41%). Agricultural crop land account for only 0.08% or 117 acres.

Table 3-2: Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*	*Total in Watershed*
Agriculture-Crops	117	0.08	117
Annual Grass	29,506	21.30	69,977
Barren	2,451	1.77	4,752
Chaparral	898	0.65	4,931
Fir Forest	46,104	33.28	95,521
Oak Woodlands	43,629	31.50	134,463
Pine Forest	2,477	1.79	8,932
Redwood	13,029	9.41	13,029
Riparian	98	0.07	113

Table 3-2: Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*	*Total in Watershed*
Urban	35	0.02	35
Water	165	0.12	842
Wetlands	0	0	42
	138,509		

The following 10 special status species are listed in the CNDDB for the Middle Fork Eel River Watershed:

Table 3-3: 10 Special Status Species

10 Special Status Species from the Natural Diversity Database (NDDB)

Common Name:	Scientific Name:	Global Rank:	State Rank:	Federal Listing:	State Listing:
Anthony Peak Lupine	*Lupinus antoninus*	G1	S1.3	Federal Species of Concern	None-No State classification
Baker's Meadowfoam	*Limnanthes bakeri*	G1	S1.1	Federal Species of Concern	California-listed as Rare
Foothill Yellow-legged Frog	*Rana boylii*	G3	S2S3	Federal Species of Concern	None-No State classification
Milo Baker's Lupine	*Lupinus milo-bakeri*	G1Q	S1.1	Federal Species of Concern	California-listed as Threatened
Northern Goshawk	*Accipiter gentilis*	G4	S3	Federal Species of Concern	None-No State classification
Northern Spotted Owl	*Strix occidentalis caurina*	G3T1	S1	Federally listed as Threatened	None-No State classification
Northwestern Pond Turtle	*Clemmys marmorata marmorata*	G4T4	S3	Federal Species of Concern	None-No State classification
Oregon Fireweed	*Epilobium oreganum*	G2	S2.2	Federal Species of Concern	None-No State classification
Stebbins' Lewisia	*Lewisia stebbinsii*	G1	S1.2	Federal Species of Concern	None-No State classification
Water Howellia	*Howellia aquatilis*	G2	S1.2	Federally listed as Threatened	None-No State classification

NDDB Global Rank Explanation

The global rank reflects overall condition (rarity and endangerment) of an element throughout its range. Ranks are assigned by the NDDB biological staff following review of all available information.

Global Rank	Meaning
G1:	Less than 6 Element Occurrences (EO) OR less than 1,000 individuals OR less than 2000 acres
G2:	6 - 20 EOs OR 1,000 - 3,000 individuals OR 2,000 - 10,000 acres
G3:	21 - 100 EOs OR 3,000 - 10,000 individuals OR 10,000 - 50,000 acres
G4:	Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat.
G5:	Population or stand demonstrably secure to ineradicable due to being commonly found in the world.
GnTn:	Subspecies receive a T-rank attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies; where n = 1,2,3,4,5 as described above.

The CNDDB also list the following 7 fish species as native to the Middle Fork Eel Watershed:

Table 3-4: Fish Status Ratings

Fish Status Ratings (defined by Dr. Peter Moyle, U.C. Davis)

Status	Meaning
1:	Threatend or endangered-usually formally listed but not always
2:	Special concern-species is in decline or has very limited distribtuion
3:	Watch list-species in decline but not yet in serious trouble. Monitoring needed
4:	Species overall not in decline or in danger of extinction but has subspecies or distinctive populations that are
5:	Species widespread and abundant

Figure 3 illustrates the current physical and biological setting in the Middle Main Eel River Watershed.

Land Use

Approximately 42% of the watershed lies in Humboldt County with an average parcel size of 82 acres. The dominant land use is grazing/timber.

Table 3-5: Middle Main Eel Planning Watershed Characteristics

Characteristic	*Value*
Total Acres	333,345
Total Acres within County	138,509
% of Total within County	42%
Average Parcel Size (Acres)	82.00
Largest Watershed	Eel River
Dominant Land Uses	grazing/timber
Largest Private Land Owner	P Webster

Grazing/timber and timber production land uses consist of 93.6% of the land use by acreage in the watershed, with residential uses, open space and parks making up much of the rest.

Table 3-6: Middle Main Eel Planning Watershed Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
grazing/timber	77,439	55.91%
timber production	52,219	37.70%
rural residential - vacant	9,500	6.86%
rural residential	9,292	6.71%
open space/parks	8,490	6.13%
public	308	0.22%
camp	84	0.06%
commercial	72	0.05%

Table 3-6: Middle Main Eel Planning Watershed Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
single family residential	29	0.02%
single family residential - vacant	10	0.01%

Private ownerships consist mostly of large timberland or ranch holdings of over 600 acres each.

Table 3-7: Middle Main Eel Planning Watershed Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed**
P Webster	14,884	10.75%
Pacific Lumber	13,126	9.48%
N Satterlee	7,266	5.25%
H & U Prior	6,186	4.47%
Fort Baker Ranch	5,108	3.69%
Whitlow Ranch	4,782	3.45%
S Launer	4,409	3.18%
A Fearrien	3,702	2.67%
McBride Properties	3,458	2.50%
C Stewart	3,167	2.29%
S Kahn	2,564	1.85%
Buck Mountain Ranch	2,033	1.47%
R Prior	2,022	1.46%
T Smith	2,016	1.46%
Gusmeroli Ranch	2,005	1.45%
Cab Ranch	1,925	1.39%
Perry Ranch	1,696	1.22%
Ed Land & Timber Partnership	1,581	1.14%
W & C Burgess	1,494	1.08%
E Fearrien	1,368	0.99%
Big Rock Ranch	1,191	0.86%
Hoopes Partnership	1,140	0.82%
Eel River Sawmills	1,130	0.82%
L Jewett	1,083	0.78%
O & M Whitlow	1,079	0.78%
R & J Anzini	981	0.71%
F Anderson	771	0.56%
G Brown	738	0.53%
F & M Nunnemaker	738	0.53%
L Banducci	726	0.52%
R Chism	722	0.52%

Table 3-7: Middle Main Eel Planning Watershed Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed**
J Anzini	701	0.51%
R Anzini	691	0.50%
Willison Lumber	689	0.50%

Table 3-8: Acres of Public Lands

Public Land	*Total*
Six Rivers National Forest	3,216
Other BLM	2,679

Figure 3 illustrates current land use and ownership in the Middle Main Eel River Watershed.

Fisheries

The Eel River supports the largest remaining native coho salmon population in California, as well as fall-run Chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey.

The abundance of salmon and steelhead in the Eel River system had been declining over the past 60 years. Factors contributing to the declines are habitat loss caused by timber harvesting practices, associated road building following World War II, as well as certain types of grazing practices, water diversion, and over-fishing.

For a more detailed discussion of the Eel River fisheries, their life stages, and status, the reader is referred to the sections above for the Lower Eel River Watershed and the South Fork Eel River Watershed.

3.2 WATER QUALITY

The EPA has classified the Middle Fork and South Fork Eel as having "less serious problems"; the Lower Eel, however, received a rating of "more serious problems." Presumably this is due to the aggregate strain of the sedimentation loads of the tributaries as well as the regulation of flows by human means.

As with the Lower Eel River watershed, the Middle Eel River has high seasonal rainfall combined with a rapid runoff rate on unstable soils which delivers large amounts of sediments to the river. As a result, The Eel River may transport more sediments than any other river of its size in the world, due to heavy winter rainfall running through highly unstable soils. These sediments are deposited throughout the lower gradient reaches of the system.

With or without changes in the channel from increases in coarse sediment, salmon are negatively affected by the additions of fine sediment. Fine sediment smothers spawning sites, reducing the ability of salmon to reproduce successfully.

The North Coast Watershed Assessment Program (NCWAP) is a multi-agency approach to gathering, developing, analyzing and presenting watershed assessments and data for north coast

watersheds. In addition to the NCRWQCB, four agencies within the Resources Agency are involved: Department of Fish and Game, Department of Forestry and Fire Protection, Division of Mines and Geology, Department of Water Resources. Each has specific tasks relating to gathering existing data, filling information gaps by collecting new data, analyzing the data, and presenting the resulting watershed assessments in a standardized format for agency, landowners, and watershed groups. Within the watershed management area the Middle Fork Eel River is scheduled for assessment in FY 2002-03.

The Watershed Management Initiative (WMI) of the Basin Plan of the Regional Water Quality Control Board contains the following goals for the Middle Eel River Watershed:

A primary goal is to protect and enhance the salmonid resources. The cold water fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality. The following Nonpoint Source issues were identified by the Regional Water Board staff and relate directly to concerns about the cold water fishery:

- Stream Sedimentation: A large portion of the watershed supports commercial timberlands, and concern has been raised regarding the past and present impacts of timber harvest. Logging roads are a concern due to increased runoff and delivery of sediment to local waterbodies on private and federal lands. There is a need to provide a clear linkage between numerous small upland or upslope activities and larger problems downstream in the waterways. Changes in the morphology of channels have occurred from increased sedimentation rates; shallower, wider channel form increases insolation, decreases low flow velocity, increases deposition of very fine material. Sedimentation of small streams in the Eel River delta has caused localized flooding and accelerated erosion in some cases from redirected stream channels. Gravel extraction increasing in the upper Eel watershed is a concern. The regulation of gravel extraction is primarily through a US Army Corps and California Department of Fish and Game process.
- Past and current timber harvest practices have decreased the canopy cover over tributaries and the mainstem of the river. Lack of canopy cover increases the solar radiation reaching the water and increases water temperature. High water temperatures are detrimental to cold water fisheries' reproduction.
- Potential impacts from dairies and grazing have not been fully evaluated. Concern has been raised regarding dairy industry and grazing impacts to the watershed from direct discharges of waste and/or whey, animals in the creeks and waterways, trampling of stream banks, and other erosion mechanisms. Dairies should be brought up to Title 27 standards. Grazing issues include erosion and sedimentation, and water chemistry issues.
- Ground water contamination concerns, as well as erosion and sedimentation issues should be included in outreach and education activities. Problem sites should receive progressive enforcement per the State's Nonpoint Source Pollution Control Program.
- Herbicide application on private and public lands is a water quality concern.
- Interbasin transfers of water and regulated flows from dams affect sediment, flow, and temperature dynamics. These activities may contribute to the impairment of the beneficial uses.
- The seasonal erection of Benbow Dam has raised temperature and migration issues for anadromous salmonids.

Additionally, the WMI includes a Nonpoint water quality management strateby for the Middle Fork of the Eel River:

- Implement and enforce best management practices for nonpoint source regulation. These actions include inspection of nonpoint source dischargers, joint participation among landowners, government agencies, and other stakeholders to develop and implement better land-use practices, and follow road construction and maintenance standards that minimize soil disturbance and erosion throughout the watershed.
- Work with the timber industry to address timber harvest impacts and issues (i.e., erosion, herbicides and riparian management). Work with USFS regarding timber harvest related activities, including road building and road abandonment, in the upper Eel River Basin.
- The North Fork, Middle Fork, and upper mainstem Eel are scheduled for sediment and temperature TMDLs in 2002, 2003, and 2004, respectively. The process to establish sediment reduction strategies will involve considerable public outreach, assessment of sources, assessment of impairments, development of quantifiable targets, consideration of feasible solutions to reduce sources, and coordinated monitoring. The RWQCB will work with EPA on TMDL development and implementation/outreach, and prepare for Basin Plan amendments.
- Investigate herbicide impacts to surface and ground water.
- Implement and enforce best management practices for nonpoint source regulation for herbicide applications, increase interagency coordination and use task force to target bad operators. Investigate herbicide impacts to surface and ground water. Work with CalTrans on NPS discharges from roadwork.
- Promote grants for nonpoint source studies and implementation.
- Manage funded 319(h) projects, including the new project for dairy outreach and pollution control activities.

The NCWAP will begin assessment activities in the Middle Fork Eel River watershed in FY 2002-03, as part of the effort to satisfy a number of assessment concerns and provide the assessment and data in a computerized database that can be housed in the watershed.

Table 3-9: Middle Main Eel River Planning Watershed
Physical and Biological Characteristics

Miles of Road by Type		
Road Type	*Total in Humboldt County*	*Total in Watershed*
improved	96	132
unimproved	267	747
Miles of Streams by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	335	774
2	74	178
Miles of Streams by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
3	34	90
4	22	43
7	39	79

Table 3-9: Middle Main Eel River Planning Watershed
Physical and Biological Characteristics

Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	117	117
Annual Grass	29,506	69,977
Barren	2,451	4,752
Chaparral	898	4,931
Fir Forest	46,104	95,521
Oak Woodlands	43,629	134,463
Pine Forest	2,477	8,932
Redwood	13,029	13,029
Riparian	98	113
Urban	35	35
Water	165	842
Wetlands	0	42
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	882	2,531
Cenozoic Sedimentary	18,656	18,656
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	118,970	312,157
Acres of Public Lands		
Public Land	*Total*	
Six Rivers National Forest	3,216	
Other BLM	2,679	

Figure 3-1: Middle Main Eel Planning Watershed

4 Lower Klamath Watershed

4.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The State Water Resources Control Board has identified the Klamath River Watershed Management Area (most of that portion of the overall Klamath River Basin which is within the State of California) and the area has been divided into three sub-basins: Lower Klamath, Middle Klamath and Upper Klamath. This division facilitates recognition of its diversity in climatic and geologic facets and land uses that affect water quality in different ways in different sub-areas of the basin. In addition to this, for-convenience segmentation of the watershed area within California, it is recognized that roughly half of the watershed is north (and mostly upstream) of the California-Oregon state border. This "segment" of the basin in Oregon has profound effects on the quality and quantity of the Klamath River in California. The Trinity River watershed, though within the overall Klamath "Basin," is not included in the Klamath River Watershed Management Area.

The Lower Klamath subwatershed encompasses that portion of the Klamath River and its tributary watershed downstream from the Scott River to the Pacific Ocean (excluding the Trinity River), and is 2,564 square miles in area. Included in the watershed are the Salmon River, Blue Creek, numerous smaller perennial streams, and the Klamath River delta/estuary. The area is largely rugged, steep forest land with highly erodable soils. The population of the area is small and scattered. Predominant vegetative cover types consist of fir forest, oak woodlands, pine forest, chaparral and redwood.

A pattern of extreme floods and droughts has appeared to be the norm during the 20th Century in the Klamath Basin. For the Orleans area, records indicate that the 1920s were the driest decade, the 1950s were the wettest decade, and the 1980s were average. Flooding of extreme magnitudes occurred in December 1995, December 1964, and February 1974. In a study of historic and prehistoric flood deposits and botanical evidence in the Klamath River Basin, major flood events similar in magnitude to the 1964 flood occurred around 1600 and again about 1750. Less intensive floods recur anywhere from two to fifty year intervals. The intensity of flooding also varies with location in the Basin.

In terms of geology, the Humboldt County portion of the Klamath River Basin encompasses the North Coast Ranges province. In the North Coast Ranges, landslides and soil slips are common due to the combination of sheared rocks, shallow soil profile development, steep slopes, and heavy seasonal precipitation.

Table 4-1: Acres of Bedrock Type

Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	66,767	94,293
Cenozoic Sedimentary	3,240	9,032
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	262,780	389,877
Water and/or Unclassified	0	251

Habitats. Within Humboldt County, the vegetative cover of the watershed consists predominantly of forested communities, including: fir forest (40.26%), oak woodlands (31.68%), and pine forest (17.9%). Including redwood and riparian habitats the total percentage of the watershed that is forested is 94.4%.

Table 4-2: Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*	*Total in Watershed*
Agriculture-Crops	0	0	339
Annual Grass	4,339	1.30	5,190
Barren	2,693	0.81	4,000
Chaparral	9,484	2.85	15,121
Coastal Scrub	1,019	0.30	2,914
Fir Forest	134,084	40.26	211,821
Oak Woodlands	105,480	31.68	119,105
Pine Forest	59,607	17.90	89,897
Redwood	7,275	2.18	24,176
Riparian	7,954	2.39	18,138
Urban	6	0.002	329
Water	1,030	0.31	2,159
Wetlands	1	0.0003	60
	332,972		

Land Use

The Lower Klamath watershed is dominated by montane hardwood forest (to the west) and Douglas fir (to the east), with montane chaparral and Klamath mixed conifer forest present in the central watershed. The U. S. Forest Service manages the majority of the forest lands in the basin. Six Rivers National Forest was created in 1947 from parts of the Klamath, Trinity, and Siskiyou national forests. Public ownership of forest land in the basin was centered in the remote areas, especially on the upper watersheds of the many full-flowing streams. Private timberlands originally developed on the more accessible tracts, which were nearest the two ends of the Klamath Basin with access to interstate highways or railroads. Each of the three tribes of the area has some forest land within its jurisdiction, ranging from 76,000 acres for the Hoopa Valley Tribe, to 3,840 acres on the Yurok Reservation, to about 100 acres for the Karuk Tribe. Most of these sites were logged in recent decades.

Approximately 67% of the Lower Klamath watershed is within Humboldt County, and the average parcel size in the county is 162.26 acres. The largest single landowner in the county is Simpson Timber and the dominant land uses are timber production and open space/parks.

Table 4-3: Lower Klamath Planning Watershed Characteristics

Characteristic	*Value*
Total Acres	493,453
Total Acres within County	332,787
% of Total within County	67%
Average Parcel Size (Acres)	162.26
Largest Watershed	Klamath River
Dominant Land Uses	Timber Production & open space/parks
Largest Private Land Owner	Simpson Timber

Table 4-4: Lower Klamath Planning Watershed Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
timber production	150,785	45.31%
open space/parks	144,367	43.38%
tribal lands	23,623	7.10%
rural residential - vacant	7,047	2.12%
rural residential	5,219	1.57%
grazing/timber	746	0.22%
public	617	0.19%
vacant	15	0.00%
church	5	0.00%
single family residential	2	0.00%
commercial	2	0.00%

Timber production and open space/parks account for over 88% of the land use in the watershed, while tribal lands and residential uses account for a little over 10% of the land use. Vacant rural residential lands amount to 7,047 acres.

Table 4-5: Lower Klamath Planning Watershed Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed*
Simpson Timber	117,497	35.31%
Soper-Wheeler Company	9,866	2.96%
Yurok Tribe	6,087	1.83%
G & G Trust	3,035	0.91%
S Kahn	2,844	0.85%
Hope Enterprises	2,086	0.63%
L & M Downs	1,041	0.31%
G Graves	937	0.28%
Eel River Sawmills	924	0.28%

A significant portion of the watershed is public lands, with the largest single land ownership represented by Six River National Forest:

Table 4-6: Acres of Public Lands

Public Land	*Total*
Six Rivers National Forest	138,829
Hoopa Valley Indian Reservation	18,701
Other Federal Lands	2,912
Other Tribal Lands	1,748
Redwood National Park	1,485

Figure 4 illustrates current land use and ownership in the Lower Klamath River Watershed.

Fisheries

According to the Department of Fish and Game,3 the Lower Klamath River supports a number of anadromous fish species including spring, fall and late fall-run Chinook salmon, coho salmon, fall, winter and summer-run steelhead trout and coastal cutthroat trout. The mainstem Lower Klamath River provides habitat for all life stages of Chinook salmon, coho salmon, and steelhead trout.

Chinook. The Six Rivers National Forest portion of the Lower Klamath watershed includes several important spawning tributaries for salmon and steelhead. Spawning escapement levels for natural fall-run adult chinook salmon in the Klamath-Trinity basin between 1981 and 1991 averaged 45,500 per year. However,, the 1990 and 1991 natural escapement have averaged only 12,000 fish, the lowest returns since 1978. The California Department of Fish and Game estimates that an escapement of as much as 106,000 fall-run chinook salmon are needed to adequately occupy the currently available spawning habitat in the Klamath-Trinity River system. Although both quality and quantity of available spawning habitat have declined, the low number of fall chinook salmon returning to spawn is presently the dominant constraint upon recovery of this population. The reasons for the decline of Klamath fall chinook have been conjectured to be flow reductions caused by drought conditions, reduced ocean productivity, over-harvest and high-seas drift net fisheries.

Coho. Coho occur in low numbers in forest tributaries of the Lower Klamath watershed. The coho population in the Klamath is primarily supported by a hatchery program. The available habitat for naturally spawning coho currently is very under utilized.

Steelhead. Steelhead provide a major sport fishery in the Klamath-Trinity River system. Returns of steelhead to two hatcheries had declined in 1992 to only 10% of previous returns. The system is known for its "half-pounder," a steelhead up to 16" in length that returns to fresh water after only a few months in the ocean. The "half-pounder" is found in only three rivers in the world: Klamath-Trinity and Eel in California, and the Rogue in Oregon. For most steelhead (exclusive of the "half-pounder"), after living about eight months in fresh water, they return to the ocean, grow there for one to two years, and immigrate up-river again to spawn. Steelhead are eagerly sought, especially by fly-fishers, because of their gameness and aggressiveness in taking a fly. The "half-pounder" provides a major share of the sport fishery value of the Klamath-Trinity River system.

Tribal fisheries include the Yurok, Hoopa, and Karuk. Yurok tribal memebers conduct both subsistence and commercial gill net fisheries in the Klamath River between the Trinity River and the Klamath's mouth. Most of the Yurok fishing effort occurs in the estuary near Highway 101. Since passage of the 1988 Hoopa-Yurok Settlement Act, Hoopa Valley Tribal members fish exclusively on the Trinity River which flows through their reservation. The Hoopas' harvest of fall run chinnok has ranged from 2,000 to 5,000 since 1985, and their take of spring chinook salmon has ranged from 1,000 in 1985 to 4,200 in 1987. The Hoopas take coho, steelhead, and green sturgeon incidentally during their spring and fall chinook salmon gill netting. Members of the Karuk Tribe have fishing privileges in the half mile of the Klamath River below Ishi Pishi Falls, near the Humboldt-Siskiyou county line. Traditional Karuk fishers use hand-held dip nets to snatch salmon from the turbulent water below the Falls, and take far fewer salmon than the downstream Tribal fishers.

Recreational fishery includes river anglers who pursue steelhead, coastal cutthroat trout, shad, and sturgeon in addition to chinook and coho salmon. Anglers harvest the fall chinook mainly along the Yurok Reservation in the lower Klamath where the fish's eating quality is still good during the late summer. However, the steelhead fishery is probably the Klamath River region's greatest attraction.

4.2 WATER QUALITY CONCERNS

Summer temperatures (reaching a high of 80 degrees Fahrenheit) and low dissolved oxygen have combined to form an environment often lethal to riparian salmon. Some cold-water regions have ameliorated the conditions for local fish.

The Water Quality Control Plan for the North Coast Region (Basin Plan) and the Watershed Management Initiative recognize that the Klamath watersheds are culturally, climatically and geologically diverse. The watershed provides some of the highest-quality water resources of the Region, yet it simultaneously produces some of the most-challenging water-resource conflicts. The Basin Plan contains specific water quality objectives for many index points within the Basin and it provides implementation programs to protect and enhance identified beneficial uses of water. The over-arching regulatory provision of the Basin Plan is its discharge prohibitions section, which prohibits direct waste discharge to all freshwater surface waters in this management area. The one exception to this prohibition results from the situation of City of Tulelake at a place that was once submerged by the waters of Tule Lake.

Water quality issues have arisen as a result of unauthorized discharges or inadequately treated residential sewage. In one past instance, the Regional Water Board adopted enforcement measures and sponsored grant funding assistance for the community of Happy Camp where flood damages caused raw sewage discharges. This issue was resolved after a community-wide sewerage system was built. Other issues have included:

- Several to-the-river garbage dumps have been abated;
- Many mill sites and industrial/commercial activities which had direct discharges and spilled
- petroleum products have been cleaned up;
- Acid-drainage-producing mine waste sites also are under regulation by the Regional Water
- Board.

While such "past" issues now require diligent regulation, today's water quality issues in the sub-basin are related to the salmonid-habitat qualities of the mainstem river and the effects of silvicultural activities on both federal and private lands to the tributaries. These issues include high summertime temperatures, sedimentation, erosion, mass wasting and stream modifications which affect salmonid habitats, and forest land herbicide applications which threaten domestic water supplies.

The Regional Water Quality Control Board staff has coordinated assessment activities in the basin to enhance communication, identify water quality issues, identify water quality monitoring needs, and improve coordination amongst agencies and public interest groups.

The Klamath River Basin Fisheries Task Force (KRBFTF) was authorized by Congress in 1986 and is overseeing a 20-year effort to restore salmonid fishery values to the Klamath watershed. It is headed by a multiple representative Task Force that makes funding, management, and scheduling decisions regarding fishery restoration efforts in the watershed. We coordinate our activities closely with the KRBFTF.

The Klamath Basin Ecosystem Restoration Office (ERO) is mandated and funded to coordinate ecosystem restoration in Oregon's portion of the basin. It also holds an annual conference in the

upper basin to further communication and acts as a clearinghouse for information and coordination. The federal Bureau of Reclamation, Fish and Wildlife Service and National Biological Service all are actively involved in the ERO.

The general emphasis in the watershed is to continue interagency coordination, assess existing conditions and uses, focus reduction efforts for sediment, nutrient and oxygen-demanding loadings to selected sub-watersheds, assess conditions and operations to determine where water temperature and nutrient improvements are feasible, and support efforts to improve riparian areas. Plans include efforts to increase assessment, evaluate objectives attainment, and maintain the nonpoint source grant program.

Monitoring. Long-term monitoring is a goal for the entire WMA. The North Coast Watershed Assessment Program will be a priority for the Klamath watersheds in the near term. Significant Regional Water Quality Control Board staff resources and contract funds will be expended by the program in performing the watershed assessments.

Ground water. The underground storage tank program and remedial work on existing localized ground water
contamination will continue. Continued outreach regarding hazardous waste handling and potential ground water contamination is a priority in preventing future problems.

Nonpoint Source Program. The Regional Water Quality Control Board will continue to work with local agencies and groups regarding land use effects on water quality, following the State Nonpoint Source Pollution Control Program strategy of first emphasizing voluntary implementation of controls to reduce nonpoint source pollution.

Timber Harvest. The Regional Water Quality Control Board has an extensive Timber Harvest program where staff review and inspect timber harvest plans for implementation of the Forest Practice Rules and best management practices to ensure protection of water quality and beneficial uses. They are expanding their program activities on private land in concert with California Department of Forestry and Fire Protection. They are also expanding their review and inspection of timber sales as well as other projects on U.S. Forest Service lands. Additional funding is needed to implement the non-timber NPS activities of the Management Agency Agreement (MAA) between the USFS and the SWRCB.

This WMA unit encompasses the Smith River and all the Klamath River with in California. An estimated 20% of the timber harvested in the Region occurs in this hydrologic area. Aerial and ground application of herbicides is an issue with the Native Americans of this area. The USFS is the single largest landowner and is protecting water quality through the implementation of Management Agency Agreement with the State Water Resources Control Board. The primary water quality issues are recovery of threatened and endangered species of coho salmon and steelhead trout and protection of domestic water supplies in small rural communities.

Water Quality Planning. The Basin Plan review process necessarily feeds into the activities in this WMA to the extent issues are identified that affect the Klamath River WMA:

- review of water quality problems in the Lost, Klamath, Scott, and Shasta rivers
- evaluation of dissolved oxygen and temperature objectives,
- consideration of a nutrient objective,
- review of Nonpoint Source Control Measures.

Table 4-7: Lower Klamath River Planning Watershed
Physical and Biological Characteristics

Miles of Road by Type		
Road Type	*Total in Humboldt County*	*Total in Watershed*
improved	126	161
primary	1	13
secondary	29	38
unimproved	988	1,406
Miles of Streams by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	544	854
2	155	243
3	112	171
4	46	77
5	9	10
6	23	23
8	31	43
Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	0	339
Annual Grass	4,339	5,190
Barren	2,693	4,000
Chaparral	9,484	15,121
Coastal Scrub	1,019	2,914
Fir Forest	134,084	211,821
Oak Woodlands	105,480	119,105
Pine Forest	59,607	89,897
Redwood	7,275	24,176
Riparian	7,954	18,138
Urban	6	329
Water	1,030	2,159
Wetlands	1	60
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	66,767	94,293
Cenozoic Sedimentary	3,240	9,032
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	262,780	389,877
Water and/or Unclassified	0	251

Table 4-7: Lower Klamath River Planning Watershed
Physical and Biological Characteristics

	Acres of Public Lands
Public Land	*Total*
Six Rivers National Forest	138,829
Hoopa Valley Indian Reservation	18,701
Other Federal Lands	2,912
Other Tribal Lands	1,748
Redwood National Park	1,485
Prairie Creek Redwoods State Park	705

Table 4-8: Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*	*Total in Watershed*
Agriculture-Crops	0	0	339
Annual Grass	4,339	1.30	5,190
Barren	2,693	0.81	4,000
Chaparral	9,484	2.85	15,121
Coastal Scrub	1,019	0.30	2,914
Fir Forest	134,084	40.26	211,821
Oak Woodlands	105,480	31.68	119,105
Pine Forest	59,607	17.90	89,897
Redwood	7,275	2.18	24,176
Riparian	7,954	2.39	18,138
Urban	6	0.002	329
Water	1,030	0.31	2,159
Wetlands	1	0.0003	60
	332,972		

Figure 4-1: Lower Klamath Planning Watershed

5 South Fork Trinity River Watershed

5.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The 1998 U.S. EPA Total Maximum Daily Load (TMDL) Study summarizes the physical and biological setting in the watershed as follows.

"The South Fork Trinity River is a tributary to the Trinity River, in the Klamath River Basin of northern California. The watershed is primarily forested, and is located within Trinity and Humboldt Counties.

The South Fork originates in the North Yolla Bolly Mountains about 50 miles southwest of Redding, and runs northwest for approximately 90 miles before reaching its confluence with the Trinity River near Salyer. It flows mostly through Trinity County, forming the boundary between Trinity and Humboldt Counties in its lower 12 miles. The South Fork Trinity River is the largest undammed river in California, and constitutes 31 percent of the Trinity River sub-basin, and 6 percent of the Klamath basin (USDA FS 1998). The 56 mile stretch from Forest Glen to the mouth is protected by the California Wild and Scenic Rivers Act."

Using the Strahler stream order classification system, there are 2,522 miles of streams in the South Fork Trinity River (SFTR) Planning Watershed with 2,310 miles in Trinity County and 212 miles in Humboldt County. In Humboldt County, approximately 78% of the streams fall in orders 1 or 2: (the smallest tributaries). Only 13% of the streams are classified in orders 4-7. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75% of the streams in orders 1 and 2, and 12% in orders 4-8. The smallest planning watershed in Humboldt County, the Jacoby Creek Watershed, has 35 miles of streams in Humboldt County with 78% in orders 1 and 2, and the remaining 22% in order 3: (*Note: as an order 1 stream connects with another order 1 stream, the stream becomes an order 2 stream; as an order 2 stream connects with another order 2 stream, the stream becomes an order 3 stream, and so on*).

Vegetative cover within the watershed in Humboldt County consists primarily of Timberlands and Oak Woodlands: (73% in Fir, Redwood and Pine, and 19% in Oak Woodland). The remaining vegetative cover is in Chaparral (6%) and other vegetative cover types (2%).

90% of the bedrock underlying the watershed is Sedimentary and Metasedimentary.

The EPA report goes on to say that: "The fishery in the South Fork has declined dramatically since the flood of December 1964. Unstable geology and erosion-producing land use practices have been blamed for the many mass wasting events triggered by that flood, which resulted in dramatic instream changes, including channel widening, aggradation, and loss of pool depth, all of which adversely affect the fishery. Since that time, further channel changes suggest improvements in some locations, while continued, chronic sediment inputs may be hindering a more complete or faster recovery overall. The chinook salmon spawning run has increased slightly in the last several years, and sediment slugs continue to move downstream, which may suggest the beginnings of a trend toward recovery.

For purposes of characterizing watershed conditions and water quality concerns, the US Environmental Protection Agency (EPA) has divided the watershed into three main sub-basins: the upper South Fork sub-basin, from the headwaters to its confluence with Hayfork Creek; the lower

South Fork sub-basin, including tributaries that drain directly to the South Fork Trinity River from the Hayfork Creek confluence downstream to the confluence with the mainstem Trinity River (not a sub-basin in the hydrological sense since it is downstream of the other two sub-basins); and the Hayfork Creek sub-basin.

These three sub-basins are distinct from one another. The Upper South Fork sub-basin is fairly steep and mountainous, with highly erodible, steep, short tributaries west of the mainstem and steeper but more lengthy and complex tributaries east of the mainstem. Tributaries entering the Lower South Fork are similar, although the mainstem itself includes a very low gradient reach in the Hyampom Valley as well as a steeper reach downstream of that flowing through an entrenched gorge. The Hayfork Creek sub-basin, which is particularly distinct from the Upper and Lower South Fork Trinity River sub-basins, is relatively stable geologically. The forested headwaters contain high gradient reaches of the stream, leading to the broad, flat Hayfork Valley, leading to a steeper reach entering the mainstem South Fork Trinity River at the Hyampom Valley.

The South Fork Trinity River drains an area containing steep, unstable slopes adjacent to some of the most rapidly eroding terrain in the United States. Rivers to the south and west, such as the Eel, have some of the highest recorded suspended sediment loads in the world (Judson and Ritter, 1964). The South Fork basin straddles the boundary between the Coast Ranges and the Klamath Mountains geologic provinces.

The Coast Ranges are underlain by the Franciscan Assemblage, a highly deformed, faulted and sheared complex of partly metamorphosed marine sedimentary and volcanic rocks. Geologic units in the Coast Range Province include the South Fork Mountain Schist, which is highly erodible. Units in the more stable metamorphic and intrusive basement of the Klamath Mountains geologic province include the Galice Formation, Rattlesnake Creek Terrane and the Hayfork Terrane, which includes scattered granitic and ultramafic intrusions.

92% of the bedrock underlying the watershed is Sedimentary or Metasedimentary. Areas to the east of the mainstem, including most of the Hayfork Creek sub-basin, are generally more stable than the steep slopes of South Fork Mountain and the lower basin. Very high and extreme rated areas are almost exclusively found on the eastern slope of South Fork Mountain (primarily the west side of the South Fork mainstem, including the Grouse Creek, Old Campbell Creek and lower mainstem areas), while the Hayfork Creek basin and much of the upper South Fork sub-basin, particularly east of the mainstem, is considered to represent only moderate hazard.

Precipitation is highly seasonal, typical of California, with 90 percent falling between October and April. A portion of the annual precipitation falls as snow at the higher elevations (generally higher than about 2,000 ft). Annual precipitation ranges from about 35 inches in the Hayfork Valley to over 80 inches on the west side of the basin along the northern end of South Fork Mountain. Generally, unstable areas on the west side of the South Fork mainstem also receive the highest rain and snowfall. The combination of heavy rainfall and unstable geology results in highly unstable landscape in the western portion of the basin.

Occasionally, rain falls on the existing snowpack, which can result in exceptionally intense flooding. The basin landscape and its responses to management activities reflect its geology. Accordingly, where feasible, the TMDL presents information or recommendations relative to geology. To the extent that information is available, the TMDL discusses specific locations where water quality standards are being met, and focuses on areas where the sources of sediment are most problematic and where corrections are most achievable."

The following table summarizes the physical and biological characteristics within the South Fork Trinity River Planning Watershed.

Table 5-1: South Fork Trinity River Planning Watershed
Physical and Biological Characteristics

Miles of Road by Type		
Road Type	*Total in Humboldt County*	*Total in Watershed*
Improved	39	97
Secondary	0	53
Unimproved	182	2,208
Miles of Streams by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	129	1,486
2	37	521
3	18	240
4	9	138
5	0	49
6	0	57
7	19	31
Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	0	442
Annual Grass	568	6,920
Barren	370	2,119
Chaparral	4,590	24,950
Fir Forest	41,202	444,625
Oak Woodlands	13,496	50,574
Pine Forest	12,377	64,218
Redwood	0	51
Riparian	468	1,179
Urban	0	484
Wetlands	14	519
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	6,153	92,089
Cenozoic Sedimentary	0	21,979
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	67,051	480,606
Acres of Public Lands		
Public Land	*Total in Humboldt County*	
Six Rivers National Forest	52,336	

Land Use

Approximately 80 percent of the basin is public land managed by the U.S. Forest Service (USFS), with about a third of that managed by Six Rivers National Forest in the lower portion of the basin, and the upper two thirds managed by Shasta-Trinity National Forest. The U.S. Bureau of Land Management (BLM) manages a small parcel in the basin. Three timber companies, Simpson Timber Company, Sierra Pacific Industries and Forest Products, own parcels in several tributaries. The remainder of the watershed is owned privately, by individuals for residences and, particularly in the Hayfork Valley, used for agricultural operations.

There are no formal tribal lands in the watershed, but two Indian tribes, which are not formally recognized by the federal government at the present time, claim ancestral rights to lands in the upper South Fork (Nor Elmuk Band of Wintu Indians) and Madden (Old Campbell) Creek, a tributary to the lower South Fork (Tsnungwe Tribe). The Hoopa Valley Tribe also claims ancestral rights to tributary areas of the lower South Fork. However, there is no formally recognized Indian Country in the basin.

The Humboldt County GIS mapping identifies the following land use and ownership in the portion of the watershed that is located within Humboldt County. Approximately 72% of the land in the watershed in Humboldt County is in public ownership.

Table 5-2: South Fork Trinity Planning Watershed Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
open space/parks	52,382	71.56%
timber production	20,074	27.42%
rural residential - vacant	498	0.68%
rural residential	251	0.34%

Table 5-3: South Fork Trinity Planning Watershed Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed**
Timber Products Company	5,731	7.83%
Simpson Timber	1,936	2.64%
James Russ	1,736	2.37%
Eel River Sawmills	1,604	2.19%
R & S Cook	1,557	2.13%
Soper-Wheeler Company	1,284	1.75%
Spalding & Son	1,234	1.69%
R Emmerson	921	1.26%

There are over 2,500 miles of improved and unimproved roads within the SFTR planning watershed. In Humboldt County, there are 39 miles of improved roads and 182 miles of unimproved roads.

Figure 5 illustrates the current land use and ownership in the portion of the South Fork Trinity Watershed within Humboldt County.

Fisheries

The US EPA TMDL study of 1998 summarized the status of the fishery in the South Fork Trinity River as follows.

"Six known stocks and runs of anadromous fish utilize the South Fork Trinity River watershed. The most abundant historically is the spring-run chinook salmon (*Oncorhyncus tshawytscha*). The second most abundant, historically and currently, is the fall-run chinook, which is also a significant indicator of the fish population in the basin. Other cold-water species include winter and summer steelhead (*O. mykiss*), coho salmon (*O. kisutch*), and pacific lamprey (*Lampetra pacifica*). Chum salmon (*O. keta)* have been infrequently observed in the watershed (PWA1994).

Although relatively little data exist to document the historical fish population, there are many accounts of an abundant fishery, ie. "A local fisherman reports that the South Fork of the Trinity River is full of salmon and small trout and there is one hole in which there is at least 1,000 salmon." (Trinity Journal, 1936, as reported in PWA 1994). Fish counts declined dramatically following the December 1964 flood. For example, in 1963 and 1964, the spawning spring chinook population was estimated at 10,000 or more fish; complete surveys were not conducted in the 1960s following the December 1964 flood, but estimates in the period that followed that flood ranged from as few as a dozen in some years during the 1970s and 1980s. Fall-run chinook spawners were estimated at over 3,300 in 1963. Later counts estimated 500 or fewer fish in the late 1980s, with somewhat higher numbers documented only in the last few years (as high as 1,835 in 1996) (Healey 1963, LaFaunce 1967, LaFaunce 1975, Jong & Mills 1994, PWA 1994, Jong 1997). Other species, including steelhead, also declined in number, although data are more scarce.

While many of the past and present effects of the December 1964 flood are part of the natural variation in sediment supply, it is clear that additional stresses have been caused by management activities. The oversupply of sediment in the South Fork basin resulted in pool filling, decreased spawning habitat, lowered invertebrate production and increased temperatures (PWA 1994).

Land management activities that historically and currently contributed to the decline in the cold water fishery include: timber operations, with road building on erodible terrain likely being the greatest cause of concern; agricultural operations such as ranching, with bank erosion contributing to excess sediment and diversion of water leading to higher water temperatures and nutrient contributions; and mining operations, although there are very few mining operations in the basin. Residential land uses probably do not contribute significant amounts to the problem."

The 1998 U.S. EPA study summarized water quality concerns in the South Fork Trinity River Watershed as follows.

"Past and present land use practices have accelerated natural erosion processes in the South Fork Trinity River basin, resulting in increased sedimentation in the river channels and decreased support of the cold water fishery, evidenced by significantly decreased runs of spawning salmonids. In particular, available data and anecdotal observations indicate that, following the December 1964 flood, numerous landslides and debris flows delivered considerable quantities of sediment to the stream channel in some reaches, resulting in formation of river deltas in some locations, channel aggradation and widening, decreased depths and numbers of pools, decreased numbers of fish, increases in fine sediments in the bed material, and, apparently, increases in temperatures associated with decreased depths and loss of riparian canopy (Haskins & Irizarry 1988, PWA 1994, Matthews 1998). The overall quantity of sediment delivery to the stream has decreased since then, but chronic inputs of sediment from roads as well as episodic inputs from washouts and mass wasting continues (Matthews 1998, Raines 1998, D. Hagans, pers. comm. 1998, M. Smith, pers. comm. 1998).

Limitations to the water quality related to the effects of accelerated erosion rates are not equally distributed throughout the basin. The worst effects have been found in the more erodible portions of the basin in the Upper and Lower South Fork sub-basins, particularly west of the mainstem, and in areas where land management practices are most intense. Smaller tributaries generally have been affected less severely than mainstem lower gradient reaches. The impacts have been most notable in the Hyampom Valley, with most of the sediment being delivered from South Fork Mountain tributaries, particularly Grouse Creek and Pelletreau Creek subwatersheds, both of which have been heavily logged since the 1940s (PWA 1994).

The logging boom expanded through the basin in the 1960s, and probably exacerbated the detrimental effects of the 1964 flood. In particular, many logging practices on the erodible geology of the western basin altered the natural hillslope hydrology--e.g., through construction of roads and stream crossings--causing additional erosion and sediment impairment. Continued accelerated sediment production is found in many of these areas, particularly where large-scale forest fires have further exacerbated the problems. Some continued in-channel changes are also part of the natural cycle of adjustments to natural and management-induced events that would be
expected following a major disturbance such as the 1964 flood.

The Action Plan for Restoration of the South Fork Trinity River Watershed and its Fisheries (PWA 1994) contains a summary of known resource conditions and constraints. Its main recommendations for restoration in the basin include reducing future sediment yield to the South Fork Trinity River. It also includes recommendations related specifically to temperature reductions, which this TMDL does not specifically address. Several members of the South Fork CRMP (Coordinated Resource Management Plan) group have begun to investigate the temperature issue in the South Fork basin (Farber et. al 1998)."

The 1998 EPA Study concludes that:

"For much of the South Fork basin, unstable and highly erodible terrain as well as land management activities have resulted in high sediment yields from landslides. The greatest source of sediment loading is mass wasting not associated with management sources. Lands west of the South Fork mainstem are particularly susceptible both to natural mass wasting and to accelerated mass wasting from management activities. The rates of sediment loading generated from these areas are significantly greater than that from other locations.

Overall sediment loading for the 1944-1990 period averaged 1,053 tons/mi2/yr. Based on the analyses conducted for this TMDL, it is estimated that about two-thirds of sediment load is associated with natural sources and about one/third has been associated with various land management activities. It is likely that some sources of mass wasting are misattributed. The rates vary by location, with about 2,385, 1,050, and 361 tons/mi2/yr in the Lower South Fork, Upper South Fork and Hayfork Creek sub-basins, respectively. By far the highest rates are found in the seven subwatershed areas in the most erodible geologic terranes west of the South Fork Trinity River mainstem, which are dominated by mass wasting processes.

Sediment delivery associated with mass wasting from all source categories in the 1975 to 1990 period has decreased significantly over the previous period, probably due to factors including:

The December 1964 flood and other storms during the 1960-1975 period triggered some landslides that might have otherwise been triggered in the later period.
Storm and flood events were less likely to trigger large landslides in the later period, both due to the character of the events (lower antecedent moisture prior to a peak flow, for example) and in some cases due to lower intensities (prolonged periods of drought with a few large peak flows in between).

Less intensive and more protective land management practices, such as implementation of Forest Practice Rules and reductions in harvest activities following the listing of the Northern Spotted Owl in 1990 (A. Kallis, pers. comm. 1998).

Surface erosion and washouts and gullying from roads has more than doubled during 1975 to 1990, compared to the 1944 to 1960 time period, in contrast to the reduction of mass wasting in the later period. This may be due to large storms in combination with a much larger road network, more harvested acres, numerous inadequately maintained roads and undersized drainage structures.

Roads generate about twice the levels of sediment loading as timber harvesting. Roads are the most significant component of management-related sediment production. In the Hayfork Creek sub-basin, roads and bank erosion are the most significant components of the overall sediment production, largely due to the fact that mass wasting is a much less significant process in that sub-basin.

The average annual loading rates derived for this TMDL provide useful information for planning only when a longterm monitoring and analysis horizon is applied. Evaluation of sediment loading dynamics over short time periods (e.g., less than about 10 years) is unlikely to yield meaningful results, given that the South Fork basin sediment loading is dominated by infrequent, high magnitude events. Recovery from those events, which can occur naturally but are clearly exacerbated by management activities, can take many decades to complete.

Decreased land management activities have probably reduced present-day rates of sediment production over those determined in the sediment budget process."

5.2 TMDL TARGETS AND RECOMMENDATIONS

The 1998 US EPA Study established the following TMDL limits.

"The South Fork basin allocations have been developed for erosion processes (associated with land use activities where feasible) based on the source analysis. The load allocations have been developed as long term annual average loads per square mile at the basin-wide and sub-basin scales. Sediment storage was not factored into the TMDL, loading capacity, and allocation calculations.

The TMDL for the South Fork is being expressed as long-term annual average sediment loading per square mile for the entire basin. This meets the regulatory definition that "TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure." (40 CFR 130.2). This annual TMDL could be converted into daily loads, but expressing the TMDL as an annual average yield is more appropriate for sediment loading. The annual average loading rate for this TMDL should be measured in terms of not less than 10-year rolling annual averages. The longer term annual average timestep is an appropriate approach to account for the large inter-annual variability in sediment loading and the long-term timeframe in which beneficial use impacts occur and change.

This annual average loading per square mile will be referred to as the TMDL for the South Fork Trinity River and Hayfork Creeks. The TMDL is calculated by applying the loading capacity range from the previous section, which was estimated at 737 tons/square mile/year (rounded). The TMDL for the South Fork is therefore estimated to be 737 tons/square mile/year, expressed as 10-year or longer term rolling annual averages.

There are no point sources of sediment discharge in the basin; therefore there are no wasteload allocations. The following are the load and wasteload allocations. The Allocations divide the TMDL among key source categories, including natural background sources. The allocations are derived from

the source analysis. The individual load allocations are based on EPA's assessment of the degree to which loadings from different source categories can actually be controlled or prevented.

The controllable fraction of total loads from each source category was estimated, and the remaining loads by category were summed and compared with the TMDL. This analysis reveals that, with the application of reasonable practices to control and prevent future loading, at least an additional 63 tons/mi2/yr of reductions, or 58,716 tons/yr, would be needed to achieve reductions adequate to meet the TMDL. It is assumed that this amount represents the quantity of sediment produced by management-related mass wasting that was assigned to non-management related causes in the source analysis. If it is determined through further analysis that the quantity of management-related sediment is even greater than the amount that was determined in the source analysis plus the amount allocated to the margin of safety, then the allocations would need to be revised based on that additional information.

Table E-4 summarizes the information used to calculate the individual allocations. The total historical loads estimated for each source category (column a) are provided in column b. Column c provides an estimate of the percent of the historical load that is controllable. The estimate of controllable load in column d was calculated by multiplying the loads from column b by the controllable percentages in column c. Column e is the remaining load, calculated by subtracting the controllable load (column d) from the historical load (column b). Thus, column e becomes the load allocation. There are no point sources in the watershed and none are expected to be proposed in the near future. Therefore, the wasteload allocation for point sources is zero.

Table 5-4: Summary of TMDL and Allocations for the South Fork Basin

a	b	c	d	e
Source Mechanism	**Historic Sediment Load 1944-1990[1] ($t/mi^2/yr$)**	**Percent Controllable[2]**	**Controllable Load[3] ($t/mi^2/yr$)**	**Remaining Load (Allocation)[4] ($t/mi^2/yr$)**
Management Sources				
Harvest-Mass Wasting	75	60%	45	30
Harvest-Surface Erosion	22	85%	19	3
Roads-Mass Wasting	80	80%	64	16
Roads-Surface Erosion	71	85%	60	11
Roads-Washouts, gullies, small slides	42	85%	36	6
Cumulative/Other-MassWasting and Bank Erosion	81	35%	29	52
SUBTOTAL-Harvest	*97*	*66%*	*64*	*31*
SUBTOTAL-Roads	*193*	*83%*	*160*	*33*
Total Management Sources	371	68%	253	118
Non Management Sources				
Mass Wasting	521	0%	0	521
Surface Erosion	16	0%	0	16
Bank Erosion	145	0%	0	145
Total Non Management Sources	682	0%	0	682
Margin of Safety[5]			63	(63)
TOTALS	1,053	30%	316	737

[1] The estimated historic sediment load for each source.

[2] The percent of that historic load that is estimated as controllable. Controllable discharges are those discharges resulting from human activities that can influence the quality of the waters of the State and that can be reasonably controlled.

[3] The load that is estimated as controllable (the percent controllable multiplied by the historic load).

[4] The difference between the historic load estimate and the controllable load estimate. This is the estimated load at which salmonids in the South Fork basin would no longer be limited by sediment. There are no point sources in the basin, and no waste load allocation.

[5] The margin of safety is defined as the portion of the load allocation that is reserved. It is assumed that the reserved load actually represents controllable management sources that have been assigned in the source analysis to non-management sources.

Approximately 10 percent of the Trinity River watershed is within Six Rivers National Forest. Major reductions in anadromous fish populations have occurred in the river. By 1980, it is estimated that in comparison to a 1950 base, the upper river steelhead population had declined by 90 percent and the lower river by 80 percent. According to the Six River National Forest Draft Environmental Impact Statement for the National Forest Plan, the natural chinook salmon populations have declined by 85 percent. The hatchery at Lewiston has mitigated for some loss, especially with regard to spring-run chinook. Some of the major factors commonly cited as possible causes of salmonid reductions include the construction of Trinity Dam (and subsequent reduced stream flows), the 1964 flood, overharvest of salmon, and intensive logging practices.

The South Fork Trinity River is a tributary to the Trinity River, in the Klamath River Basin of northern California. The watershed is primarily forested, and is located within Trinity and Humboldt Counties. The purpose of the South Fork Trinity River Sediment Total Maximum Daily Load (TMDL) is to identify loading allocations that, when implemented, are expected to result in the attainment of applicable water quality standards for sediment. The South Fork Trinity River

watershed is included on California's Clean Water Act (CWA) Section 303(d) list as water quality limited due to sediment. The sedimentation in the South Fork Trinity River watershed was judged to exceed the existing Water Quality Standards (WQS) necessary to protect the beneficial uses of the basin, particularly the cold water fishery. Accelerated erosion from land use practices and natural sources impacts the migration, spawning, reproduction, and early development of cold water fish such as spring and fall run chinook salmon and steelhead trout.

The South Fork Trinity River (SFTR) has historically been recognized as a major producer of chinook and coho salmon and steelhead trout (PWA 1994). The South Fork originates in the North Yolla Bolly Mountains about 50 miles southwest of Redding, and runs northwest for approximately 90 miles before reaching its confluence with the Trinity River near Salyer (Figure 5). It flows mostly through Trinity County, forming the boundary between Trinity and Humboldt Counties in its lower 12 miles. The South Fork and its main tributary, Hayfork Creek, are both undammed. The South Fork Trinity River is the largest undammed river in California, and constitutes 31 percent of the Trinity River sub-basin, and 6 percent of the Klamath basin (USDA FS 1998). The 56 mile stretch from Forest Glen to the mouth is protected by the California Wild and Scenic Rivers Act.

The fishery in the South Fork has declined dramatically since the flood of December 1964. Unstable geology and erosion-producing land use practices have been blamed for the many mass wasting events triggered by that flood, which resulted in dramatic instream changes, including channel widening, aggradation, and loss of pool depth, all of which adversely affect the fishery. Since that time, further channel changes suggest improvements in some locations, while continued, chronic sediment inputs may be hindering a more complete or faster recovery overall. The chinook salmon spawning run has increased slightly in the last several years, and sediment slugs continue to move downstream, which may suggest the beginnings of a trend toward recovery.

The purpose of the South Fork Trinity River Sediment Total Maximum Daily Load (TMDL) is to identify reductions of sediment delivery to the river system that, when implemented, are expected to result in the attainment of applicable water quality standards, including adequate salmonid habitat.

5.3 CONCLUSIONS

For much of the South Fork basin, unstable and highly erodible terrain as well as land management activities have resulted in high sediment yields from landslides. The greatest source of sediment loading is mass wasting not associated with management sources. Lands west of the South Fork mainstem are particularly susceptible both to natural mass wasting and to accelerated mass wasting from management activities. The rates of sediment loading generated from these areas are significantly greater than that from other locations.

Sediment delivery associated with mass wasting from all source categories in the 1975 to 1990 period has decreased significantly over the previous period, probably due to factors including:

- The December 1964 flood and other storms during the 1960-1975 period triggered some landslides that might have otherwise been triggered in the later period.
- Storm and flood events were less likely to trigger large landslides in the later period, both due to the character of the events (lower antecedent moisture prior to a peak flow, for example) and in some cases due to lower intensities (prolonged periods of drought with a few large peak flows in between).
- Less intensive and more protective land management practices, such as implementation of Forest Practice Rules and reductions in harvest activities following the listing of the Northern Spotted Owl in 1990 (A. Kallis, pers. comm. 1998).

Surface erosion and washouts and gullying from roads has more than doubled during 1975 to 1990, compared to the 1944 to 1960 time period, in contrast to the reduction of mass wasting in the later period. This may be due to large storms in combination with a much larger road network, more harvested acres, numerous inadequately maintained roads and undersized drainage structures. Roads generate about twice the levels of sediment loading as timber harvesting. Roads are the most significant component of management-related sediment production.

5.4 DEVELOPMENT OF IMPLEMENTATION PLAN

The State is currently developing a draft implementation plan, and has published a preliminary draft to solicit comments on the *env-trinity* e-mail server (NCRWQCB 1998). EPA supports development of this plan, which should include reasonable assurances that the nonpoint source load allocations established in the TMDL will be achieved. These assurances may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs.

EPA has reviewed the State's draft implementation plan, and supports the key features, which include provisions for:

- Regulatory, non-regulatory and incentive-based options for implementing the provisions of the TMDL.
- Encouraging development of landowner-based sediment reduction plans, from individual landowners or cooperative groups of landowners.
- Specifying requirements for the sediment reduction plans, including baseline inventory, assessment of unstable areas, measures for control and prioritization of sediment delivery, and provisions for monitoring and reporting.
- Alternative land management guidelines for landowners not wishing to submit plans, including measures for roads, landings, and skid trails; prohibited actions in unstable areas; and protection of riparian areas and Class I, II and III watercourses.
- Recognizing parallel regulatory and planning efforts such as Sustained Yield Plans, Non-Industrial Timber Mangement Plans, Habitat Conservation Plans, Ranch Plans, Timber Harvest Plans, and Shasta-Trinity and Six Rivers National Forest Long Range Management Plans and Access and Transportation Management Plans. South Fork Trinity River/Hayfork Creek Sediment TMDLs, December 1998 Implementation/Monitoring - 58
- Intent to establish the implementation plan by January 1, 2000, and encouraging landowners to commit to developing sediment reduction plans by January 1, 2003, if that is the option.

5.5 PRESIDENT'S NORTHWEST FOREST PLAN

The implementation plan should also consider ongoing efforts that may facilitate the implementation of the TMDL. For example, implementation plan should consider the President's Northwest Forest Plan (FSEIS/ROD, 1994), which is operative for all of the USFS ownership in the basin (about 80% of the land area). That plan identifies the South Fork as Tier 1 Key Watershed, which implies that its protection and restoration as a refugia area are a high priority. This designation signifies the presence of habitat for potentially threatened or endangered species or stocks of anadromous salmonids, generally high quality water and fish habitat, or a genuine potential for watershed recovery to eventually provide a refuge for endangered anadromous salmonids.

The Northwest Forest Plan also includes an Aquatic Conservation Strategy (ACS), comprised of identifying key watersheds, conducting watershed analysis, establishing interim riparian reserves, and

doing watershed restoration. These activities, and those of the Standards and Guidelines under the ROD, have been incorporated into the Land and Resource Management Plans (LRMPs) of the forests. Furthermore, the South Fork from Forest Glen to the mouth of the river was designated as a component of the California Wild and Scenic Rivers System in 1972, which provides additional protections to the river.

5.6 OTHER ONGOING IMPLEMENTATION EFFORTS

The State may wish to explicitly consider other efforts that are ongoing to actively coordinate its monitoring efforts. For example, Trinity County is coordinating efforts of counties throughout the range of the Northern California ESU for coho salmon. The main focus is on road maintenance under County jurisdiction. The South Fork CRMP is an organized group of local stakeholders and government agencies working together to make improvements in the South Fork. They have been identifying problem areas and restoration opportunities, and funding restoration work. Their main priorities are in addressing land use and land management activities that could be contributing to water quality problems, including: reducing ongoing and potential erosion and sediment yield from roads, hillslopes and banks, improving water quality and quantity, and providing for streamside riparian protection and improvements.

Figure 5-1: South Fork Trinity Planning Watershed

6 Lower and Main Trinity Watershed

6.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The Trinity River flows east to west and is the largest tributary to the Klamath River, joining the Klamath 40 river miles from the ocean. The Trinity basin as a whole is among the three largest California anadromous river systems north of San Francisco, second to the Klamath and similar to the Eel River in volume and drainage area. Portions of the greater Trinity River watershed area lies in the eastern half of Trinity County, which includes 39.29 miles of the river and all tributaries from the base of the Lewiston Dam to its confluence with the North Fork Trinity River, encompassing 268,299 acres. This Portion comprises approximately 14 percent of the entire Trinity River Basin.

The Trinity River watershed lies within the area known as the Klamath Province, including headwater reaches of the Trinity Alps and the Trinity Mountains. The highest point in the analysis area is in the northern headwaters in the Trinity Alps on Sawtooth Mountain, elevation 8,888 feet. The lowest point at the confluence of the North Fork Trinity River is approximately 1,475 feet in elevation. Virtually the entire watershed area is mountainous, with steep V-shaped valleys formed by the tributaries. Only 5.1 percent of the whole Trinity Basin is farmland, most of which occurs in the Hayfork Valley. Most ridgetop elevations range from 4,000 to 5,000 feet.

Lands within the analysis area are of mixed ownership. The Shasta-Trinity National Forest manages 86,335 acres (32 percent of analysis area) of relatively consolidated national forest lands, including approximately 60,000 acres in the Trinity Alps associated with the Canyon Creek watershed, and smaller tributaries including the forks of Weaver Creek and Rush Creek north of Weaverville. A second major block of approximately 20,000 acres lies southwest of Junction City and drains the north end of the Hayfork Divide. Public lands managed by the BLM total 53,910 acres (20 percent of the analysis area) and have a checkerboard ownership pattern interspersed with private lands. Consolidated areas of BLM land occur only in the Grass Valley Creek watershed, a recent acquisition for watershed restoration, and in the lower Canyon Creek watershed north of Junction City. Of 39.3 miles on mainstem Trinity River in the planning area, 18.5 miles occur on BLM lands, 3.6 miles occur on USFS lands, and 17.2 miles on private lands. Other federal and state lands managed by Bureau of Reclamation (BR) or State of CA comprise 786 acres. Private lands account for 127,721 acres (48 percent of the analysis area).

Climate over the analysis area can be broadly described as "Mediterranean" in terms of rainfall distribution. Nearly all rainfall occurs within a period of six to eight months centered around the winter season. Winter storms originate over the Pacific Ocean, with the amount and distribution largely determined by local topographic factors. Average annual rainfall varies from 35 to 75 inches with a range of variation, dependent upon location, of 15 to over 100 inches in extreme years. Precipitation will occur as either rain or snow, depending on a variety of factors. Storms from the Pacific Ocean have a "snow level" associated with them, which generally drops as storms move east, away from any moderating effects of the ocean. This relative snow level can vary greatly from one storm to another. Only the highest elevations receive most precipitation in the form of snow, and conversely, only the lowest elevations of the downstream end of the analysis area receive most precipitation in the form of rain. The area falls into a transient-snow/rain zone. The transient rain/snow zone geography can have a leveraging or dampening influence on the relationship between precipitation and run-off, depending on the temperature of the event and subsequent precipitation and temperature patterns. Warm storms carrying large amounts of precipitation combined with snowmelt can produce extremely high runoff events over large areas of the watershed.

Winter temperatures depend upon the origins of air masses moving across the Pacific, with lows ranging from low teens to below zero at higher elevations. Summer temperature ranges have greater predictability due to the normal summertime location of high pressure over the eastern Pacific. This weather feature effectively blocks the seasonally weaker Pacific storm fronts, leading to a continuous season of clear, cloud-free weather. Warm summer air masses of tropical origin bring occasionally humid summer weather conditions, which create convective weather phenomena, including lightning. The warm temperatures that characterize the dry summer season reflect the lessening of marine influences on the interior landscape. Humid maritime air dries and warmse as it moves easterly over the land mass. Afternoon summer temperatures routinely reach 90 to 110 degrees at lower elevations and up to 85 degrees at the highest elevations. These weather patterns combine with temperature and precipitation regimens to produce a relatively high wildfire frequency interval of 7 to 35 years.

The watershed lies within the Klamath Mountains Geomorphic Province (DWR 1980). Major rocks range from 330 to 125 million years in age (Devonian to Jurassic). Principal geologic features include Copley Greenstone, the Bragdon and Abrams formations, ultramafic rocks, the Shasta Bally batholith, the Weaverville formation, landslide deposits and river terrace deposits. These formations yield four erosive or unstable rock types which affect the watershed. The first type are the ultramafics. Where these rocks are present, serpentine rock occurs, which is readily susceptible to mass movement. The second type, the Weaverville formation, consists of mudstone, sandstone, and conglomerate with an impervious dark green clay matrix. The formation is generally unstable. The third type is the Abrams formation, which is a schist. It is considered stable, but soils which form on this material are highly erodible. The fourth type, granitic rocks of the Weaver Bally batholith, Canyon Creek pluton, Wildwood pluton and the Shasta Bally batholith, are the most erosive of the four rock types and are the major sediment-producing formations. The granitic soils are coarse- textured, easily eroded soils with a predominance of weak bedrock that is easily broken down into sands. On steep slopes the coarse-textured material is highly erodible and produces extremely high volumes of sediment. Concentrated water flowing on this highly erosive landscape results in accelerated erosion. This is most acute where road systems, skid trails, landings, etc. have altered the hydrologic processes on upland slopes. The granitic formations occur in several major tributaries, including Grass Valley Creek, Indian Creek, Rush Creek, Canyon Creek, Reading Creek, Weaver Creek, Browns Creek, Deadwood Creek, and Hoadley Gulch.

Table 6-1: Acres of Bedrock Type

Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	61,141	173,040
Cenozoic Sedimentary	600	2,653
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	130,536	476,358
Water and/or Unclassified	0	2,915

The upland landscape is characterized by three major forest types. The mixed evergreen conifer forest with chinquapin, madrone, black oak and canyon live oak includes a portion of the Rush Creek drainage and upper sections of Grass Valley Creek, Indian Creek, Reading Creek, and Browns Creek. The Klamath montane mixed conifer forest includes higher elevations north of the Trinity mainstem. The Oregon white oak forest is typical throughout lower elevations along the mainstem and in all but the headwaters of the major tributaries (Kuchler 1977). Extensive south slope areas of the watershed are shrub-dominated. The northern extent of the watershed is noted for its diversity of conifer

species, with the center of this richness located just north of the Trinity Alps in the Klamath Mountains. A variety of climatic influences converge in the area, having receded and encroached over geologic time, leaving disjunct populations in remnant microclimates which persist from one period to the next (Fowells 1965). Characteristic influences include boreal, maritime, continental, and Mediterranean, with aspect and elevation determining the location and extent of these influences.

The dominant vegetative cover types in the Humboldt County portion of the watershed are: fir forest (52.16%), oak woodlands (23.46%), pine forest (16.35%), and chaparral (3.9%). Agricultural crop lans make up only 0.16% , while urban developments account for 0.58%.

Table 6-2: Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*	*Total in Watershed*
Agriculture-Crops	297	0.16	388
Annual Grass	1,939	1.01	3,435
Barren	983	0.51	8,061
Chaparral	7,501	3.90	39,707
Coastal Scrub	117	0.06	117
Fir Forest	100,294	52.16	405,621
Oak Woodlands	45,110	23.46	106,801
Pine Forest	31,439	16.35	83,457
Riparian	3,124	1.62	4,263
Urban	1,112	0.58	1,137
Water	354	0.18	1,573
Wetlands	19	0.01	104
	192,270		

Wildlife species represent a high degree of diversity, reflecting the influences of elevation, climate, topography, and vegetation. Characteristic species of forested areas of the Pacific Northwest are relatively abundant. These include black bear, black-tailed deer, northern flickers and other woodpeckers, alligator lizards, and newts. Numerous species with special status inhabit the Trinity River watershed as well. The California Department of Fish and Game database for the northern spotted owl provides information on numerous known territories for the species in the watershed (density of one territory per 4,800 surface acres). All three North American accipiters (Cooper's hawk, sharp-shinned hawk, northern goshawk) occur in the watershed. Pacific fishers have been sighted, as have ring-tailed cats and northern flying squirrels. Black salamanders and tailed frogs have been found in the area. Riparian-associated wildlife species also exhibit a high degree of diversity and density. Bird species richness is high compared to other riparian locations in the west. Species sighted during surveys include numerous special status species such as the willow flycatcher, yellow-breasted chat, yellow warbler, and black-capped chickadee. Rare raptors are present as well, including bald eagle, peregrine, and merlin. A variety of shorebirds and waterfowl inhabit the analysis area and include herons, egrets, sandpipers, wood ducks, and three species of merganser. The composition of the riparian bird community is likely to have changed as a result of the dam-related increases in acreages of riparian vegetation.

Riparian mammals occurring along the mainstem Trinity River include numerous rodent species, whose distributions are linked to the distribution of riparian vegetation. Larger, semi-aquatic species occur as well, including beavers and river otters. The native herpetofauna includes two candidates for

a federal listing: western pond turtles and yellow-legged frogs. Introduced bullfrogs have begun to invade the area, with potentially deleterious effects on native amphibians, fishes, and waterfowl.

The Lower Trinity Watershed is mostly rural with human population centered near Trinity Center, Weaverville, Lewiston, Hayfork and Hyampom. The only large-scale agriculture is cattle grazing. Timber harvest continues but at a much reduced level than in the past on Federal lands. However, the intensity and scope of logging appears to be increasing in private lands. Toxicity concerns center around acid mine drainage (AMD) from abandoned mines and past mining activities, sediment release from subdivision development and eroded roads in areas with unstable soil and decomposed granite (DG), septic tank use, aboveground and underground tanks, and lumber mills. The U.S. Forest Service and the Bureau of Land Management federally manage approximately 80 percent of the land in the Trinity WMA. Of the remaining 20 percent of the basin, which is privately owned, approximately half are industrial timberlands. Old existing access roads that are not maintained or properly decommissioned are a continual source of sedimentation into the Trinity River and its tributaries. Tourism including rafting, especially on the lakes, is part of the economy of this area.

Land Use and Ownership

Land use in the Trinity River watershed continues to be limited by the mountainous terrain and dispersed ownership of the land. With much of the land in forests and publicly owned, logging remains an important use. Other major uses of the land in the watershed are recreation, housing, mining and road networks. Along the Trinity River, private property ownership and development has increased. All of these land uses have resulted in ecological and economic impacts within the watershed and have helped shape human values and expectations.

Logging, conducted extensively throughout the tributaries except Canyon Creek, has significantly modified natural conditions. Most of the forested areas have been cut at least once and many areas twice. Logging intensified as technologies improved and roads were constructed in unstable locations, increasing natural erosion rates. Certain logging practices such as tractor logging and poor road construction may increase erosion and sedimentation, alter runoff characteristics and destroy aquatic and terrestrial wildlife habitat. The decline in logging in recent years has negatively affected the economy of the area, as this community has been resource-dependent.

Table 6-3: Lower Trinity Planning Watershed Characteristics

Characteristic	*Value*
Total Acres	654,967
Total Acres within County	192,277
% of Total within County	29%
Average Parcel Size (Acres)	69.72
Largest Watershed	Trinity River
Dominant Land Uses	open space/parks & tribal lands
Largest Private Land Owner	Simpson Timber

Approximately 29% of the watershed lies within Humboldt County, with an average parcel size of 69.72 acres. The largest single private land owner is Simpson Timber, however, much of the watershed is under the management of the U. S. Forest Service, which accounts for the land use of open space/parks as being the dominant land use.

Table 6-4: Lower Trinity Planning Watershed Land Use

Existing Land Use	*Total Acres*	*% of Watershed**
open space/parks	93,682	48.72%
tribal lands	68,988	35.88%
timber production	21,045	10.94%
rural residential	4,501	2.34%
rural residential - vacant	3,713	1.93%
public	167	0.09%
commercial	83	0.04%
gravel mining	41	0.02%
multi family residential	25	0.01%
church	18	0.01%

Open space/park lands (including Forest Service lands), tribal lands and private timber production lands account for approximately 95% of the land use in the watershed within Humboldt County.

Table 6-5: Lower Trinity Planning Watershed Private Ownership over 640 acres

Private Land Owner	*Total Acres*	*% of Watershed**
Simpson Timber	5,631	2.93%
Eel River Sawmills	5,471	2.85%
R Emmerson	1,896	0.99%
Security National Properties	795	0.41%
Pacific Forest Industries	751	0.39%

Table 6-6: Acres of Public Lands

Public Land	*Total*
Six Rivers National Forest	93,573
Hoopa Valley Indian Reservation	68,456

Figure 6 illustrates current land use and ownership in the Lower Trinity River Watershed.

Fisheries

According to the Department of Fish and Game, the Trinity supports several anadromous fish populations, including Chinook salmon, coho salmon, and steelhead trout. The Klamath-Trinity Watershed supports the second largest run of Chinook salmon in the State, second only to the Sacramento River watershed.

The river supports four anadromous fish species: the chinook salmon, coho salmon, steelhead trout, and Pacific lamprey. Historic accounts of huge salmonid runs are typical of the rivers of the Pacific Northwest and are described anecdotally as having spooked horses at river crossings. Chinook salmon pre-dam run sizes or escapement estimates from four years of historic data from 1944, 1945, 1955, and 1956 ranged from 19,000 to 67,115, with a mean of 38,154. Post-dam estimates adjusted to exclude hatchery returns range from 2,551 to 54,921, with a mean of 13,465 (Fredrickson, Kamine,

and Assoc. 1980). Resident fish species include rainbow trout, three-spined stickleback, speckled dace, and Klamath small-scale sucker (Moffett and Smith 1950). Eastern brook trout and brown trout have been introduced as sport fish.

Major reductions in anadromous fish populations have occurred in the river. By 1980, it is estimated that in comparison to a 1950 base, the upper river steelhead population had declined by 90 percent and the lower river by 80 percent. According to the Six River National Forest Draft Environmental Impact Statement for the National Forest Plan, the natural chinook salmon populations have declined by 85 percent. The hatchery at Lewiston has mitigated for some loss, especially with regard to spring-run chinook. Some of the major factors commonly cited as possible causes of salmonid reductions include the construction of Trinity Dam (and subsequent reduced stream flows), the 1964 flood, overharvest of salmon, and intensive logging practices.

Numbers of chinook have declined overall since construction of Trinity and Lewiston dams, although there has been extensive variation in run size during this period. Spring chinook generally begin entering the basin, as they did historically, in late spring and early summer and begin spawning in early to mid- September. The fall run of chinook salmon is presently the dominant run (numerically) in the Trinity River. This run generally enters the analysis area during late summer or early autumn (September to October). They reach sexual maturation quickly and usually begin spawning in October. Although the spring run begins spawning earlier, there is some overlap of spawning activity between the two runs.

Presently, coho salmon and steelhead occur throughout the main stem as well as in may of the tributaries. Coho enter the analysis area during fall and spawn from late fall to early winter. Steelhead enter the basin during several months of the year and most spawning in the analysis area occurs in early winter. Steelhead populations have continued to decline for several years in the Trinity basin even though they have been protected from commercial harvest for several years. Summer Steelhead trout runs have been recorded from the North Fork Trinity River, New River (tributary to the Trinity), South Fork Trinity River, and Canyon Creek.

The Trinity River hatchery was constructed in order to mitigate the loss of salmonids that were historically produced above the dam sites. Each year, the hatchery artificially spawns returning adult chinook and coho salmon and steelhead. Numbers or returning adults have varied widely with each species since the hatchery began operation. Returns of chinook salmon have ranged from 2,586 to 36,386; coho returns have ranged from 12 to 23,338, and steelhead returns have ranged from 13 to 6,941. Numbers of juveniles released from the hatchery have varied as well. Recent releases (1991-1995) for fall run chinook fingerling have ranged from 202,275 to 2,342,037; spring run fingerling releases have ranged from 828,406 to 1,498,015. For the same time period, coho and steelhead yearling releases have ranged from 384,555 to 627,739 and 323,791 to 1,158,171 respectively.

Fish habitat in the analysis area is limited by reduced flows and the physical condition of the Trinity River and its tributaries. Historical spawning beds composed of clean gravel and cobble have become embedded with fine sediment deposits. Access to shallow water rearing habitat once abundant on gravel bars is blocked or buried by sediment berms which line both sides of the river and by the loss of gravel recruitment resulting from the dams. The habitat losses resulting from the sedimentation of the river channel have reduced the reproductive carrying capacity of this portion of the Trinity River.

Trinity and Lewiston dams are migration barriers which block salmon and steelhead from 109 miles of suitable reproductive habitat. The loss of this habitat has contributed to the reduction of fish numbers. Spring chinook which historically "summered-over" in deep pools between Lewiston and Stuarts Fork are now limited to pools below Lewiston which have partially filled with sediment. Summer releases from Lewiston reservoir are artificially higher than historic levels in order to provide cool water for the spring chinook adults.

Introduced fish species include brown trout, brook trout, and three-spine stickleback. The effects of introduced species have not been thoroughly studied in the Trinity basin. Brown trout compete directly for food and cover with all native salmonids in the river. Brown trout become territorial and larger fish tend to dominate areas of suitable habitat. Direct mortality results from brown trout preying on juveniles of other species including salmon and steelhead.

Recreational fishing is important on the main stem and many tributaries. The economic value of sport fishing is significant and provides employment to many residents and recreation for visitors, and benefits the owners of resorts, motels and restaurants. This industry is dependent on a healthy productive fishery, and the decline of the fishery has negatively affected these businesses.

6.2 WATER QUALITY CONCERNS

This portion of the Trinity River is designated as a wild and scenic river. This area has experienced hydraulic mining in the past. Current mine practices consist of small placer sluicing and hard rock milling operations. An assessment of abandoned mines, past and present mining activities needs to be conducted. A formal inventory needs to be compiled with exploratory site information on the disposition of acid mine drainage, sedimentation, waste handling and remediation as appropriate, to meet long-term water quality standards.

The Hoopa Tribe's governing body, The Hoopa Valley Tribal Council, has been recognized by the United States with sovereignty similar to that of a State. One element of that sovereignty is the Tribe's authority and duty to administer the Clean Water Act (CWA) within its reservation's borders. Trinity River flows across the southern border of the Tribal land and remains within the Tribe's jurisdiction until the confluence with Klamath River. The Tribe has prepared and adopted its CWA-based Water Quality Management Plan and submitted it to US EPA for review and approval. The tribe conducts timber harvesting without state or federal oversight. Logging in the Lower Trinity by private industry is moderate.

Due to insufficient flows to transport sediments, the Trinity has been classified by the EPA as sediment impaired. The Department of Fish and Game rates the Trinity as fair in terms of temperature; in the upper 40 miles, temperatures rarely exceed 70 degrees Fahrenheit, though lower river stream temperatures typically exceed 70 degrees during the summer months. Geology and soils interact with vegetation, climate, various land disturbances and stream channel sediment transport characteristics to produce sediment. Highly erosive granitic soils constitute 17 percent of the analysis area and are distributed over eight tributaries. Estimates indicate that these areas produce 72 percent of the sediment reaching the Trinity main stem. Land use activities which modify drainage patterns or remove vegetative cover in these highly erosive areas can greatly accelerate erosion and sedimentation. Efforts to curb sediment production and delivery are concentrated in these geographic areas.

Granitic sediment produces the size fraction which is most detrimental to the aquatic habitat in the Trinity river. Granitic soils contain a high percentage of sand, a sediment which becomes embedded in the river bed, destroying aquatic habitat. It is the major particle constituent of the sediment berms deposited on natural gravel bars along the river. Non-granitic soils dominantly have very gravelly loam and very gravelly clay loam soil textures, which produce a bimodal distribution of sediment. The fine size sediment component remains suspended and is transported down the river. The coarse size sediment component constitutes the gravel fraction which is beneficial to the aquatic ecosystem. This coarse sediment is currently in deficit, an indirect result of the Lewiston and Trinity dams.

Two tributaries, Grass Valley Creek (GVC) and Canyon Creek constitute 65 percent of the granitic areas. Land management in GVC has undergone drastic changes in the last few years. Since 1993 GVC has been dominantly publicly owned and managed for erosion and sediment control rather than timber production. Granitic soils in the Canyon Creek watershed are publicly owned, are managed as wilderness area, have few roads and consequently experience low erosion rates considering the high erosion hazard. Erosion control activities in GVC have reduced the long term sediment production capacity by about 50 percent and land management goals have changed from timber production to erosion and sediment reduction. These measures should gradually reduce erosion to the natural range of variability.

Vegetation in the analysis area consists of coniferous and hardwood forests, montane chaparral and riparian. Large, severe wildfire events destroy vegetation and leave the soil susceptible to severe erosion. Erosion following fire can produce large sediment influxes to the tributary streams which may be transported and deposited in the main stem Trinity River.

The suppression of wildfire has resulted in the buildup of fuel throughout the analysis area and has increased the potential for large scale fires, which burn with greater intensity than under "natural" conditions and generally result in greater resource damage. Large scale watershed disturbance such as wildfire can result in soil hydrophobicity, loss of vegetative cover, increased runoff and severe erosion and sediment production, which may damage aquatic habitat.

Current land use activities which constitute the greatest sedimentation hazards are logging and the transportation network. Logging disturbs the natural equilibrium by removing vegetative cover and altering the natural drainage pattern through road construction. Logging practices which minimize the impacts of these phenomena, such as helicopter yarding and retention of the maximum vegetative cover practical, can reduce erosion and sedimentation resulting from this land use. Transportation network design, location and maintenance can reduce the sediment production and delivery. The logging and wood processing industry is a major employer in the area.

An aggressive program of site treatment and land use technique improvements has been underway for years in the analysis area. Additional progress can be made and the program should continue. The sediment budget process identified potential sources of sediment by tributary and in some cases, specific areas within tributary watersheds. Substantial progress testing and implementing sediment control practices has been made in several tributaries especially in the Grass Valley Creek watershed. Inventories of sediment sources have been completed in other tributary watersheds and are listed in the bibliography. The sediment budget indicates there may be additional significant sources which have not been identified yet. Specifically the granitic areas of small tributaries encompassed by the "Trinity Gorge" watershed appear to have significant potential which should be investigated further. Inventory and treatment procedures established in the basin should be followed to identify potential sediment sources and develop treatment scenarios. Existing inventories should be reviewed and determinations made whether to implement treatments.

Treatment activities which restore natural hydrologic processes and facilitate reestablishment of native plant communities are the preferred alternatives. Treatments include but are not limited to: road reconstruction, road decommission, culvert replacement or removal, vegetative plantings, mulching, headcut and streambank stabilization.

Land use practices, specifically road building associated with urban development and timber production activities and timber harvest methods, should be aggressively regulated in order to prevent the sediment producing disturbances which occurred historically.

This WMA is mostly rural with human population centered near Trinity Center, Weaverville, Lewiston, Hayfork and Hyampom. The only large-scale agriculture is cattle grazing. Timber harvest continues but at a much reduced level than in the past on Federal lands. However, the intensity and scope of logging appears to be increasing in private lands. Toxicity concerns center around acid mine drainage (AMD) from abandoned mines and past mining activities, sediment release from subdivision development and eroded roads in areas with unstable soil and decomposed granite (DG), septic tank use, aboveground and underground tanks, and lumber mills. The U.S. Forest Service and the Bureau of Land Management federally manage approximately 80 percent of the land in the Trinity WMA. Of the remaining 20 percent of the basin, which is privately owned, approximately half are industrial timberlands. Old existing access roads that are not maintained or properly decommissioned are a continual source of sedimentation into the Trinity River and its tributaries. Tourism including rafting, especially on the lakes, is part of the economy of this area.

6.3 KNOWN POINT SOURCES OF POLLUTION

There are several contaminated sites in the area. The Copper Bluff Mine continues to emit toxins. Celtor chemical works, located on the Hoopa Valley Reservation, is a US EPA Superfund site. A remedial action plan has been implemented. Twelve sites are being investigated in the Hoopa/Willow Creek area where known releases from underground storage tanks occurred. A possible release from underground fuel tanks located at a closed gas station in Salyer needs to be investigated. There are PG&E electrical substations in Hoopa and Willow Creek. These are being investigated for historic releases of mineral oil that may have contained PCB's. Storm water discharges from these facilities are also being investigated. An unknown number of aboveground storage tanks exist in the area. There are also a number of lumber mills (such as the Burnt Ranch Mill) that have a history of using wood preservatives including pentcholorophenol that may be the source of soil and groundwater contamination. These sites need to be investigated. A burn dump at Burnt Ranch was operated for years and closed. It needs to be investigated and assessed for hazardous materials and impacts on water quality.

The North Coastal Watershed Assessment Program (NCWAP) is currently scheduled to focus on watershed assessment in the WMA in FY 2001-02. That program will gather existing data and collect new data on private and state lands in the WMA. The final product will be an interactive computerized format including the data and watershed assessment.

Table 6-7: Lower Trinity River Planning Watershed
Physical and Biological Characteristics

Miles of Road by Type		
Road Type	*Total in Humboldt County*	*Total in Watershed*
improved	40	77
secondary	37	85
unimproved	567	1,170
Miles of Streams by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	299	1,545
2	98	512
3	64	283
4	25	119
5	1	37
6	0	51
7	0	42
8	30	31
Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	297	388
Annual Grass	1,939	3,435
Barren	983	8,061
Chaparral	7,501	39,707
Coastal Scrub	117	117
Fir Forest	100,294	405,621
Oak Woodlands	45,110	106,801
Pine Forest	31,439	83,457
Riparian	3,124	4,263
Urban	1,112	1,137
Water	354	1,573
Wetlands	19	104
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	61,141	173,040
Cenozoic Sedimentary	600	2,653
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	130,536	476,358
Water and/or Unclassified	0	2,915

Figure 6-1: Lower Trinity Planning Watershed

7 Van Duzen River Planning Watershed

7.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The Van Duzen River (VDR) Planning Watershed is located in California's North Coast Range, primarily in Humboldt County, and encompasses a total area of approximately 428 square miles: 367 square miles in Humboldt County and 61 square miles in Trinity County. The watershed is southeast of the City of Eureka and approximately 50 miles east of the "triple junction" of the American, Pacific and Gorda tectonic plates near Cape Mendocino (US Environmental Protection Agency 1999).

Elevations within the watershed range from 5,906 feet at its headwaters at Red Lassic peak to 62 feet at its confluence with the Eel River. The Van Duzen River is 73.5 miles long and one of the few remaining free flowing rivers in California. The watershed receives between 50-100 inches of rain annually, which occurs almost entirely from October through April. Because of this wide range in rainfall, annual peak discharge from the Van Duzen River varies widely (Klein 1988).

Using the Strahler stream order classification system, there are 808 miles of streams in the VDR watershed in Humboldt County and 128 miles in Trinity County. In Humboldt County, approximately 79% of the streams fall in orders 1 or 2: (the smallest tributaries). Only 13% of the streams are classified in orders 4, 5 and 6. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75% of the streams in orders 1 and 2, and 12% in orders 4-8. The smallest planning watershed in Humboldt County, the Jacoby Creek Watershed, has 35 miles of streams in Humboldt County with 78% in orders 1 and 2, and the remaining 22% in order 3: (*Note: as an order 1 stream connects with another order 1 stream, the stream becomes an order 2 stream; as an order 2 stream connects with another order 2 stream, the stream becomes an order 3 stream, and so on*).

Vegetative cover within the watershed in Humboldt County consists primarily of Timberlands and Oak Woodlands: (55% in Fir, Redwood and Pine, and 25% in Oak Woodland). The remaining vegetative cover is in Grasslands (15%) and other vegetative cover types (5%).

The VDR planning watershed can be classified into five primary terrain types, based on similar bedrock and relative slope stability (Kelsey 1977):

- Sandstone, generally stable terrain
- Sandstone, potentially unstable active slides
- Melange, generally stable serpentine alluvial terrain
- Melange, older slump-earthflow terrain
- Melange, active slump-earthflows

99% of the bedrock underlying the watershed is Sedimentary or Metasedimentary. Sedimentation rates are considered high in the watershed because of the high uplift and stream incision rates into relatively weak bedrock units. This combination has produced a high incidence of landsliding adjacent to stream channels, including large slump-earthflows and extensive zones of debris sliding. A highly active tectonic setting, combined with sensitive terrain and high rainfall amounts, make the VDR one of the most erodible watersheds in the United States: (Brown and Ritter 1971).

For purposes of characterizing watershed conditions and water quality concerns, the US Environmental Protection Agency (EPA) has divided the watershed into three distinct areas: lower basin, middle basin and upper basin. The lower basin encompasses approximately 129 square miles from the confluence with the Eel River to the confluence with Grizzly Creek, including the lower Yager Creek and Lawrence Creek tributary, but excluding the North, Middle and South Fork of Yager Creek. The middle basin encompasses approximately 202 square miles ranging from the upper Yager Creek Basin to the confluence of Grizzly Creek. The upper basin encompasses approximately 98 square miles and includes the remainder of the upper portions of the watershed.

The following tables summarize the dominant physical and biological characteristics within the VDR planning watershed.

Table 7-1: Summary of Dominant Physical and Biological Characteristics Within the Lower, Middle and Upper VDR Basins*

Dominant Characteristics	*Lower Basin*	*Middle Basin*	*Upper Basin*
Terrain Type	Stable sandstone, interspersed with potentially unstable sandstone along steep streamsides and stable melange in lower floodplain	Older slump and active earthflow in mélange as well as some potentially unstable sandstone	Potentially unstable sandstone in the headwaters area and stable sandstone in the lower area
Vegetation Type	Redwood Forest	Prairie and oak/fir woodland	Mixed conifer forest
Channel Types & Aquatic Habitat	Braided or meandering trunk streams in lower floodplain, low to moderate gradient tributaries accessible for fish spawning and smaller steep gradient transport reaches	Generally steeper, more confined and transport dominated reaches. Depositional reach in lower mainstem above Bridgeville	High gradient, transport dominated tributary stream feed low gradient, meandering to braided trunk streams.
Distribution of Anadromous Fish	Coho, Chinook, steelhead and coastal cutthroat present	Chinook and Steelhead present	Steelhead and resident trout present
Land Use Patterns	Industrial Timber, farming in lower floodplain, some rural residential near river along the river, recreation and gravel mining	Ranching, dispersed rural residential and timber production	US Forest Service with some rural residential along the mainstem.

**Source: US Environmental Protection Agency Study of 12/16/99 on the Van Duzen and Yager Creek Total Maximum Daily Load for Sediment.*

Table 7-2: Van Duzen River Planning Watershed Physical and Biological Characteristics

Miles of Road by Type		
Road Type	*Total in Humboldt County*	*Total in Watershed*
Improved	221	221
Secondary	46	47
Unimproved	502	660
Miles of Stream by Order		
Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	496	576
2	140	163
3	70	78
4	33	50
5	64	64
6	5	5
Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	3,854	3,854
Annual Grass	36,347	38,496
Barren	4,537	5,028
Chaparral	1,202	4,921
Coastal Scrub	364	364
Fir Forest	64,585	84,678
Oak Woodlands	58,154	67,381
Pine Forest	10,123	13,617
Redwood	53,730	53,730
Riparian	1,316	1,316
Urban	583	594
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	3,220	5,100
Cenozoic Sedimentary	78,349	79,720
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	153,331	189,262
Acres of Public Lands		
Public Land	*Total in Humboldt County*	
Six Rivers National Forest	16,232	
Other BLM	2,718	
Other State Lands	1,219	

**Source: Humboldt County GIS System.*

Land Use

The US EPA study of 1999 summarized historic and existing land use in the Van Duzen Watershed.

"Historically, the VDR Basin was occupied by two groups of Native Americans who were of Athabaskan descent: the Lassik and the Nongatl. They lived along the river during the winter when they harvested fish, then moved to the highland prairies in the summer to gather seeds and bulbs and to hunt game. In the Fall, they gathered acorns before returning to their winter settlements along the river.

The first Euro-Americans were believed to have settled in the VDR Basin around 1850, under the Federal Homestead Act. The VDR valley was fertile and good for farming, and highlands contained natural prairies that were well suited to grazing. Rapid settlement in the VDR led to a war with the Native Americans in which the latter were largely eliminated by 1865 (See VDR Atlas (DWR 1975) for more on Native Americans). Many archaeological sites remain in the watershed, but there are no remaining tribal lands.

Land ownership in the basin today can be generally categorized as follows, Public Land (US Forest Service, Bureau of Land Management , State and County Parks), private industrial timber, private non-industrial ranch and timber, and private rural residential. The primary community centers in the basin include: Hydesville, Carlotta, Bridgeville and Dinsmore." There are approximately 221 miles of improved roads, 46 miles of secondary roads and 502 miles of unimproved roads in the watershed in Humboldt County.

The following tables from the Humboldt County GIS system illustrate the existing land use and ownership patterns in the Van Duzen River Planning Watershed within Humboldt County. Approximately 8.5% of the land in the watershed in Humboldt County is in public ownership.

Table 7-3: Van Duzen River Planning Watershed - Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed*
timber production	134,560	57.28%
grazing/timber	51,845	22.07%
open space/parks	19,412	8.26%
rural residential - vacant	14,258	6.07%
rural residential	10,582	4.51%
agriculture	2,012	0.86%
public	1,545	0.66%
single family residential	255	0.11%
gravel mining	147	0.06%
heavy industrial	129	0.05%
commercial	89	0.04%
church	37	0.02%
camp	21	0.01%
heavy industrial - vacant	14	0.01%
single family residential - vacant	13	0.01%
vacant	13	0.01%

Table 7-3: Van Duzen River Planning Watershed - Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed*
multi family residential	7	0.00%
commercial - vacant	5	0.00%
cemetery	3	0.00%

Table 7-4: Van Duzen River Planning Watershed Characteristics

Characteristic	*Value*
Total Acres	274,083
Total Acres in County	234,899
% of Total in County	86%
Average Parcel Size (Acres)	78.12
Largest Tributary	Yager Creek
Dominant Land Uses	timber production
Largest Private Land Owner	Pacific Lumber

Table 7-5: Van Duzen Planning Watershed Private Ownership (over 640 acres in Humboldt County)

Private Land Owner	*Total Acres*	*% of Watershed*
Pacific Lumber	59,271	25.23%
Fort Baker Ranch	20,571	8.76%
C Cottrell	12,173	5.18%
Sierra Pacific Industries	8,497	3.62%
B Fulton	5,867	2.50%
Simpson Timber	5,855	2.49%
E Moore	4,559	1.94%
E Lucas	4,423	1.88%
B Barkdull	3,908	1.66%
R & G Barnwell	3,578	1.52%
Gift Ranch	3,451	1.47%
Hansen-Degnan Properties	3,443	1.47%
A Hunt	3,100	1.32%
A & B Hunt	2,890	1.23%
A Brochini Farms	2,568	1.09%
Barnum Timber	2,319	0.99%
Hunt Family Ranch	2,285	0.97%
R & O Samuelson	2,027	0.86%
A & J King	1,936	0.82%
Eaton Roughs Land Partnership	1,905	0.81%
J & D Mullen	1,849	0.79%
S Murphy	1,641	0.70%

Table 7-5: Van Duzen Planning Watershed Private Ownership (over 640 acres in Humboldt County)

Private Land Owner	*Total Acres*	*% of Watershed*
Eel River Sawmills	1,623	0.69%
C & G Cottrell	1,447	0.62%
W May	1,245	0.53%
S Kahn	1,133	0.48%
W Dunn	1,122	0.48%
R Emmerson	980	0.42%
Bridgemores River Ranch	871	0.37%
J & J Fredrickson	870	0.37%
A Victoria	826	0.35%
A Fearrien	696	0.30%

Figure 7 illustrates current land use and ownership in the Van Duzen River Watershed.

Fisheries

The VDR planning watershed maintains an aquatic habitat that supports coho and chinook salmon, steelhead trout, particularly summer stocks, rainbow trout, pacific lamprey, West coast three-spined stickelback, Sacramento sucker, Coast Range sculpin, prickly sculpin, Coastal Cutthroat trout, California roach (introduced), speckled dace (introduced), and Sacramento pike minnow or squawfish (introduced). Salmon and steelhead resources have declined over this century, and have undergone the most serious declines following the 1955 and 1964 floods, (DFG 1996).

According to the 1999 US EPA study:

"Historians have documented a thriving commercial salmon industry, between 1850 and 1890, including numerous canneries in the Eel River estuary (just downstream of the confluence with the VDR) as evidence of the abundant fish populations at that time. Eel River salmon production in 1857, which would have included VDR salmon, for example equaled that of the Sacramento River and far exceeded the combined Columbia River and Vancouver Island production, (Lufkin 1996). Very little quantitative information exists regarding historic levels of anadromous and resident fish population in the VDR.

Salmon populations regionally and statewide have continued to decline throughout the 20th century (Nehlsen et al. 1991; Higgins et al. 1992; Brown et al. 1994). A spawning reconnaissance study of Chinook salmon carried out by the US Fish and Wildlife Service in 1959 in the VDR indicated that the basin had the capability to support 7,000 chinook and reported 1,500 occupied redds at the time. In 1965, California Department of Fish & Game (DFG) estimated that the annual adult salmon runs in the Van Duzen numbered 2,500 chinook and 500 coho. The summer steelhead stock, generally considered to be less than 100, is considered at risk (Higgins et al. 1992). According to DFG (1996), coho salmon populations throughout California could be at less than six percent of their abundance during the 1940's."

7.2 WATER QUALITY CONCERNS

The 1999 U.S. EPA study summarized water quality concerns based on the three identified basins.

Lower Basin

Although the lower basin contains subwatersheds with relatively higher values of anadromous fish diversity and abundance than exist in the rest of the basin, the current fish populations are well below historic levels,

Aggradation of the lower mainstem channel, persistent form the 1964 flood event, can restrict passage of salmon and steelhead to spawning and rearing reaches especially during low flow years. The bed elevation in the lower mainstem has slightly aggraded since the late 1960's,

Several tributaries in the lower basin still suffer from poor habitat conditions, particularly with regard to insufficient number and depth of pools, excessive fine sediment levels and low levels of large woody debris.

Intensive management activities, particularly timber harvest and road-related, have exacerbated delivery rates and pose a continued threat, particularly in critical spawning and rearing reaches such as Lawrence Creek, Grizzly Creek and Cummings Creek. Continued sediment reduction efforts in the lower basin, particularly road storm-proofing and less intensive management on steep unstable areas, could yield beneficial results for anadromous fish habitat more quickly than in other areas of the basin.

Middle Basin

Summer run steelhead population is low (probably less than 100) and considered at risk. Depth of pools in the middle mainstem VDR is important for summer steelhead habitat and low gradient reaches in the middle basin are capable of supporting spawning and rearing habitat for Chinook and Steelhead,

Despite indications of channel recovery in the middle mainstem VDR, recent sediment-related habitat conditions may potentially be limiting fish recovery.

Although natural sediment sources contribute the majority (84%) of sediment from the middle basin, certain road and timber related management activities have historically represented a risk to water quality and fish habitat. Continued sediment reduction efforts, particularly road inventories, storm-proofing and maintenance, would reduce the risk of sediment delivery to low gradient spawning reaches in the middle and lower basin.

Upper Basin

Fine sediment levels, as indicated by embeddedness measurements, may potentially be impacting spawning gravel and pool habitat for steelhead in the South Fork VDR. The steep headwater areas of the South Fork VDR and West Fork VDR are capable of supplying large volumes of sediment to the lower depositional reaches thereby impacting steelhead-spawning habitat. The main concern in the upper basin is to avoid additional disturbance of sensitive hillslope areas and to correct potential sediment delivery problems associated with existing roads, thereby protecting downstream resources."

7.3 TMDL TARGETS AND RECOMMENDATIONS

In the lower basin, the EPA determined that: "90% controllability for roads and skid trails and 75% for timber harvesting is necessary in order to achieve the loading reduction estimates (30%) and the loading capacity for the lower basin. This level of sediment control in the lower basin is also justified given the relatively high contribution from management-related sources (36%) and the importance of the lower basin tributaries for salmon and steelhead spawning and rearing habitat.

The EPA determined that an 80% necessary reduction for roads and skid trails and 60% from timber harvesting is necessary and achievable in the middle and upper basin for the following reasons:

The load reductions necessary to attain the loading capacity is less (10%) in the middle and upper basin than in the lower basin (30%). Fish habitat values in the middle and upper basins are naturally lower than in the lower basin.

The percentage of the historic load attributed to controllable sources is lower in the middle (16%) and upper (20%) compared to the lower basin (36%). This indicates that management in the middle and upper basin areas has proportionally had less of an impact than in the lower basin and therefore drastic reductions are not as necessary. However, any additional sediment delivery from management-related sources in the upper basin can contribute to water quality impairment and therefore a moderate reduction is both necessary and feasible.

The following table specifies the TMDL targets for the VDR Watershed:

Table 7-6: Sediment load allocations by source mechanism for the VDR

a		b	c	d	e
Sub-basin	**Source Mechanism**	**Historic Sediment Load yds³/mi²/year (% of subbasin load)[3]**	**Percent Necessary Reduction**	**Reduced Load yds³/mi²/yr**	**Remaining Load yds³/mi²/yr (% of subbasin load) = load allocation**
Upper	Hillslope Processes (Plot and Air Photo Data): non-road slides and torrents, bank erosion, earthflows and gullies. (Natural)	1162 (80%)	0%	0	1162 (92%)
	Road and Skid Trail (Plot and Air Photo Data): incl. crossing failure, gully erosion from diversions and on the prism, and fill failures.	33 (3%)	80%	26	7 (<1%)
	Timber Harvesting (Plot and Air Photo Data): incl.. hillslope slides, torrents, gullies and bank erosion.	238 (17%)	60%	143	95 (8%)
	SUBTOTALS	1433	12%	169	1264
Middle	Hillslope Processes (Plot and Air Photo Data): non-road slides and torrents, bank erosion, earthflows and gullies. (Natural)	1593 (84%)	0%	0	1593 (94%)
	Road and Skid Trail (Plot and Air Photo Data): incl.. crossing failure, gully erosion from diversions and on the prism, and fill failures.	110 (6%)	80%	88	22 (1%)
	Timber Harvesting (Plot and Air Photo Data): incl.. hillslope slide, torrents, gullies and bank erosion.	183 (10%)	60%	110	73 (4%)
	SUBTOTALS	1886	10%	198	1688
Lower	Hillslope Processes (Plot and Air Photo Data): non-road slides and torrents, bank erosion and gullies. (Natural)	815 (64%)	0%	0	815 (91%)
	Road and Skid Trail (Plot and Air Photo Data): incl.. crossing failure, gully erosion from diversions and on the prism, and fill failures.	202 (16%)	90%	182	20 (2%)
	Timber Harvesting (Plot and Air Photo Data): incl.. hillslope slide, torrents, gullies and bank erosion.	240 (20%)	75%	180	60 (7%)
	SUBTOTALS	1257	29%	362	895
Basin		**1594**	**15%**	**241**	**1353**

[3] Historic sediment load volumes in this table are aggregated from Table 4.3, page 39.

Figure 7-1: Van Duzen Planning Watershed

8 Redwood Creek Watershed

8.1 GENERAL DESCRIPTION OF THE WATERSHED

Physical and Biological Setting

The 1998 U.S. EPA TMDL Study summarizes the physical and biological setting in the Redwood Creek watershed as follows.

"Redwood Creek watershed is a forested watershed located north of Eureka in northwestern California. Redwood Creek watershed is a 285 square mile forested watershed in Humboldt County, California. Redwood Creek flows into the Pacific Ocean near Orick. The drainage area upstream of the U.S. Geological Survey stream gauging station at Orick is 278 square miles. The Redwood Creek watershed consists mostly of mountainous, forested terrain from sea level to about 5,300 feet elevation. Primary land uses are tourism and fishing on parklands and timber and livestock production on lands upstream of Redwood National Park. The watershed is narrow and elongated, about 65 miles in length, from 4 to 7 miles wide. The lower basin includes the Park area and the middle and upper basin are located upstream from the Park."

The EPA study continues, "The climate of the Redwood Creek watershed is Mediterranean, with mild, wet winters (November to March), and warm, dry summers. Mean annual precipitation is roughly 80 inches, mostly rain, with snow frequently at altitudes above 1,600 feet. The snow zone of Redwood Creek watershed is roughly located upstream of Highway 299, which crosses the watershed approximately at the boundary between the middle and upper basin. Snowmelt can increase streamflow peaks during rain-on-snow events, as occurred in 1964.

Streamflow in Redwood Creek is highly variable from year to year as a result of annual rainfall variations. Streamflow also varies seasonally, owing to the highly seasonal distribution of rainfall. Winter flood flows can be as much as four orders of magnitude higher than summer low flows.
Floods are critical events for the resources of Redwood Creek because they erode hillslopes, reshape channels, and transport large proportions of fluvial sediment loads. Recent large floods occurred in 1953, 1955, 1964, 1972 (two floods), and 1975. The 1964 storm was a regionally significant event that caused major damage to towns, highways, and other structures, as well as significant hillslope erosion and channel changes.

No large floods occurred after 1975, until the recent 11-year return period flood in January of 1997. During January 1997, the relatively small 11-year return period flood initiated debris torrents of mud, boulders, and whole trees directly into Redwood Creek adjacent to Tall Trees Grove; the effects of a major storm would probably be much more severe. Within the time period from 1975 to 2015, there is an 80% chance of a 25-year flood. It has been 23 years since the last 25-year flood in Redwood Creek, in 1975. It has been 34 years since the last 50-year flood, and erosion potential in this basin from such a storm is estimated at more than 5 million cubic yards. Of this, 90% is from the private roads upstream from the park. Within the time period from 1964 to 2014, there is a 64% chance of a 50-year flood."

The EPA report goes on to discuss geologic features of the watershed: "Geologic structure in the Redwood Creek watershed is governed by several parallel north northwest trending faults. For much of its length, the channel of Redwood Creek closely follows the Grogan Fault.

Redwood Creek watershed is characterized by relative steep, unstable hillslopes, very steep inner gorge slopes along much of the mainstem and some tributaries, and narrow valley bottoms. Most of the Redwood Creek watershed has experienced uplift over the past several hundred thousand years.

The basin is underlain by the Franciscan complex of unmet amorphosed sandstones, mudstones, schists, and scattered blocks of other rock types. In general, slopes west of the Creek (which generally follows the Grogan fault) are underlain by schist, and slopes east of the Creek are underlain by sandstones and mudstones."

According to the County's GIS, nearly all (99%) of the bedrock is sedimentary or medisedimentary. A very high percentage of the land area of Redwood Creek basin is underlain by rock types that are relatively weak and susceptible to erosion and mass soil movements (e.g., schists and mudstones). Remaining areas of the watershed, which are underlain by more competent rock types, (e.g. interbedded sandstone/mudstones) are somewhat more resistant to erosion, but form steep slopes which are susceptible to rapid, shallow landsliding processes.

The natural vegetation of the Redwood Creek watershed consists mostly of coniferous forest, but also includes areas of oak woodland and grassland prairie. The County's GIS shows vegetative cover within the watershed consists primarily of Timberlands and Oak Woodlands: (56% in Fir, Redwood and Pine, and 31% in Oak Woodland). The remaining vegetative cover is in Annual Grass (6%), Riparian (4%) and other cover types (3%). The EPA TMDL Study states that the distribution of plant communities in the watershed depends primarily on water availability and fire regime.

Old-growth forest currently covers 24,315 acres in the watershed, equivalent to 14% of its total area. Near the coast, the most common forest tree is the Sitka spruce. Most of the lower basin forest, however, is dominated by coast redwoods. Farther inland, where summer temperatures are higher and fog is less frequent, Douglas fir is more common than redwood. Several hardwood species grow in association with both redwood and Douglas fir, including bigleaf maple, red alder, tanbark oak, madrone, and bay. Prairies and oak woodlands occur on south and west-facing ridgetops and hillslopes on the east side of Redwood Creek.

In addition to the watershed's vegetation characteristics, the TMDL study describe the area's wildlife: "Approximately 250 species of wildlife (amphibians, reptiles, mammals, and birds) are known to occupy habitats found in the Redwood Creek watershed. Thirty three species of wildlife are identified as species of special concern (threatened, endangered or sensitive to human activities (see RNP, 1997 for details).

The Redwood Creek watershed provides aquatic habitat for a variety of fish species. Anadromous and resident salmonids identified in Redwood Creek include steelhead and rainbow trout, coastal cutthroat trout, coho salmon, and chinook salmon. Other fish identified or reported include the tidewater goby, Humboldt sucker, threespine stickleback, coast range sculpin, Pacific lamprey, and eulachon. Five species of fish have been listed as species of special concern, endangered species, or sensitive species by federal and state agencies." (See the following section titled, "Fisheries" for more information.) The photograph below shows one of the fish present in the Redwood Creek Planning Watershed, the Coho Salmon.

The draft NCWAP reports that the Redwood Creek estuary provides an important transition between marine and freshwater environments. Because of their high productivity and isolation from predators, the estuary normally provides a very productive environment for fish. Sediment supply to the estuary is naturally high due to its position near the mouth of Redwood Creek. And as discussed later in this chapter, land management practices upstream and the adjacent flood control levee have accelerated the natural processes.
The following table summarizes the physical and biological characteristics within the Redwood Creek Planning Watershed based on the County's GIS.

Table 8-1: Redwood Creek Planning Watershed
Physical and Biological Characteristics

Acres of Bedrock Type	
Rock Type	*Total in Humboldt County*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed	469
Cenozoic Sedimentary	18,103
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	169,161
Water and/or Unclassified	86
Acres of Public Lands	
Public Land	*Total*
Redwood National Park	67,803
Prairie Creek Redwoods State Park	12,203
Other Federal Lands	2,553
Six Rivers National Forest	2,477
Other BLM	1,057
Miles of Road by Type	
Road Type	*Total in Humboldt County*
Improved	180
Primary	15
Secondary	11
Unimproved	473
Miles of Streams by Order	
Stream Order	*Total in Humboldt County*
1	339
2	93
3	44
4	61
5	7
Acres of Vegetative Cover	
Cover Type	*Total in Humboldt County*
Agriculture-Crops	420
Annual Grass	10,418
Barren	431
Chaparral	3,368
Coastal Scrub	1,108
Fir Forest	35,989
Oak Woodlands	58,920
Pine Forest	17,536
Redwood	50,647

Acres of Vegetative Cover	
Cover Type	*Total in Humboldt County*
Riparian	8,248
Urban	49
Water	430
Wetlands	18

Source: Humboldt County GIS.

Stream Classifications

Using the Strahler stream order classification system2, there are 544 miles of streams in the Redwood Creek (RC) Planning Watershed. Approximately 79% of the streams fall in orders 1 or 2: (the smallest tributaries). Only 13% of the streams are classified in orders 4 and 5. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75% of the streams in orders 1 and 2, and 12% in orders 4-8. The smallest planning watershed in Humboldt County, the Jacoby Creek Watershed, has 35 miles of streams in Humboldt County with 78% in orders 1 and 2, and the remaining 22% in order 3.

Land Use and Ownership

Public parkland accounts for approximately 45% of the land use within the watershed and is managed for recreation and ecological preservation. Timber production also accounts for approximately 45% of the of the land use within the watershed. Agriculture and rural residential development account for much of the remaining 10% of the existing land uses. The community of Orick is also located near the mouth of Redwood Creek. There are approximately 679 miles of roads in the watershed according to the County's GIS maps, 206 miles of improved roads and 473 miles of unimproved roads.[3]

The Humboldt County GIS mapping system identifies the following land use and ownership characteristics in the Redwood Creek watershed.

[2] In this stream classification system, as an order 1 stream connects with another order 1 stream, the stream becomes an order 2 stream; as an order 2 stream connects with another order 2 stream, the stream becomes an order 3 stream, and so on.

[3]The GIS-based figures are about half of the amount cited in the US EPA TMDL study of 1998 (roughly 1,400 miles), and do not include any of the 3,000 miles of skid trails identified in the study.

Table 8-3: Redwood Creek Planning Watershed Characteristics

Characteristic	*Value*
Total Acres	187,788
Total Acres within County	187,788
% of Total within County	100%
Average Parcel Size (Acres)	137.06
Largest Watershed	Redwood Creek
Dominant Land Uses	Open Space/Parks & Timber Production
Largest Private Land Owner	Simpson Timber

Source: Humboldt County GIS.

Table 8-4: Redwood Creek Planning Watershed Private Ownership over 640 acres

Private Land Owner	*Total Acres*	*% of Watershed*
Simpson Timber	32,764	17.45%
Barnum Timber	16,533	8.80%
James Russ	8,426	4.49%
Stover Ranch	6,726	3.58%
R Emmerson	6,647	3.54%
Eel River Sawmills	4,048	2.16%
S Kahn	3,523	1.88%
Russ Ranch & Timber Company	2,947	1.57%
Sierra Pacific Industries	1,136	0.61%
Pacific Forest Industries	992	0.53%

Source: Humboldt County GIS.

Table 8-5: Redwood Creek Planning Watershed Land Use

Existing Land Use	*Total Acres*	*% of Watershed*
Open space/parks	84,146	44.81%
Timber production	83,514	44.47%
Grazing/timber	6,360	3.39%
Rural residential - vacant	6,066	3.23%
Rural residential	4,100	2.18%
Public other	2,154	1.15%
Agriculture	901	0.48%
Heavy industrial	84	0.04%
Vacant	51	0.03%
Commercial	31	0.02%
Commercial - vacant	29	0.02%
Gravel mining	29	0.02%

Table 8-5: Redwood Creek Planning Watershed Land Use

Existing Land Use	*Total Acres*	*% of Watershed*
School	14	0.01%
Single family residential	11	0.01%
Multi family residential	5	0.00%
Single family residential - vacant	5	0.00%

Source: Humboldt County GIS.

Timber harvesting is the most widespread land use in Redwood Creek basin. Over 85% of the basin upstream of the park has been logged, including about 30% which was logged between 1978-1992. About three-quarters of this recently logged area was logged using intensive silvicultural methods which remove all or almost all trees from the harvest area.

Substantial areas of the park were intensively logged prior to their inclusion in the park. Harvested areas remain at greater risk of increased erosion (principally through landsliding) for at least a year or two following harvest, and possibly for longer periods of time. It is expected that timber harvesting of second growth timber in the upper basin will continue in the future, so erosion potential associated with these harvests will need to be addressed through the TMDL study.

The EPA TMDL Study states that past studies indicate that streamside landsliding and gullying on hillslopes may be the most significant processes delivering sediment to Redwood Creek. That study identified roughly 1,400 miles of forest roads and over 5,000 miles of skid trails have been built within the basin, of which about 445 miles of roads and 3000 miles of skid trails were included within the national park boundaries. About half the roads and a very high percentage of skid trails upstream of the park are not properly maintained or have been abandoned. A large proportion of observed erosion is associated with an extensive road network (7.3 mi/mi2) on private lands, improperly designed and maintained roads and skid trails, and timber harvesting.

The NCWAP assessment found that intensive fine and suspended sediment problems arose in the Prairie Creek subbasin during and after the construction of the Highway 101 bypass in 1988-90. Studies indicated that impacts to salmonid habitat occurred as a result and that the habitat may not yet be fully recovered.

Most of the likely future erosion potential in the basin caused by human activity is associated with logging roads and skid trails, although roads constructed for other purposes also pose significant erosion potential. The following table identifies the stream crossings on County roads that are potential sources of sediment erosion. The crossings have been prioritized to treat the most potentially damaging crossings first.

Figure 8 illustrates current land use and ownership in the Redwood Creek Watershed.

Fisheries

The US EPA TMDL study of 1998 summarized the status of the fishery in Redwood Creek as follows. "The cold water fishery is identified by the Regional Water Board as a beneficial use of the Redwood Creek watershed. The creek historically supported large numbers of coho salmon, chinook salmon, steelhead trout, and other fish species. Reliable data about historical fish populations in Redwood Creek are lacking. In 1965, the California Department of Fish and Game roughly estimated spawning escapement of 5000 chinook, 2000 coho, and 10,000 winter steelhead.

Coho salmon, a species native to the Redwood Creek, is listed by the National Marine Fisheries Service as a threatened species. In addition, steelhead and chinook salmon populations have declined significantly in the watershed. By 1994, five fish species found in Redwood Creek were classified as a species of concern, threatened or endangered by U.S. Fish and Wildlife Service and/or the California Department of Fish and Game: tidewater goby, coast cutthroat trout, coho salmon, spring run chinook salmon, and summer steelhead trout (RNP, 1997). Sedimentation due to natural geologic instability, past and present land use practices, and other factors has contributed to the reduction and loss of habitat necessary to support cold water fish including salmonids. The second most abundant, historically and currently, is the fall-run chinook, which is also a significant indicator of the fish population in the basin. Other cold-water species include winter and summer steelhead (*O. mykiss*), coho salmon (*O. kisutch*), and pacific lamprey (*Lampetra pacifica*). Chum salmon (*O. keta)* have been infrequently observed in the watershed (PWA1994).

More sediment has been supplied to the low gradient reaches of the mainstem than it can effectively transport. Low gradient reaches of the mainstem Redwood Creek have acted as long term repositories of eroded sediment which originated in upstream areas. Although the creek is apparently beginning to downcut through aggraded sediments in its lower basin reaches, this stored sediment has the potential to affect channel structure and habitat values for centuries. In contrast, the higher gradient mainstem reaches in the upper watershed have removed about half the sediment deposited by the 1964 flood within 20 years (RNP, 1997).

Most mainstem pools were filled by sediments born primarily by the 1964 flood, and to a lesser extent by other high magnitude events between 1954 and 1975. Pool frequency and mean depth appeared to increase since 1975 as the creek began to move out previously deposited sediment loads, and pool recovery is more apparent in the upper basin. However, many pools were again filled by sediments following the moderate 1997 storm season. Reduced pool frequency and depth impairs rearing habitat by reducing availability of cool water refuges and increasing predation.

Many reaches of Redwood Creek became substantially wider and shallower in response to excessive sediment inputs and destructive flood flows which occurred between the mid 1950s and mid 1970s. Stream width increased and depth decreased in response to streambank erosion and channel aggradation. Although channel deepening and pool development have been observed in all but the lower few miles of the Creek, the mainstem generally lacks an adequate pool-riffle structure and cover. Coarse sediment deposited in the mainstem allows a large proportion of summer base flows to infiltrate and flow subsurface, thereby limiting the surface water available to fish and increasing surface water temperatures.

Although many reaches of Redwood Creek have begun to downcut through aggraded sediments (especially in the middle and upper basins), stream widths have not decreased substantially. Fish habitat impacts associated with increased width and decreased depth include increases in water temperature, decreased cover to hide from prey, and increased difficulty in moving up and down the stream in search of food and cool water refugia. In addition, aggraded sediment deposits have formed "deltas" at the mouths of many tributaries which impede fish passage upstream into tributaries. Finally, as the creek has widened and riparian timber has been harvested, canopy coverage of the stream has been reduced substantially, contributing to water temperature increases." The following photograph shows a portion of the lower mainstem of Redwood Creek where the stream is downcutting through sediments eroded from upstream tributaries.

The EPA TMDL Study continues, "Although limited data are available concerning stream substrate composition in Redwood Creek, it appears that there is a slight trend toward coarsening of bed material since the 1970s. However, levels of fine sediment (which can be harmful to fish spawning

success) appear to be higher than desirable for successful fish spawning in many reaches of Redwood Creek, principally in the lower basin.

Large woody debris (LWD) in North Coast streams provides multiple functions which are key to the maintenance of healthy stream habitat and the moderation of sedimentation impacts on those streams. Presence of adequate LWD is a key factor in pool formation, sediment storage, and nutrient loading in many streams. Due to extensive harvesting of riparian forests along Redwood Creek and its tributaries along with extensive streambank erosion, recruitment of LWD is well below historic levels needed to support healthy fish habitat and to moderate sediment transport."

The EPA TMDL Study continues, "The A lack of suitable rearing habitat in the mainstem and tributaries has forced juvenile fish to the estuary, where they are subject to the impacts of sudden, extreme changes in salinity resulting from breaching of the sand bar by ocean waves and currents." It also points out that in recent years, spawning habitat is improving slowly as gravels are cleaned of fine sediment.

The draft NCWAP Watershed Assessment found that Prairie Creek subbasin provides the best salmon and steelhead habitat of any of the Redwood Creek subbasins. With its coastal fog belt position and dense streamside canopy from mature vegetation, stream water temperatures are fully suitable for salmonids, The following photograph shows the mature streamside canopy along Prairie Creek.

8.2 WATER QUALITY CONCERNS

The 1998 U.S. EPA Total Maximum Daily Load (TMDL) Study[4] and the draft North Coast Watershed Assessment Program (NCWAP) Redwood Creek Watershed Synthesis Report[5] summarized water quality concerns in the Redwood Creek Watershed. In general, stream channels in the Redwood Creek basin are wider, shallower, and more homogeneous than is desirable or were historically present.

The EPA report concludes that Redwood Creek (the largest creek in the watershed planning area) is particularly prone to storm-induced erosional events, and would probably experience extensive erosion under natural conditions. However, land management activities have accelerated this natural process, overwhelming the stream channel's ability to efficiently move the delivered sediment.

Land management patterns and practices have contributed to increased erosion beyond natural rates through landsliding and gullying and stream bank erosion. The resultant erosion causes sediment to enter the stream, filling deep pools and depositing silt in spawning gravels.

Stream channel structure along the mainstem of Redwood Creek and its tributary watersheds has changed substantially over the last 50 years. Key changes in the mainstem of Redwood Creek include: (1) increases in the volume of stored sediment, (2) decreases in pool numbers and depth, (3) increases in stream width and decreases in stream depth, (4) reduced amounts of large woody debris, and (5) deposition of high levels of fine sediments on the stream bottom.

[4] TMDL Studies are pollution control plans drafted by the US Environmental Protection Agency (EPA) to meet the requirements of Section 303(d) of the Federal Clean Water Act. The TMDL serves as the means to attain and maintain water quality standards for impaired water bodies. . In Humboldt County, TMDLs are most often applied because of pollution related to sedimentation and siltation, whereas in most other regions of the state they are necessary to control chemicals and nutrient imbalances. For more information on the program, see the sections titled "Other Total Maximum Daily Load Watersheds" and "Regulatory Framework" later in this chapter.

[5] The interagency North Coast Watershed Assessment Program produces assessments of watershed conditions to determine factors affecting fish production and recommend measures for watershed improvements.

Anadromous and resident salmonid[6] populations in Redwood Creek are much reduced in comparison to historic levels. Habitat conditions are probably still quite degraded relative to pristine conditions, but are showing signs of improvement. Although channel deepening and pool development have been observed in all but the lower few miles of the Creek, the mainstem generally lacks an adequate pool-riffle structure and cover. Coarse sediment deposited in the mainstem allows a large proportion of summer base flows to infiltrate and flow subsurface, thereby limiting the surface water available to fish and increasing surface water temperatures. Large deltas in some tributaries block some tributary mouths and prevent migration of fish.

The draft NCWAP study finds that naturally high erosion rates, major storms, upstream human-caused disturbances, and levee construction in the estuary have exacerbated sediment accumulation in the estuary and reduced the quantity and quality of habitat for salmon. Water temperatures in the estuary have exceeded the "fully suitable" range for salmonids since at least 1997, when monitoring began.

The lack of suitable rearing habitat in the mainstem and tributaries has forced juvenile fish to the estuary, where they are subject to the impacts of uncontrolled breaching of the sand bar.

Spawning habitat is improving slowly as gravels are cleaned of fine sediment. Canopy closure along the upper reaches of Redwood Creek is increasing, but is still far less than it was in the early 1900's. Tributary water temperatures are generally suitable for salmon and steelhead, but are too high along much of the mainstem for optimal fish habitat conditions.

Recruitment of large woody debris (LWD) and nutrients are probably well below historic levels. This condition is likely to persist into the future as deciduous willows and alders take the place of evergreen conifers along much of the mainstem and tributaries, and as large conifers along watercourses in the upper basin are harvested. Willows and alders generally yield less durable LWD than conifers.

The draft NCWAP study also contains a detailed analysis of the status and condition of existing roads, and concludes that remaining erosion potential associated with poorly designed and maintained roads remains the largest future erosion source in the basin which can be controlled and is not part of natural loading.

Although there has been some recovery in the Redwood Creek and tributary channels, it is expected that a very high percentage of improperly constructed or maintained roads and skid trails will fail during the next high magnitude storm. Unless corrected through road upgrading, maintenance, and/or decommissioning, such road failures are expected to cause substantial direct erosion (through crossing failures, stream diversions, etc.) and indirect erosion events (e.g. gully formation and mass wasting events).

Other continuing land uses in the basin pose less substantial erosion potential although potential impacts could be significant in local settings. Intensive timber harvesting, particularly using clearcutting and tractor logging in sensitive streamside areas may pose significant erosion potential in the future. State and county roads pose significant erosion potential in some locations. Ranching operations and residential property management may also have the potential to cause significant erosion, particularly in locations where livestock access contributes to bank erosion.

[6] The term "anadromous" refers to the tendency for salmon, steelhead and some other trout (salmonids) to swim upstream to spawn.

8.3 NCWAP RECOMMENDATIONS AND REQUIREMENTS

As they are met in future years, the reductions in sedimentation levels required by the US EPA TMDL Study (Table H-7) will help restore the historic characteristics of the watershed's creeks and streams. The draft NCWAP report recommends the following measures be implemented to help meet those TMDL targets and to otherwise improve the condition of the watershed for salmon and steelhead (and other salmonids as well).

Improvements to estuary conditions for salmon should be made through activities both within the estuary and upstream. Within the estuary, opportunities should be explored for levee modifications that would improve flow conditions, drainage patterns, and increase estuarine habitat area and increase the function of adjacent wetlands and sloughs. Upstream actions that reduce sediment generation and transport and that help to lower water temperatures will also benefit salmon habitat conditions in the estuary.

Roads should be decommissioned or upgraded in accordance with existing or future road assessment surveys, especially roads located on unstable slopes and roads near streams. If new roads need to be constructed, they should not be located near the valley bottom where they may pose a high risk of generating sediment delivery to streams.

Timber management on steep slopes should use lower impact silvicultural prescriptions and cable or helicopter yarding to reduce the potential for sediment production.
Timber management should ensure that adequate streamside protection zones are used to reduce solar radiation and to moderate air temperatures in order to reduce heat inputs to Redwood Creek and its tributaries.

Where current streamside canopy is inadequate and site conditions are appropriate, land owners and land managers should use tree planting and other vegetation management techniques to hasten the development of denser and more extensive riparian canopy.

To address the lack of large woody debris, land owners and land managers should encourage its recruitment by allowing streamside conifers to grow to large sizes, and through direct placement of large woody debris in the stream channel. Land owners and managers should consider cautious thinning from below in riparian areas to hasten the development of large riparian conifers (which make better instream structures than willows and alders).

8.4 TMDL TARGETS

The 1998 US EPA Study established the following TMDL limits. "The allocations divide the TMDL among key source categories, including natural background sources. (The method for addressing natural background is discussed below.) The allocations are derived from the adjusted sediment budget presented in the source analysis section, which was based primarily on the sediment budget in the Redwood Creek watershed analysis.

The individual load allocations are based on EPA's assessment of the degree to which fraction of total loads from each source category was estimated, and the remaining loads by category were summed and compared with the TMDL. This analysis found that application of reasonable TMDL.

"Controllable" sources of sediment are defined as those that are associated with human activities and will respond to mitigation, altered land management, or restoration. The percentages reflect professional judgment of how successful the various best management practices (BMPs) generally are in controlling these sources. These assessments of source control potential are generally consistent

with though slightly more stringent than those used for the Garcia River sediment TMDL established in 1998 and the Redwood Creek TMDL.

A significant portion of bank erosion is believed to be associated with higher flow elevations caused by changes in channel shape, which in turn are associated with sediment loads in the future, it is assumed that the frequency and magnitude of bank erosion will decline, and that the volume of eroded bank sediments will decline as well. Finally, it is expected that some reduction in bank erosion will occur in response to improvements in livestock management practices and, potentially, timber harvesting practices in riparian zones."

The following table shows the average yearly rates of erosion in the Redwood Creek basin at Orick from 1954 to 1997. It shows a general trend toward less sedimentation being delivered in the creek presently compared to previous years.

Table 8-6: Historic Erosion Rates in the Redwood Creek Watershed

Time Period	*Annual Average Load (tons/mi2/year)*	*Source*
1954-1980	5,995	Redwood Creek Watershed Analysis Appendix C
1974-1992	3,120	Watershed Analysis
1981-1997	2,769	Calculated from Watershed Analysis and Redwood National Park (RNP) data
1954-1997	4,749	Calculated from Watershed Analysis and Redwood National Park (RNP) data

Source: U.S. EPA TMDL Study for the Redwood Creek Watershed, 1998.

The report goes on to state, "It is estimated that about 40% of loads from mainstem landslides could be prevented. The sediment budget description inferred that most debris torrents are road-related. Because road-related debris torrents can usually be avoided through proper road siting and maintenance (e.g., through avoidance of side-casting), the estimated 50% control level is realistic.

Natural background is addressed in the allocations in two ways. First, explicit estimates of natural background loading levels are provided for different mass wasting processes, and it was assumed these sources are not controllable. Second, it is inferred that a portion of fluvial erosion would be naturally occurring, although the proportion of uncontrollable loads for the fluvial erosion categories that are related to natural sources versus uncontrollable anthropogenic sources is not distinguished. Control percentages for these sources are more modest as a result. Allocations for road-related sediment applies to all land use activities including roads for timber, agricultural, residential, and park management activities as well as state and county roads.

Table 8-7: Summary of TMDL and Allocations for the Redwood Creek watershed.

a	b	c	d	e
Source Mechanism	**Historic Sediment Load[1] ($t/mi^2/yr$)**	**Percent Controllable[2]**	**Controllable Load[3] ($t/mi^2/yr$)**	**Remaining Load (Allocation)[4] ($t/mi^2/yr$)**
Roads, Landings and Skid Trails erosion	690	85%	580	110
Gully Erosion (~90% road related)	1020	85%	870	150
Bare Ground Erosion	400	85%	340	60
Stream Bank Erosion	590	35%	210	380
Tributary Landslides: Naturally Occurring	210	0%	0	210
Tributary Landslides: Road Related	360	80%	290	70
Tributary Landslides: Harvest Related	390	50%	190	200
Mainstem Landslides (Human Induced and Naturally Occurring)	810	40%	320	490
Debris Torrents	100	50%	50	50
Other Mass Movements (Naturally Occurring): - earthflows - block slides	180	0%	0	180
Totals	4750		2850	1900

Source: U.S. EPA TMDL Study for the Redwood Creek Watershed, 1998.

Figure 8-1: Redwood Creek Planning Watershed

9 Cape Mendocino Planning Watershed

9.1 GENERAL DESCRIPTION OF WATERSHED

Physical and Biological Setting

The Cape Mendocino Planning Watershed (CMP) is located in California's North Coast Range. The watershed is immediately east of the "triple junction" of the American, Pacific and Gorda tectonic plates, a highly active geologic province (see Chapter Geologic Hazards . primarily in Humboldt County, and encompasses a total area of approximately 319,628 acres. Almost all (98%) of it lies in Humboldt County and the remainder in Mendocino County.

There are 40 sub-watersheds in the CMP and 1,062 miles of streams in the Humboldt County portion. (There are also 18 miles of the Planning Area's streams in Mendocino County.) Based on the Strahler stream order classification system approximately 80% of the streams fall in orders 1 or 2: (the smallest tributaries), similar to other coastal watershed planning areas in the County.

The CMP is mostly steep mountainous topography. The basin's higher elevation slopes . commonly exceed 15 percent gradient. Broad, alluvial streamside flats are present in the lower valleys. The lower stream channels are dominated by large gravel bars typically composed of cobble, gravel and fine sediments. Headwater elevations range from 1,350 feet at Four Comers at the mainstem headwaters, to 4,088 feet at Kings Peak, which is located less than three miles from the ocean and is the tallest mountain in the coastal range.

The mainstem Mattole river, the largest sub watershed within the CMP is approximately 62 miles long, and receives water from over 74 tributary streams. There are approximately 545 perennial stream miles in the Mattole watershed basin. The Mattole River enters the Pacific Ocean approximately 10 miles south of Cape Mendocino. During most summers, a sand spit encroaches all the way across the river mouth to form a bay mouth barrier, which creates a lagoon behind it. Generally the barrier remains until runoff from fall rains breeches it. However, in some years large swells at times of high tide overtop the barrier and a new outlet channel is carved through the barrier.

Geologic Features. The Cape Mendocino planning watershed can be classified into three primary bedrock types:

1. Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary
2. Cenozoic Sedimentary, and
3. Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed

Almost all (99%) of the bedrock underlying the watershed is Sedimentary or Metasedimentary. As with other watersheds in Humboldt County, sedimentation rates are high in the watershed because of the high uplift and stream incision rates into relatively weak bedrock units. This combination has produced a high incidence of landsliding adjacent to stream channels, including large slump-earthflows and extensive zones of debris sliding. A highly active tectonic setting, combined with sensitive terrain and high rainfall amounts, make the Cape Mendocino one of the most erodible watersheds in the State.

Sediment supplied to streams from landslides can vary, dependant on the bedrock and/or landslide types being eroded. For example, debris slides in the King Range are likely to produce coarser grained materials (sands and cobbles), while earthflows in the Coastal terrane will produce significant amounts of finer grained materials (silts and clays) during high water flows.

The major active fault zones in the Mattole basin are the Cooskie and Petrolia shear zones. The Cookskie Shear Zone is a poorly defined zone of sheared and broken rock which extends easterly from Punta Gorda, and the Petrolia shear zone is a similar structure extending southeast through Petrolia toward along the Mattole River. If the Cookskie and Petrolia shear zones are on-land extensions of the offshore plate boundary fault systems (McPherson and Dengler, 1992; Clarke and McLaughlin, 1992), they represent significant active fault zones. In addition, the San Andreas Fault, which represents the boundary between the Pacific and north American plates, lies either onshore or immediately offshore in the coastal drainages to the west of the Mattole watershed.

The Honeydew earthquake of 1991 occurred on one of these faults and measured 6.3 on the Richter scale. Some coastal areas in the Petrolia region were uplifted nearly five feet (5') during that event.

Vegetation. Prior to European settlement, coniferous forest extended throughout most of the Cape Mendocino Planning Watershed. The current vegetation is predominately forestland. The This area is unusual within the Northern California coast as having very little redwood forest present; only about 5% of the forests in the area are Redwood forests. It is thought this is primarily due to the King Range blocking the summer fog.

Fir forests and Oak Woodlands are the predominant vegetation types in the area, with 46% presently in Fir forests and 20% of the area in Oak Woodlands.

Natural prairie grassland is concentrated on the northwestern portion of the basin, but prairie soils occur throughout the basin, mostly on ridgetops. Approximately one fifth (21%) of the area is covered by grasslands. According to the public review draft Mattole Watershed Synthesis Report (March 22, 2002), half of the forest land in the Mattole watershed is comprised of trees that have an average size of 12-24 inches diameter at breast height (DBH). As these trees mature, harvesting will likely increase in the watershed planning area. Twenty percent (20%) of the area is covered by stands that average greater than 24 inch DBH trees and another 11 % is covered by pole- sized trees 6-11 inches DBH.

The portion of the watershed planning area that lies in Mendocino County has a significant amount of crop land. More than 90% of the crop land in the watershed occurs in Mendocino County.

Roads. Gravel roads comprise most of the roads in the watershed planning area. There are approximately 845 miles of gravel roads in the watershed planning area while there are 247 miles of paved roads in the planning area. This works out to roughly a density of one mile of improved road for every 2 square miles and one mile of gravel road for every 1/2 square mile.

The following tables summarize the dominant physical and biological characteristics within the watershed planning area.

Table 9-1: Cape Mendocino Watershed Planning Area
Physical and Biological Characteristics

Miles of Road by Type

Road Type	*Total in Humboldt County*	*Total in Watershed*
improved	247	257
unimproved	845	864

Miles of Streams by Order

Stream Order	*Total in Humboldt County*	*Total in Watershed*
1	629	647
2	206	215
3	105	106

Table 9-1: Cape Mendocino Watershed Planning Area
Physical and Biological Characteristics

Miles of Streams by Order		
Stream Order	*Stream Order*	*Stream Order*
4	73	73
5	49	49
Total	1062	1090
Acres of Vegetative Cover		
Cover Type	*Total in Humboldt County*	*Total in Watershed*
Agriculture-Crops	55	555
Annual Grass	66,770	66,822
Barren	3,850	3,978
Chaparral	10	10
Coastal Scrub	7,032	7,078
Fir Forest	143,579	146,908
Oak Woodlands	61,844	63,665
Pine Forest	7,713	8,634
Redwood	15,224	16,502
Riparian	4,562	4,572
Urban	105	105
Water	461	461
Total	311,704	319,290
Acres of Bedrock Type		
Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	65	2,098
Cenozoic Sedimentary	26,596	25,163
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	282,124	289,755
Water and/or Unclassified	2,388	2,612
Acres of Public Lands		
Public Land	*Total*	
King Range National Recreation Area	58,240	
Other BLM	5,031	
Humboldt Redwoods State Park	1,474	
Other City, County, or Local Agencies	1,258	
Other Federal Lands	710	

Source: Humboldt County GIS

Historic and Existing Land Use

The Mattole Watershed Synthesis Report summarizes historic and existing land use in the Mattole Watershed as follows:

"...the basin was occupied by Athapaskan-speaking Mattole and Sinkyone Native Americans when the first settlers from the Eastern United States arrived in the early 1850s. Little is known about these Native Americans, for they were quickly displaced by the new settlers. Disputes over hunting ground and domestic stock culminated in a massacre at Squaw Creek in 1864. Survivors were sent to the Round Valley Reservation in the Middle Fork of the Eel River, where most succumbed to the measles epidemic in 1868..."

" In 1858, just four years after Hill explored the valley, and with the influx of new pioneers, farming began in earnest. The very first settlers were farmers and ranchers who converted native grassland into homesites, home gardens, orchards and rangeland. As grazing activities increased, conversion of the adjoining forests began. Timber was harvested for local needs or simply felled and then areas broadcast burned for conversion.

Petrolia grew rapidly during the short-lived oil boom of 1864-65. Natural gas vents and oil seeping from the ground began a local land rush that almost doubled the Valley population of282 to over 450 people by 1870 (Elliott). While many land patents were obtained and numerous test wells drilled, there was never a truly commercial volume of oil produced. Many of the oil seekers remained.

Elliott's 1882 Encyclopedia of Humboldt County noted that the Mattole area produced butter, cheese, wool, beef, mutton and pork. The encyclopedia further states that though the best fruit of the county grows in the Bear River and Mattole districts, the distance to market was too great for commercial production. This theme of distance to market and poor roads is a recurring theme that has stymied rural prosperity in the Mattole (Roscoe, 1977).

Just after the turn of the century, tannin produced from the bark of tan oak trees became a commercial commodity in the Mattole basin. The Wagner Leather Company in Briceland processed tan-bark and shipped the solution in barrels to the wharf in Shelter Cove between the years 1901 and 1922 (Cook, 1997). During the boom years, over three thousand cords of bark were processed each year by Wagner Company (Raphael, 1984). The Mattole Lumber Co. in the lower Mattole utilized a one mile rail line which led to a wharf constructed in 1908 at the mouth of the Mattole.

The valley's tan oak bark was first hauled out by mule and then transferred to horse and wagon (Clark, 1981). The wharf required constant and expensive maintenance and was not rebuilt after a storm in the winter of 1913/1914. Tan bark harvesting continued until the supply was depleted in the early 1920's, (Clark, 1981) at about the same time that the tannin extract was replaced by synthetic products.

In 1941, the most widespread use of the watershed appears to have been grazing and is indicated by the amount of grassland and recent fires which appear to be deliberate conversion of pre-existing brush and timberland. Conifer timber harvesting activities are readily apparent near Harris Creek and continue further upstream into the redwood belt. Timber harvest operations began in earnest as Douglas-fir became a merchantable building material during the post World War II boom. The 1952 air photos show the beginning of the large scale timber harvesting era in the Douglas-fir forests of the Mattole basin. This was the first entry into most of the forest land by mechanized equipment. Harvests were not designed as silvicultural treatments and were an extractive land use. The on-the-ground effects varied from a type of selection to a seed tree cut with a large amount of remaining vegetation consisting of unmerchantable conifers, tan-oak, and brush. Many of these harvests became

precursors to range conversion. The roading was typical of the time period; log landings and access roads were generally at the bottom of the slopes in or adjacent to stream channels. "

The report goes on to state that by the late 1980s, timber harvesting decreased due to changes in policy concerning management of federal lands, changes in Forest Practice Rules and the designation of the Northern Spotted Owl as federally threatened. Some timber harvest plans in the area have been hotly contested, involving protests that include civil disobedience. More recent changes in the Forest Practice Rules are more protective of streams, and new technology and science applied to timber harvesting has helped to reduce impacts to streams. For example where before roads and log landings were built adjacent to or even within streams, they are now cut upslope to minimize the potential erosion of soil into streams.

The following tables from the Humboldt County GIS system illustrate the existing land use and ownership patterns in the Cape Mendocino Planning Watershed within Humboldt County. The tables demonstrate that nearly 65% of the watershed is currently used for timber production and agriculture; another 22% is used for parks and open space.

The tables also show private land ownership patterns in the CMP are fragmented. There are only three private land owners that have more than 2% of the land holdings within the watershed area. The largest land owner is Pacific Lumber with 11% of the CMP.

Table 9-2. Cape Mendocino Watershed Planning Area Land Use in Humboldt County

Existing Land Use	*Total Acres*	*Percent of Watershed*
Timber production	125,665	40.31%
Grazing/timber	73,809	23.67%
Open space/parks	67,831	21.76%
Rural residential	23,305	7.47%
Rural residential - vacant	17,649	5.66%
Public	2,120	0.68%
Single family residential - vacant	872	0.28%
Single family residential	107	0.03%
Commercial	53	0.02%
Commercial - vacant	38	0.01%
Tribal lands	35	0.01%
Agriculture	18	0.01%
Church	11	0.00%
Multi family residential	1	0.00%
TOTAL	311,513	

Table 9-3: Cape Mendocino Watershed Planning Area Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed*
Pacific Lumber Company	34,513	11.07%
Russ Ranch & Timber Company	10,287	3.30%
R Emmerson	7,345	2.36%
Barnum Timber	5,052	1.62%

Table 9-3: Cape Mendocino Watershed Planning Area Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed*
R Stansberry	4,520	1.45%
D Schmidt	4,489	1.44%
J Zanone	4,465	1.43%
McBride Properties	4,201	1.35%
E & S Etter	3,609	1.16%
McWhorter Family Ranch	3,403	1.09%
A & J McBride	3,098	0.99%
J Edmonston	3,093	0.99%
J McBride	3,010	0.97%
James Russ	2,853	0.92%
5 S Ranch	2,808	0.90%
Save the Redwoods League	2,698	0.87%
Church of Spiritual Technology	2,525	0.81%
G Roscoe	2,474	0.79%
J & C Clark	2,241	0.72%
Beal Family Trust	2,197	0.70%
L French	2,190	0.70%
V Dwight	2,054	0.66%
J & K Russ	1,990	0.64%
J Chambers	1,968	0.63%
R Mozzetti	1,872	0.60%
M Lowry	1,814	0.58%
Bertha Russ Lytel Foundation	1,717	0.55%
F Shanahan	1,657	0.53%
F Sweet	1,550	0.50%
I Brashear	1,440	0.46%
G Whitchurch	1,417	0.45%
S & D Lowry	1,380	0.44%
W & G McBride	1,378	0.44%
A Moore	1,373	0.44%
Eel River Sawmills	1,326	0.43%
J & L Vevoda	1,297	0.42%
Scarpulla Associates	1,240	0.40%
Lloyds Bank California	1,217	0.39%
E Graham	1,197	0.38%
Hadley L	1,142	0.37%
A Ballister	1,109	0.36%
J Cook	1,105	0.35%

Table 9-3: Cape Mendocino Watershed Planning Area Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed*
S Sterling	1,079	0.35%
D Bruner	1,078	0.35%
M Brown	1,059	0.34%
Peaked Prairie Partnership	982	0.32%
J & B Phelps	973	0.31%
L Walker	917	0.29%
J & W Philbrick	866	0.28%
T Russ	848	0.27%
T Phelps	837	0.27%
F Doyle	832	0.27%
C Gill	792	0.25%
Union Bank of CA & V Dwight	771	0.25%
North Fork Ranch	697	0.22%

Figure 9 illustrates the current land use and ownership patterns in the portion of the Cape Mendocino Watershed located in Humboldt County.

Fisheries

The CMP maintains an aquatic habitat that supports coho and chinook salmon, and steelhead trout, particularly summer stocks, which are found in less than a dozen streams in California. The NCWAP points out two notable fish species that have apparently gone extinct in the Mattole Basin are spring-run chinook salmon (DFG 1972) and green sturgeon (Moyle et al. 1989). Many fish in the Mattole Basin use the estuary for spawning and juvenile rearing habitat.
According to a 1965 Department of Water Resources study:

"It is insufficient to note here that the Mattole River was formerly one of the better king salmon (chinook salmon), steelhead (trout), and silver salmon (coho salmon) producers of the entire coast. Since 1950, excessive logging operations have taken place in the drainage, which has severely damaged the stream, primarily from siltation. The stream is still considered to have the potential to again be the major fish producer that it was historically if improved logging and land management principles are followed."

The NCWAP notes that chinook salmon juveniles are detained in the estuary at the mouth of the Mattole River because of the creation of lagoon conditions early in the summer. This prevents them from going to the ocean until it reopens in Fall. Unfortunately, conditions in the estuary through the summer are not hospitable and studies conducted by Humboldt State University within the past fifteen years have shown high, and perhaps total, mortality in some years.

The Mattole Salmon Group (MSG) maintains and enhances the remnant runs of native fall-run chinook salmon and coho salmon in the Mattole Basin through a hatchbox program and a rescue-rearing program. The goal of these programs is to restore native salmon runs to self-sustaining levels that can be maintained without artificial propagation or other significant human intervention. Beginning in 1981, MSG has trapped wild adult chinook and coho salmon in the Mattole Basin for use as broodstock. Eggs are obtained from females and fertilized. Fertilized eggs are incubated in hatchboxes. After hatching, fry are reared for 6 weeks before release.

All artificially propagated fish are marked, in order to provide estimates of hatchery- to-wild ratios. Adult trapping data from 1995 to 1999 suggest an overall hatchery-to-wild ratio of 13: 131, and spawning ground surveys over the same time period suggest a hatchery-to-wild ration of 3:98.

For the past several years in May and June, MSG has also trapped chinook out-migrants just upstream of the estuary. MSG project personnel and volunteers net up to 6,000 naturally spawned downstream migrant salmonids each year and hold them in rearing ponds at Mill Creek. Volunteers rear fish until water temperatures drop and/or the lagoon opens to the sea with fall rains. The combined number of chinook salmon released from the MSG's hatchbox rearing program and their rescue-rearing program since 1981 is about 400,000.

Summary of Water Quality Concerns and Recommendations

The draft NCWAP identifies the following hypothesis regarding water quality in the Mattole watershed:

- Summer stream temperatures in much of the Mattole Basin are not within the range of temperatures that fully support healthy salmon and steelhead populations.
- Aggradation from fine sediment and the lack of logs and stumps in some stream channels has reduced channel diversity needed to support salmon and steelhead populations.
- The reduction of stream flow caused by human diversions causes increases in water temperature in some areas that is not supportive of salmon and steelhead populations.

Based on these hypotheses, the study proposes the following recommendation:

- Establish 24 hour summer water and air temperature monitoring stations
- Establish monitoring stations and train personnel to measure and track fine sediment levels in the streams
- Continue efforts such as road improvements and decommissioning throughout the basin to reduce erosion into the streams
- Place large logs and stumps in the streams to improve fish habitat in areas where there is a lack of those structures
- Encourage summertime water conservation to improve stream flows and fish habitat
- Encourage planting of vegetation along streams in areas with inadequate tree cover
- Encourage timber harvesting practices that minimize soil erosion.
- Support the rescue rearing efforts of the Mattole Salmon Group.

There are numerous other creeks and rivers in the watershed including the following:

Guthrie Creek
Bear Gulch
Unnamed Tributary of Oil Creek
Oil Creek
Unnamed Creek North of Bear River
Bear River
Singley Creek
Unnamed Tributary of Singley Creek
Durr Creek
Davis Creek
Unnamed Tributary of Davis Creek
Randall Creek
Spanish Creek
Oat Creek
Kinsey Creek
Big Creek
Big Flat Creek
Shipman Creek
Unnamed Creek South of Shipman Creek
Buck Creek
Gitchell Creek
Two (2) Unnamed Creeks South of Gitchell

McNutt Gulch
Cooskie Creek
Bear Creek
Stansberry Creek
Fourmile Creek
Unnamed Creek South of Fourmile Creek
Sea Lion Gulch
Unnamed Creek South of Sea Lion Gulch
Chemise Creek
Creek
Horse Mountain Creek
Two (2) Unnamed Creeks South of Horse Mountain Creek
Telegraph Creek
Humboldt Creek
Dead Man's Creek
McKee Creek
Unnamed Tributary of McKee Creek

Habitat inventories and biological inventories of some other creeks and rivers in the Cape Mendocino Planning Watershed have been conducted by the Department of Fish and Game. The habitat inventories document the habitat available to anadromous fish, and the objective of the biological inventories document the presence and distribution of juvenile salmonid species.

Following are descriptions of the creeks and rivers that were studied and the recommendations contained in each of these reports.

Bonanza Gulch

Bonanza Gulch is tributary to the Bear River. Bonanza Gulch's legal description at the confluence with Bear River is T01N R02W S16. It is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Bonanza Gulch drains a watershed of approximately 1.8 square miles. Elevations range from about 190 feet at the mouth of the creek to 960 feet in the headwater areas. Grass dominates the watershed. The watershed is entirely privately owned and is managed for rangeland.

Recommendations:

1) Bonanza Gulch should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are nearing the threshold of the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

Beer Bottle Creek

Beer Bottle Creek is a tributary to the Bear River. Beer Bottle Creek's legal description at the confluence with Bear River is T01S R01W S12. It is a second order stream and has approximately 1.2 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Beer Bottle Creek drains a watershed of approximately 1.2 square miles. Elevations range from about 920 feet at the mouth of the creek to 2,040 feet in the headwater areas. Coniferous trees dominate the watershed. The watershed is entirely privately owned and is managed for timber production.

Recommendations:

1) Beer Bottle Creek should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

Bear River Tributary G

Tributary G is tributary to the Bear River. Tributary G's legal description at the confluence with the Bear River is T01N R01W S30. Tributary G is a first order stream and has approximately 1.6 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Tributary G drains a watershed of approximately 1.1 square miles. Elevations range from about 500 feet at the mouth of the creek to 2,355 feet in the headwater areas. Redwood/Douglas fir forest and grassland dominates the watershed. The watershed is entirely privately owned and is managed for grazing rangeland and timber production. Vehicle access via Mattole Road to Monument Road to Upper Bear River Road.

Recommendations:

1) Tributary G should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulder. Adding high quality complexity with woody cover is desirable.

Bear River Tributary F

Tributary F's legal description at the confluence with Bear River is T01N R01W S30. Tributary F is a first order stream and has approximately 1.9 miles of blue line stream according to the USGS Taylor Peak 7.5 minute quadrangle. Tributary F drains a watershed of approximately 1.6 square miles. Elevations range from about 380 feet at the mouth of the creek to 1400 feet in the headwater areas. Redwood/Douglas fir mixed coniferous forest and grassland dominates the watershed. The watershed is entirely privately owned and is managed for timber production and grazing rangeland. Vehicle access exists via Monument Road.

Recommendations:

1) Tributary F should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

Bear River Tributary E

Tributary E's legal description at the confluence with Bear River is T01N R01W S29. Tributary E is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS Taylor Peak 7.5 minute quadrangle. Tributary E drains a watershed of approximately 1.2 square miles. Elevations range from about 420 feet at the mouth of the creek to 900 feet in the headwater areas. Redwood/Douglas fir forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and grazing rangeland. Vehicle access exists via Monument Road.

Recommendations:

1) Tributary E should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) Increase the canopy on Tributary E by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels.

7) Suitable size spawning substrate on Tributary E is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

Bear River Tributary D

Tributary D's legal description at the confluence with Bear River is T01S R01W S2. Tributary D is a first order stream and has approximately 2.2 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Tributary D drains a watershed of approximately 1.2 square miles. Elevations range from about 700 feet at the mouth of the creek to 2400 feet in the headwater areas. Conifers dominate the watershed. The watershed is entirely privately owned and is managed for grazing rangeland and timber production.

Recommendations:

1) Bear River Unnamed Tributary D should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

South Fork Bear River

South Fork Bear River is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). South Fork Bear River's legal description at the confluence with Bear River is T01N R02W S21. Its location is 40•27'41• north latitude and 124•17•29• west longitude. South Fork Bear River is a second order stream and has approximately 7.0 miles of blue line stream according to the USGS Cape Town and Taylor Peak 7.5 minute quadrangles. South Fork Bear River drains a watershed of approximately 12.9 square miles. Elevations range from about 180 feet at the mouth of the creek to 1400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and grazing rangeland.

Recommendations:

1) South Fork Bear River should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are above the tolerance range for salmonids, especially in the lower section of the stream. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity woody cover is desirable and in some areas the material is locally available.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, should then be treated to reduce the amount of fine sediments entering the stream.

6) Increase the canopy on South Fork Bear River by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels.

7) There are sections where the stream is being impacted from cattle. Alternatives should be explored with the grazier and developed if possible.

Oil Creek 0

The second left bank tributary to Oil Creek is a tributary to Oil Creek located approximately 21,980' from the confluence with the Pacific Ocean. It is located in Humboldt County, California. The second left bank tributary's legal description at the confluence with Oil Creek is T01N R02W S05. Its location is 40•30•04• north latitude and 124•19•12• west longitude. The second left bank tributary is a blue line stream according to the USGS Ferndale 7.5 minute quadrangle. The second left bank tributary to Oil Creek drains a watershed of approximately 1.1 square miles. Elevations range from about 720 feet at the mouth of the creek to 2,464 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Mayflower Ranch Road.

Recommendations:

1) The second left bank tributary to Oil Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature available suggest that the maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Inventory and map sources of stream bank and upslope erosion and prioritize them according to present and potential sediment yield.

Oil Creek 1

The first right bank tributary to Oil Creek is a tributary to Oil Creek, located approximately 1706' upstream from Oil Creek's confluence with the Pacific Ocean. It is located in Humboldt County, California. The legal description of the first right bank tributary at the confluence with Oil Creek is T02N R03W S23. Its location is 41•31•05• north latitude and 124•22•30• west longitude. The first right bank tributary to Oil Creek is a blue line stream according to the USGS Ferndale 7.5 minute quadrangle. The first right bank tributary to Oil Creek drains a watershed of approximately 1.1 square miles. Elevations range from about 120 feet at the mouth of the creek to 1,080 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via the Mattole Road.

Recommendations:

1) The first right bank tributary to Oil Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that the maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Inventory and map sources of stream bank erosion and upslope erosion and prioritize them according to present and potential sediment yield.

Oil Creek 2

The second left bank tributary to Oil Creek is a tributary to Oil Creek located approximately 21,980' from the confluence with the Pacific Ocean. It is located in Humboldt County, California. The second left bank tributary's legal description at the confluence with Oil Creek is T01N R02W S05. Its location is 40•30•04• north latitude and 124•19•12• west longitude. The second left bank tributary is a blue line stream according to the USGS Ferndale 7.5 minute quadrangle. The second left bank tributary to Oil Creek drains a watershed of approximately 1.1 square miles. Elevations range from about 720 feet at the mouth of the creek to 2,464 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Mayflower Ranch Road.

Recommendations:

1) The second left bank tributary to Oil Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature available suggest that the maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Inventory and map sources of stream bank and upslope erosion and prioritize them according to present and potential sediment yield.

Oil Creek 3

The first right bank tributary to Oil Creek is a tributary to Oil Creek, located approximately 1706' upstream from Oil Creek's confluence with the Pacific Ocean. It is located in Humboldt County, California. The legal description of the first right bank tributary at the confluence with Oil Creek is T02N R03W S23. Its location is 41•31•05• north latitude and 124•22•30• west longitude. The first right bank tributary to Oil Creek is a blue line stream according to the USGS Ferndale 7.5 minute quadrangle. The first right bank tributary to Oil Creek drains a watershed of approximately 1.1 square miles. Elevations range from about 120 feet at the mouth of the creek to 1,080 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via the Mattole Road.

Recommendations:

1) The first right bank tributary to Oil Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that the maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Inventory and map sources of stream bank erosion and upslope erosion and prioritize them according to present and potential sediment yield.

Oil Creek 4

The first right bank tributary to the second left bank tributary to Oil Creek is located in Humboldt County, California (Map 1). Oil Creek is a tributary to the Pacific Ocean. The first right bank tributary to the second left bank tributary to Oil Creek has a legal description of T01N R02W S05 at the confluence with the second left bank tributary to Oil Creek. Its location is 40•29•55• north latitude and 124•18•25• west longitude. This tributary is an ephemeral stream according to the USGS Capetown 7.5 minute quadrangle. It drains a watershed of approximately 0.24 square miles. Elevations range from about 1,000 feet at the mouth of the creek to 2,464 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via a private road through the Mayflower Ranch.

Recommendations:

1) The first right bank tributary to the second left bank tributary to Oil Creek should be managed as an anadromous, natural production stream.

2) Inventory and map sources of stream bank and upslope erosion and prioritize them according to present and potential sediment yield.

Oil Creek 5

The first left bank tributary to Oil Creek is a tributary to Oil Creek, located approximately 21,130' from Oil Creek's confluence with the Pacific Ocean. It is located in Humboldt County, California. Its legal description at the confluence with Oil Creek is T01N R03W S01. Its location is 40•30•12• north latitude and 124•21•35• west longitude. The first left bank tributary to Oil Creek is a blue line stream according to the USGS Ferndale and Capetown 7.5 minute quadrangles. The first left bank tributary to Oil Creek drains a watershed of approximately 0.24 square miles. Elevations range from about 200 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via the Mattole Road.

Recommendations:

1) The first left bank tributary to Oil Creek should be managed as an anadromous, natural production stream.

2) Inventory and map sources of stream bank and upslope erosion and prioritize them according to present and potential sediment yield.

Clark Creek

Clark Creek is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California. Clark Creek's legal description at the confluence with Bear River is T01N R02S S22. Its location is 40•27•40• north latitude and 120•17•13• west longitude. Clark Creek is a first order stream and has approximately 2.8 miles of blue line stream according to the USGS capetown 7.5 minute quadrangle. Clark Creek drains a watershed of approximately 4.3 square miles. Elevations range from about 195 feet at the mouth of the creek to 1200 feet in the headwater areas. Deciduous trees dominate the watershed. The watershed is entirely privately owned and is managed for rangeland.

Recommendations:

1) Clark Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

Mountain View Creek

Mountain View Creek is tributary to the South Fork Bear River, tributary to Bear River, tributary to the Pacific Ocean, located in Humboldt County, California. Mountain View Creek's legal description at the confluence with South Fork Bear River is T01N R02W S28. Its location is 40•26•03• north latitude and 124•17•50• west longitude. Mountain View Creek is a second order stream and has approximately 1.4 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Mountain View Creek drains a watershed of approximately 2.6 square miles. Elevations range from about 390 feet at the mouth of the creek to 1380 feet in the headwater areas. Deciduous trees dominate the watershed. The watershed is entirely privately owned and is managed for rangeland and timber production.

Recommendations:

1) Mountain View Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful

temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) Increase the canopy on Mountain View Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

7) Suitable spawning substrate on Mountain View Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel in order to expand redd site distribution in the stream.

Peaked Creek

Peaked Creek is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Peaked Creek's legal description at the confluence with Bear River is T01N R01W S28. Its location is 40•26•00• north latitude and 124•11•40• west longitude. Peaked Creek is a second order stream and has approximately 4.1 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Peaked Creek drains a watershed of approximately 2.9 square miles. Elevations range from about 500 feet at the mouth of the creek to 1,740 feet in the headwater areas. Conifers dominate the watershed. The watershed is entirely privately owned and is managed for timber production.

<u>Recommendations:</u>

1) Peaked Creek should be managed as an anadromous, natural production stream.

2) Where feasible, design and engineer pool enhancement structures to increase the number of pools or deepen existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

5) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

West Side Creek

West Side Creek is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California. West Side Creek's legal description at the confluence with Bear River is T01N R02W S23. Its location is 40•27•03• north latitude and 120•15•13• west longitude. West Side Creek is a third order stream and has approximately 5.5 miles of blue line stream according to the USGS Capetown and Taylor Peak 7.5 minute quadrangles. West Side Creek drains a watershed of approximately 5.3 square miles. Elevations range from about 280 feet at the mouth of the creek to 1,240' in the headwater areas. Grass dominates the watershed. The watershed is entirely privately owned and is managed for rangeland.

Recommendations:

1) West Side Creek should be managed as an anadromous, natural production stream.

2) The water temperature data available suggest that maximum temperatures are above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream

6) Increase the canopy on West Side Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

7) There are sections of the creek where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

8) Suitable spawning substrate on West Side Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel in order to expand redd site distribution in the stream.

Figure 9-1: Cape Mendocino Planning Watershed

10 TRINIDAD WATERSHED

10.1 GENERAL DESCRIPTION

Physical and Biological Setting

Maple Creek, extending 18.3 river miles (with a north fork of 7.8 river miles), and Little River, extending 19.6 river miles, are the main waterways in the Trinidad Watershed, which is spread along the northern Humboldt County coast. Trinidad Watershed covers 83,684 acres, making it the smallest watershed in Humboldt County next to South Fork Trinity. Patricks Point State Park occupies a small area of the watershed north of the City of Trinidad.

Table 10-1: Trinidad Watershed Characteristics

Characteristic	*Value*
Total Acres	83,684
Total Acres in County	83,684
% of Total in County	100%
Average Parcel Size (Acres)	42.18
Largest Watershed	Little River
Dominant Land Uses	timber production
Largest Private Land Owner	Simpson Timber

Maple Creek and Little River arise at the foot of the Coast Ranges, the latter in a crook between the Mad and Redwood watersheds. Little River discharges to the Pacific Ocean three miles south of the city of Trinidad, while Maple Creek empties to an estuary north of Trinidad Head.

Geological Features

The Trinidad watershed is located within the northern Coast Ranges Geological Province, and consists largely of Quaternary terrace and late Pleistocene marine terrace deposits that overlie the lower Cretaceous-aged Franciscan Formation, a melange of graywacke, sandstone, shale and chert. Recent alluvium landslides, and beach deposits overlie the Franciscan and terrace deposits in some locations.

This area is seismically active. Faults include the Trinidad fault, located approximately 5 miles south-southwest of Patricks Point State Park, and the Big Lagoon fault in the north of the watershed. The Trinidad fault is capable of generating an upper bound earthquate with a moment magnitude of 7.3 according to Laco Associates (2000).

Vegetative Cover

The Trinidad watershed is predominantly Redwood forest (57%) with significant amounts of oak woodlands (14%), riparian areas (10%) and some pine forest (8.5%).

Table 10-2: Trinidad Watershed Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% of total coverage*
Agriculture-Crops	378	0.45
Annual Grass	1,494	1.79

Table 10-2: Trinidad Watershed Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% of total coverage*
Barren	845	1.01
Coastal Scrub	2,062	2.46
Fir Forest	439	0.52
Oak Woodlands	11,723	14.04
Pine Forest	7,160	8.57
Redwood	47,661	57.07
Riparian	8,473	10.15
Urban	449	0.54
Water	2,545	3.05
Wetlands	276	0.33
TOTAL	83,505	

Special-Status Wildlife and Sensitive Natural Communities

Several occurrences of special-status wildlife species occur in the watershed and are documented in the CNDDB (2002). These include: the southern torrent salamander inhabiting cold, well-shaded permanent streams; tailed frogs inhabiting perennial montane streams, and the red tree vole found in stands of Douglas fir. Sensitive natural communities in the watershed include wetlands and riparian forest.

Land Use and Ownership

The predominant land use in the watershed is timber production, which accounts for almost 83% of the watershed. Parks and open space make up almost 7% of the watershed, while residential uses account for 5.5%.

Table 10-3: Trinidad Watershed Land Use

Existing Land Use	*Acres*	*% of Watershed*
timber production	69,384	82.91%
open space/parks	5,719	6.83%
rural residential	2,775	3.32%
rural residential - vacant	1,864	2.23%
agriculture	744	0.89%
commercial	436	0.52%
city	194	0.23%
public	126	0.15%
tribal lands	62	0.07%
commercial - vacant	44	0.05%
school	18	0.02%
multi family residential	12	0.01%
single family residential	10	0.01%
single family residential - vacant	4	0.00%

Table 10-4: Acres of Public Lands

Public Land	*Total*
Humboldt Lagoons State Park	2,480
Redwood National Park	783
Harry A. Merlo State Recreation	734
Patrick's Point State Park	681

Private timberland owners account for the over 80% of the watershed ownership.

Table 10-5: Trinidad Watershed Private Ownership over 640 acres

Private Land Owner	*Total Acres*	*% of Watershed*
Simpson Timber	65,482	78.25%
G Roddy	1,038	1.24%
V Guynup	986	1.18%

Figure 10 illustrates current land use and ownership in the Trinidad Watershed.

Fisheries

The anadromous salmon and trout present in neighboring watersheds are can also be found in the Trinidad watershed. However, for the most part, the watershed consists of smaller coastal streams that do not have the inland reach of other watersheds. Much of this coastal fisheries habitat is protected as parks and open space.

10.2 SUMMARY OF WATER QUALITY CONCERNS

Trinidad is the only watershed in Humboldt County for which the need for TMDLs have not been identified. However, the watershed could still be subject to development impacts that increase sediment loading in streams and rivers. Protective measures under local government control identified in other watershed in the County would serve to address these concerns in the Trinidad watershed as well.

Figure 10-1: Trinidad Planning Watershed

11 Mad River Watershed

11.1 GENERAL DESCRIPTION

Physical and Biological Setting

The Mad River is the main waterway in the Mad River Watershed and has numerous tributaries throughout its run. The Mad River flows through Trinity and Humboldt Counties 100 miles to the Pacific Ocean, draining a watershed area of 497 square miles. The easternmost portion of the watershed is part of Six Rivers National Forest; Mad River County Park occupies a small area in the northwest. Average flows in the Mad River range from less than 300 cubic feet per second (cfs) to flood stages of up to 81,000 cfs. Mean discharge is 1,381 cfs, ranging from 45 cfs in late summer to 3,646 cfs midwinter.

Table 11-1: Mad River Watershed Characteristics

Characteristic	*Value*
Total Acres	322,143
Total Acres within County	221,337
% of Total within County	69%
Average Parcel Size (Acres)	28.35
Largest Watershed	Mad River
Dominant Land Uses	timber production
Largest Private Land Owner	Simpson Timber

Headwaters of the Mad River originate at the southeast end of the watershed at an elevation of 6,070 feet; the watershed runs diagonally across the County from the central eastern border northwest to the Pacific Ocean just north of the Humboldt Bay Area.

Geology. The Mad River Basin lies within the northern coast range province. The geology of the watershed is complex and variable, having some areas that are high sediment producers and others that produce much less sediment. The basin in underlain by three principle rock formations that occur in northwest trending bands and are aligned with the general trend of the river. These formations range in age from pre-Cretaceous to Pliocene in age and are separated by major faults. Most of the basin is underlain by late Jurassic to late Cretaceous rocks of the Franciscan formation, consisting predominantly of sandstones and shales with lesser amounts of altered volcanic rocks, cherts, conglomerates, and serpentine.

The youngest rocks in the basin are unconsolicated marine sediments belonging to the Falor formation of the recent Pliocene era. These rocks may have formed from deposits accumulating under a shallow sea which extended into an ancestral Mad River Valley. Subsequent uplift and faulting lifted the Falor formation to its present position in the north central portion of the basin. The clays and soft sands of this formation often become saturated and unstable, resulting in rotational slumping.

Late Quaternary fluvial terraces are found along several stretches of the Mad River. These are indicative of major geologic cycles of channel aggradation followed by channel incision and degradation over about 40,000 years. Recent alluvium contains mixtures of boulders, gravel, sand, silt and clay that has accumulated in the tributaries and main stem of the Mad River. At moderately

low flows of 1,000 to 4,000 cfs these alluvial deposits move readily as the channel shifts course and meanders downstream.

Table 11-2: Mad River Watershed Acres of Bedrock Type

Rock Type	*Total in Humboldt County*	*Total in Watershed*
Cenozoic-Precambrian Plutonic, Metavolcanic, and Mixed Rocks	665	665
Cenozoic Sedimentary	10,147	10,147
Mesozoic-Paleozoic-Precambrian Sedimentary and Metasedimentary	174,056	178,942
Water and/or Unclassified	93	94

Current Sediment Runoff

The Mad River is on the EPA's 303(d) List of waterways for which sedimentation is a point of concern requiring the implementation of a total maximum daily load. The Department of Fish and Game reports that Sweasey Dam was built in 1938 upstream of the mouth of the Mad River to provide water to Eureka. High sediment load accumulation caused the dam to fill in by 1960, after which it was removed; it is estimated that it will take 35 to 40 years for the channel to recover downstream of the dam. Ruth Dam, further upstream, is a barrier to adult salmonids, and has a considerable influence on streamflow for 80 miles below the dam.

Vegetative Cover

Forested areas predominate over 85% of the watershed, with fir (36%), redwood (22.9%), oak woodlands (19.8%), and pine forest (6.2%) being most common.

Table 11-3: Mad River Watershed Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*	*Total in Watershed*
Agriculture-Crops	1,509	0.68	1,509
Annual Grass	16,565	7.48	16,565
Barren	1,904	0.86	1,904
Chaparral	3,266	1.48	3,266
Coastal Scrub	1,184	0.53	1,184
Fir Forest	80,359	36.30	80,359
Oak Woodlands	43,956	19.86	43,956
Pine Forest	13,751	6.21	13,751
Redwood	50,688	22.90	50,688
Riparian	3,127	1.41	3,127
Urban	4,038	1.82	4,038
Water	568	0.25	568
Wetlands	407	0.18	407
TOTAL	221,322		

Land Use and Ownership

Predominant land uses in the watershed are timber production, timber/grazing or open space/parks, which combined represent 87% of the land use. Residential uses account for 9.64% of the watershed acreage. Agricultural use represents only about 1%.

Table 11-4: Mad River Watershed Land Use in Humboldt County

Existing Land Use	*Total Acres*	*% of Watershed**
timber production	141,525	63.94%
open space/parks	32,238	14.56%
grazing/timber	19,022	8.59%
rural residential	10,466	4.73%
rural residential - vacant	9,301	4.20%
agriculture	2,350	1.06%
single family residential	1,143	0.52%
public	1,088	0.49%
heavy industrial	678	0.31%
city	599	0.27%
gravel mining	398	0.18%
vacant	215	0.10%
single family residential - vacant	198	0.09%
commercial	193	0.09%
multi family residential	175	0.08%
golf course	115	0.05%
school	70	0.03%
church	69	0.03%
heavy industrial - vacant	69	0.03%
light industrial - vacant	68	0.03%
commercial - vacant	54	0.02%
multi family residential - vacant	49	0.02%
light industrial	33	0.01%
tribal lands	7	0.00%

The largest single private land owner in the watershed is Simpson Timber Company, which owns approximatley 41.7% of the watershed within Humboldt County. Public lands take up 14.2% of the watershed in Humboldt County, consisting primarily of lands within Six Rivers National Forest.

Table 11-5: Mad River Planning Watershed Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed**
Simpson Timber	92,358	41.73%
R Emmerson	6,765	3.06%
Pacific Lumber Company	4,616	2.09%

Table 11-5: Mad River Planning Watershed Private Ownership over 640 acres in Humboldt County

Private Land Owner	*Total Acres*	*% of Watershed**
Fort Baker Ranch	3,856	1.74%
C & T Bertolone	3,569	1.61%
C & F Carrington	3,056	1.38%
V Guynup	2,816	1.27%
James Russ	2,063	0.93%
Hunt Family Partnership	1,988	0.90%
Sierra Pacific Industries	1,796	0.81%
F Ribar	1,757	0.79%
G Roddy	1,706	0.77%
Maple Creek Ranch	1,322	0.60%
L Ford	1,212	0.55%
Muecke-McAdams California	1,147	0.52%
M & K Mather	1,129	0.51%
McAdams	1,099	0.50%
F Fulton	885	0.40%
Treelands Ltd	867	0.39%
J & G Timmons	799	0.36%
Russ Ranch & Timber Company	638	0.29%

Table 11-6: Acres of Public Lands

Public Land	*Total*
Six Rivers National Forest	30,752
Other County of Humboldt	722
	31,474

Figure 11 illustrates current land use and ownership in the Mad River Watershed.

Fisheries

The Mad River supports runs of anadromous salmonids including Chinook salmon, coho salmon, and steelhead and cutthroat trout. Except for cutthroat trout, all anadromous salmonids in the Mad River are federally protected.

Anadromous fish spawning takes place in the main channel and in several main tributaries. Downstream from the Mad River Hatchery, the main spawning tributaries are Warren Creek, Lindsay Creek, Mill Creek, and the North Fork of the Mad River. Lindsay Creek appears to be extremely important for both coastal cutthroat and coho salmon.

The coldwater fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality. It is recognized that a number of activities already presented for protecting other uses and enhancing assessment and monitoring will also serve to further this goal, thus they are not repeated here.

The following Nonpoint Source issue was identified by the public, and agencies, and relate directly to concerns about the coldwater fishery:

• Stream sedimentation from various land use activities limits coldwater aquatic uses. Stream sedimentation from rural subdivisions is an issue with regard to aquatic habitat, especially for salmonids. Logging roads are a concern because of the potential to increase runoff and delivery of sediment to local waterbodies on private and federal lands. The Mad River is listed on the federal Clean Water Act section 303(d) list for sedimentation affecting salmonid populations. Strategies for reduction of erosion and sedimentation are needed.

11.2 SUMMARY OF WATER QUALITY CONCERNS

Land use in the Mad River Watershed is primarily timber production, with agricultural uses in the non-forested areas consisting primarily of grazing and dairies. Lily bulb farms are found in the Arcata bottoms and the McKinleyville area. Urbanized areas include McKinleyville and Blue Lake on the Mad River, and Arcata on Humboldt Bay. Rural residential developments are scattered throughout the timber/grazing interface.

Freshwater streams in this unit support production of anadromous salmonids, including steelhead and cutthroat trout, coho and chinook salmon. The Mad River is the drinking water and industrial supply for the Humboldt Bay Area, and other coastal streams provide drinking water for local communities and individual homes.

The upper hillslope areas of the Mad River Watershed, while populated to varying degrees, are primarily occupied by timber production and harvesting activities, with coast redwood as the predominant harvested species. Past practices and continued problems with harvesting techniques and road construction have added to stream sedimentation, in varying degrees, in all the drainages in the watershed.

The Mad River watershed is mixed private and Forest Service timberland with a long history of timber harvest. Gravel mining occurs in the lower portions of the watershed. The Mad River is Section 303(d) listed for sediment and temperature impacts. The primary issues for the watershed are forestry-related, with urbanization and associated industrial and public point sources. For the Mad River and its tributaries, discharge of waste is allowed only under NPDES permit during the period of October 1 through May 14 and at 1% of the flow of the receiving water. The McKinleyville Community Services District discharges municipal effluent to the Mad River in compliance with those restrictions. The City of Blue Lake does not discharge directly, disposing of effluent in percolation/evaporation ponds.

11.3 IMPLICATIONS FOR LOCAL GOVERNMENT PLANNING:

Land use and development activities that could result in increased sedimentation in the watersheds steams and rivers should be regulated to prevent such discharge. Additionally, these more urban areas are subject to potential impacts of urbanization, including increased stormwater runoff resultant from further subdivision and development for residential and commercial uses. The following measures should be considered to address such impacts:

- Minimizing agricultural land conversions through the subdivision process.
- Strict adherence to the requirements of the Grading, Erosion Control, and Streamside Management Area Ordinance for ministerial or principally permitted developments.
- Development of standards for stormwater runoff control to be met by new discretionary projects (subdivision, use permits, etc.).
- Development of a model urban runoff program for areas in the County that meet the criteria of Phase II stormwater permitting requirements.

Figure 11-1: Mad River Planning Watershed

12 Eureka Plain (Humboldt Bay) Watershed

12.1 GENERAL DESCRIPTION

Physical and Biological Setting

The four major streams of the Eureka Plain are Jacoby Creek (draining 17 square miles), Freshwater Creek (draining 31 square miles), Elk River (draining 29 square miles), and Salmon Creek (draining 17 square miles). Jacoby and Freshwater Creeks drain into Arcata Bay to the north, Elk River into Entrance Bay near Eureka, and Salmon Creek into South Bay. Smaller streams flow primarily into the North Bay.

Humboldt Bay is the largest estuary in California north of San Francisco. The watershed is 223 square miles in area, though the Bay's smaller tributaries only drain a total of approximately 35 square miles. Public landholdings are the Headwater Forest Reserve, Humboldt Bay National Wildlife Refuge, Mad River Wildlife Area, and Lanphear Dunes. Eureka Plain is also host to more urban land than any other watershed. Streamflow in the Humboldt Bay Watershed peaks in the winter (November through March) and is lowest during the summer. Maximum flow at the Jacoby Creek inlet is approximately at 737 cfs, with a range of peaks between 380 cfs and 2,510 cfs.

Humboldt Bay includes the typical coastal values of an estuarine embayment, as well as an extensive commercial oyster industry. It is a major shipping center for the north coast, the largest such center between San Francisco and Coos Bay, Oregon, and presents the potential for water quality problems associated with industrial uses adjacent to the bay.

Table 12-1: Eureka Plain Watershed Characteristics

Characteristic	*Value*
Total Acres	124,617
Total Acres within County	124,617
% of Total in County	100%
Average Parcel Size (Acres)	7.58
# of Sub-Watersheds	23
Largest Watershed	Elk River
Dominant Land Use	Timber Production
Largest Land Owner	Pacific Lumber

Sand spits separate the Humboldt Bay from the ocean; the Bay (officially categorized as a multi-watershed coastal lagoon) is split into the South Bay, Entrance Bay and North Bay. The headwaters of the Bay's tributaries originate in nearby hills, which separate the watershed from the Eel and Mad River watersheds to the south and north. This plain consists of both tidal marshes and stream floodplain surrounding the Bay's edge.

Geologic Features

Two main types of rocks occur in the watershed—the older and more resistant sedimentary rocks of the Yager Formation and a sequence of geologically younger rocks known as the Wildcat Group. The Yager and Wildcat rock units can be viewed as two distinct units—an underlying hard "basement"

(the Yager Formation) overlain by a mantle of softer younger rocks (the Wildcat Group). The older Yager rocks are well cemented and resistant to erosion while the Wildcat rocks are very soft, weakly cemented, and very susceptible to erosion. The Wildcat Group typically underlies most of the forested areas and upper slopes, and the Yager Formation is only exposed in the stream bottoms and inner gorges of the main tributaries.

Stream channel deposits derived from the Yager Formation are typically composed of hard sandstone and conglomerate pebbles, cobbles, and boulders, with smaller amounts of sand and silt. Soils formed from the Yager sediments have abundant rock fragments and sand components and the soils are well drained and moderately resistant to erosion.

The Wildcat Group is composed of soft, poorly consolidated marine sandstones, siltstones, and claystones. All these rocks are weakly cemented, highly erodible, and prone to slope movement, and small streamside landslides are especially common on these younger rocks within the Elk River and Salmon Creek watersheds. These landslides are most often caused by streambank erosion, which destabilizes oversteepened hill slopes in stream corridors. The soft rocks of the Wildcat are also easily eroded and broken down into their fine components—sand, silt, and clay. The Wildcat rocks are the most susceptible to surface or sheet erosion where rock exposures lack vegetative cover, especially along recently built logging roads, landings, and skid trail networks. Fine sediments from these exposed unvegetated areas are transported during rainstorms and are eventually deposited in streams.

Based on past geologic reports and recent field inventories of potential erosion sites, future erosion and sediment delivery to streams within the watershed can be expected to be highest for rocks of the Wildcat Group. These rocks are the most easily eroded, and the most susceptible to fill failures. Most of the past logging and road building activities within the watershed have taken place on rocks of the Wildcat Group. Old roads and landings along the inner gorge area of the South Fork of Elk River, and roads and landings located just upslope of the inner gorge in the Salmon Creek drainage pose the highest risks of failure in the near future. The most serious erosion hazards are abandoned stream crossings on roads and road fill perched over stream channels. These erosion hazards have a high potential to deliver large amounts of sediment directly into streams, which would result in damage to aquatic habitat.

Table 12-2: Elk River Drainage Acres of Bedrock Type

Rock Type	*Total in Humboldt County*
Sedimentary	31,637
Sedimentary and Metasedimentary	2,047
Water and/or Unclassified	152

Table 12-3: Freshewater Creek DrainageAcres of Bedrock Type

Rock Type	*Total in Humboldt County*
Sedimentary	10,633
Sedimentary and Metasedimentary	9,051

Table 12-4: Jacoby Creek Drainage Acres of Bedrock Type

Rock Type	*Total in Humboldt County*
Sedimentary and Metasedimentary	9,778
Sedimentary	3,250

Current Sediment Runoff

Freshwater Creek and the Elk River are on the State 303(d) List, requiring medium-priority TMDLs for sedimentation and siltation.

Vegetative Cover

The Eureka Plain is the most developed of the Humboldt County watershed areas, with about 7% of the watershed characterized as urban. Nonetheless, redwood forest make up over 61% of the watershed, and agriculture-crop lands account for 8.6%.

Table 12-5: Eureka Plain Watershed Acres of Vegetative Cover

Cover Type	*Total in Humboldt County*	*% in Humboldt County*
Agriculture-Crops	10,726	8.61
Annual Grass	8,182	6.57
Barren	4,111	3.30
Coastal Scrub	379	0.30
Fir Forest	1,828	1.47
Oak Woodlands	2,540	2.03
Pine Forest	1,729	1.39
Redwood	76,686	61.55
Riparian	5,687	4.56
Urban	8,801	7.06
Water	303	0.24
Wetlands	3,615	2.90
TOTAL	124,587	

Land Use

Land use in the watershed is primarily timber production (54%), with agricultural uses (9.16%) in the non-forested areas consisting primarily of grazing and dairies. Lily bulb farms are found in the Arcata bottoms and the McKinleyville area. Urbanized areas include McKinleyville and Blue Lake on the Mad River, and Arcata and Eureka on Humboldt Bay. Rural residential developments are scattered throughout the timber/grazing interface. Public lands account for 12.58% of the watershed and include the Headwaters Forest, Humboldt Bay National Wildlife Refuge, State Parks and Refuges, and City land holdings.

The Pacific Lumber Company (PALCO), the largest of many timber companies in the area, owns approximately 211,700 acres of forestland in Humboldt County, encompassing lands within 22 watersheds including the Elk River and Freshwater Creek watersheds. PALCO conducts timber harvesting and related activities on the lands within its ownership, and the Timber Division is funded to oversee water quality protection of the Habitat Conservation Plan (HCP). The HCP is intended to

protect habitat for endangered species and requires that PALCO incorporate interim prescriptions (best management practices) into its timber harvest and harvest-related activities, while performing watershed analysis for the watersheds within its ownership. As watershed analyses are completed, watershed-specific and project-specific prescriptions will be developed, implemented, monitored, and adapted as necessary. In the interim, PALCO is required to conduct several types of monitoring, including interim prescription effectiveness monitoring. PALCO has been required by State and Regional Water Board orders to monitor water quality in association with some timber harvesting activities. Regional Board staff believes that the interim prescriptions of the HCP may not be adequate to restore, protect or maintain water quality objectives and beneficial uses in 303(d)-listed waterbodies. According to the RWQCB (WMI 2002), since there is no in-stream effectiveness monitoring, adaptive management cannot adequately address the effectiveness of interim prescriptions.

Table 12-6: Eureka Plain Watershed Land Use

Existing Land Use	*Acres*	*% of Watershed*
timber production	67,496	54.16%
open space/parks	17,019	13.66%
city	12,353	9.91%
agriculture	11,415	9.16%
rural residential	8,503	6.82%
rural residential - vacant	3,792	3.04%
single family residential	2,550	2.05%
grazing/timber	1,403	1.13%
public	1,143	0.92%
heavy industrial	967	0.78%
single family residential - vacant	388	0.31%
heavy industrial - vacant	382	0.31%
school	320	0.26%
vacant	274	0.22%
commercial	262	0.21%
multi family residential	254	0.20%
golf course	150	0.12%
unclassified	129	0.10%
landfill	86	0.07%
church	48	0.04%
commercial - vacant	30	0.02%
multi family residential - vacant	28	0.02%
light industrial - vacant	16	0.01%
light industrial	5	0.00%
cemetery	4	0.00%
camp	2	0.00%

Table 12-7: Acres of Public Lands

Public Land	*Total*
Headwaters Forest Reserve	7,478
City of Eureka	3,067
Humboldt Bay National Wildlife Refuge	2,626
City of Arcata	1,401
Other City, County, or Local Age	1,103
Other State Lands	685

Figure 12 illustrates current land use and ownership in the Eureka Plain Watershed.

Fisheries

There are five species of salmon and trout found in the Humboldt Bay watershed: coho salmon, Chinook salmon, chum salmon, steelhead trout, and coastal cutthroat trout. Steelhead trout and cutthroat trout are found in all streams capable of supporting salmonids.
All of the main streams of the Eureka Plain Watershed that flow into Humboldt Bay support wild populations of salmon, steelhead trout, and cutthroat trout.

The coldwater fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality. The following Nonpoint Source issues and actions were identified by the public, and agencies, and relate directly to concerns about the coldwater fishery:

- Stream sedimentation from various land use activities limits coldwater aquatic uses. Stream sedimentation from rural subdivisions is an issue with regard to aquatic habitat, especially for salmonids. Logging roads are a concern because of the potential to increase runoff and delivery of sediment to local waterbodies on private and federal lands. The Freshwater Creek and Elk River are listed on the federal Clean Water Act section 303(d) list for sedimentation affecting salmonid populations. Other waterbodies in the Humboldt Bay watershed may be added to the list for excessive sediment in the near future. Strategies for reduction of erosion and sedimentation are needed.
- Potential impacts from dairies and grazing need to be evaluated. Dairies should be brought up to Chapter 15 standards. Grazing issues include erosion, sedimentation, and water chemistry.
- Potential ground water contamination, such as nutrient loading via ground water to streams, is of concern. Problem sites should receive progressive enforcement per the Nonpoint Source Pollution Control Program.
- Pesticide and herbicide applications on private and public lands are a water quality concern. Use of pesticides and herbicides along roadways, in agricultural operations, in urban areas, and in lily bulb farming and forestlands in the WMA poses a threat to ground and surface waters.

Water Quality

Freshwater streams in this unit support production of anadromous salmonids, including steelhead and cutthroat trout, coho and chinook salmon. The deltas of the Elk River and Mad River Slough support commercial and sport shellfish production and harvesting.

Humboldt Bay includes the typical coastal values of an estuarine embayment, as well as an extensive commercial oyster industry. It is a major shipping center for the north coast, the largest such center

between San Francisco and Coos Bay, Oregon, and presents the potential for water quality problems associated with industrial uses adjacent to the bay.

The upper hillslope areas of the watershed, while populated to varying degrees, are primarily occupied by timber production and harvesting activities, with coast redwood as the predominant harvested species. Past practices and continued problems with harvesting techniques and road construction have added to stream sedimentation, in varying degrees, in all the drainages in the watershed.

Flooding in Freshwater Creek and Elk River has increased in frequency. The increased flood frequency may be related to stream aggradation and sediment discharges. Humboldt Bay tributaries have experienced problems from urbanization and agricultural uses in addition to timber harvest issues. Additionally, they flow into Humboldt Bay and can impact uses there. Local concerns include sedimentation of Freshwater Creek and Elk River and subsequent flooding and domestic water supply degradation. Some industrial timberland owners are developing *Sustained Yield Plans* that will address sensitive watershed issues to some degree.

The majority of the population in this watershed basin lives in the Humboldt Bay area and the cities of Eureka and Arcata. Suburban growth is occurring in the unincorporated community of McKinleyville, north of Arcata. Flat land areas around the bay are predominantly pastureland with some limited cultivation, primarily lily bulb farms. Humboldt Bay is an important commercial and recreational shellfish growing area, as well as deep-water port. Historically, wastewater discharges to the Bay impacted the shellfish uses. Recent emphasis on improved treatment and reliability and the consolidation and relocation of the Eureka wastewater plants has significantly reduced the problem. Discharge of treated wastewater to Humboldt Bay is permitted from the Arcata treatment plant and marsh complex in Arcata Bay (north Humboldt Bay) and the Elk River plant which serves the greater Eureka area. The Arcata plant discharges to a constructed marsh/pond complex prior to discharge to Arcata Bay. The Elk River plant times its discharges to out-going tidal flow so that effluent promptly exits the bay. The College of the Redwoods operates a small sewage treatment plant that discharges indirectly to south Humboldt Bay. Contamination from collection system overflows of raw sewage during high intensity rainfall events is a continued threat to commercial and recreational uses of the Bay.

Storm water runoff from all watersheds draining to the Bay convey indicators of bacterial contamination that impacts shellfish harvest. Seasonal and rainfall-based shellfish harvesting closures are in effect to mitigate the effects of nonpoint source runoff. A shellfish Technical Advisory Committee was established in November of 1995 to address nonpoint source runoff issues.

12.2 IMPLICATIONS FOR LOCAL GOVERNMENT PLANNING:

Land use and development activities that could result in increased sedimentation in the watersheds steams and rivers should be regulated to prevent such discharge. Additionally, these more urban areas are subject to potential impacts of urbanization, including increased stormwater runoff resultant from further subdivision and development for residential and commercial uses. The following measures should be considered to address such impacts:

- Minimizing agricultural land conversions through the subdivision process.
- Strict adherence to the requirements of the Grading, Erosion Control, and Streamside Management Area Ordinance for ministerial or principally permitted developments.
- Development of standards for stormwater runoff control to be met by new discretionary projects (subdivision, use permits, etc.).
- Development of a model urban runoff program for areas in the County that meet the criteria of Phase II stormwater permitting requirements.

Figure 12-1: Eureka Plain Planning Watershed

13 Regulatory Framework

13.1 FEDERAL REGULATIONS

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act requires that a permit be obtained from the U.S. Army Corps of Engineers prior to the discharge of dredged or fill materials into any "waters of the United States" including wetlands. Waters of the United States are broadly defined in the Corps' regulations (33 CFR 328) to include navigable waterways, their tributaries, lakes, ponds, and wetlands. Wetlands are defined as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."14 Such permits often require mitigation to offset losses of these habitat types. Wetlands that are not specifically 13 State of California, Office of the Governor, Annual Environment Report and Message of the Governor, 1995-1996, p 70. 14 Code of Federal Regulations, *Wetlands definition,* 1982. exempt from section 404 regulations (such as drainage channels excavated on dry land) are considered to be "jurisdictional wetlands." The Corps of Engineers is required to consult with the U.S. Fish and Wildlife Service, Environmental Protection Agency, State Regional Water Quality Control Board and California Department of Fish and Game (among other agencies) in carrying out its discretionary authority under Section 404.

The Corps of Engineers grants two types of permits, individual and general. Individual permits are required for certain activities that may have a potential for more than a minimal impact and necessitate a detailed application. The most common type of general permit is a nationwide permit. Nationwide permits pre-authorize certain specific activities, and are designed to regulate with little delay or paperwork activities having minimal impacts. Nationwide permits typically take two to three months to obtain, whereas individual permits can take a year or more. To qualify for a nationwide permit, strict conditions must be met. If conditions are met, permittees may proceed with specified activities without notifying the Corps of Engineers. However, some nationwide permits require a 30-day pre-construction notification period before activities can begin. Activities for which nationwide permits are available include minor road crossings, utility corridors, and stormwater outfalls. Part III of the *Federal Register15* contains a Final Notice of Issuance and Modification of Nationwide Permits (NWPs) by the U.S. Army Corps of Engineers (Corps). The maximum acreage limits of most of the new and modified NWPs is 0.5 acre. Most of the new and modified NWPs require notification to the district engineer for activities that result in the loss of greater than 0.1 acre of waters of the United States.

For projects requiring individual 404 permits that are not considered "water dependent" (such as marinas or harbors) that occur in "special aquatic sites" (which include wetlands), the Environmental Protection Agency 404(b) (1) guidelines and Corps regulations require that an alternatives analysis be conducted. Before an individual permit may be granted, the conclusion of the analysis must demonstrate to the agencies' satisfaction that there are no "practicable alternatives" that are less damaging to aquatic habitats than the proposed project. The first step in the 404(b) (1) process is to analyze alternatives that meet project objectives and would avoid filling special aquatic sites. If project sponsors are able to demonstrate that the proposed filling of wetlands is necessary to meet project objectives and there are no practicable alternatives to this filling, then the project mitigation plan would be reviewed by the U.S. Fish and Wildlife Service (USFWS) in relation to their mitigation policies.

Section 401 of the Clean Water Act

A Section 401 Water Quality Certification or waiver from the California State Water Resources Control Board is required before a Section 404 permit becomes valid. The Regional Board will also review the project for consistency with Waste Discharge Requirements under the State land disposal regulations (Subchapter 15). In reviewing the project, the Regional Board will consider impacts to waters of the State in addition to filling of wetlands in 15 Code of Federal Regulations, *Final Notice of Issuance and Modification of Nationwide Permits,* 65 CFR 12818-12899, Volume 65(47) March 9, 2000 in accordance with the State wetland policy. Usually, mitigation is required (if not already a condition of the 404 permit) in the form of replacement of restoration of adversely impacted "waters of the U.S."

13.2 STATE AGENCIES AND REGULATIONS

Agencies

The State Water Resources Control Board (SWRCB) holds joint authority for water allocation and water quality protection in California and is composed of five members appointed by the Governor. The State Board oversees nine Regional Water Quality Control Boards (RWQCBs), which develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the State's waters. Regional Boards develop basin plans for their hydrologic areas, issue waste discharge requirements, take enforcement action against violators, and monitor water quality. Each RWQCB has nine part-time members appointed by the Governor.

The State Department of Water Resources (DWR) prepares and updates the California Water Plan to guide development and management of the State's water resources; operates the State Water Resources Development System to supply good quality water; regulates dams, provides flood protection, and assists in emergency management; educates the public about the importance of water and its proper use; and serves a variety of local water needs. The California Department of Fish and Game (DFG) and Department of Forestry and Fire Protection (CDF) often work in concert with the Water Boards and DWR.

California Environmental Quality Act

The California Environmental Quality Act (CEQA), passed in 1970, requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

CEQA applies to certain activities of state and local public agencies. A public agency must comply with CEQA when it undertakes an activity that is subject to discretionary approval and that may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment. Most proposals for physical development in California are subject to the provisions of CEQA, as are many governmental decisions that do not immediately result in physical development (such as adoption of a general or community plan). Every development project that requires a discretionary governmental approval will require at least some environmental review pursuant to CEQA, unless an exemption applies. The environmental review required imposes both procedural and substantive requirements. At a minimum, an initial review of the project and its environmental effects must be conducted. Depending on the potential effects, further review may be conducted in the form of an environmental impact report (EIR). A project may not be approved as submitted if feasible alternatives or mitigation measures are able to substantially lessen the significant environmental effects of the project CEQA is a self-executing statute. The Agency does not enforce CEQA, nor does it review for compliance with CEQA the many state and local agency actions that are subject to CEQA.

Public agencies are entrusted with compliance with CEQA and its provisions are enforced, as necessary, by the public through litigation and the threat thereof. It is each public agency's duty to determine what is and is not subject to CEQA. The Resources Agency does not review the facts and exercise of discretion by public agencies in individual situations.16

North Coast Watershed Assessment Program

In 1999, the California Resources Agency and the California Environmental Protection Agency began developing an interagency watershed assessment program for California's North Coast. The purpose of the program is to develop consistent, scientifically credible information to guide landowners, agencies, watershed groups, and other stakeholders in their efforts to improve watershed and fisheries conditions.

The agencies brought together the DFG, CDF, Department of Conservation's Division of Mines and Geology (DMG), DWR, and the North Coast RWQCB to identify the appropriate role and objectives of a state assessment program. The resulting North Coast Watershed Assessment Program, or NCWAP, is designed to meet four goals:

- Develop baseline information about watershed conditions.
- Guide watershed restoration programs.
- Guide cooperative interagency, non-profit, and private sector approaches to protect
- the best through stewardship, easement, and other incentive programs.
- Better implement laws requiring watershed assessments such as Forest Practices,
- Clean Water and Porter-Cologne Acts, Lake or Streambed Alteration Agreement, and
- others.

The program provides a process for collecting and analyzing information to answer a set of critical questions designed to characterize current and past watershed conditions. While NCWAP will not produce prescriptions, design projects, analyze cumulative effects of proposed projects, perform risk management, or recommend policy development or regulations, information will be used to guide watershed management and restoration planning, restoration and recovery planning for anadromous fisheries, and implementation of watershed protection policies and regulations. 16 California Environmental Resources Evaluation System, "Frequently Asked Questions about CEQA," 1998.

State and Local Government Non-Point Pollution Control Regulations

Nonpoint source pollution, also known as polluted runoff, is the leading cause of water quality impairments in California and the Nation. Nonpoint sources, including natural sources, are the major contributors of pollution to impacted streams, lakes, wetlands, estuaries, marine waters, and ground water basins. Unlike pollution from distinct, identifiable point sources (e.g. industrial or waste treatment plant pipe discharge pipes), nonpoint source pollution comes from many diffuse sources. Rainfall, snowmelt, or irrigation water that moves over and through the ground results in nonpoint source pollution. As the runoff moves, it picks up and carries away natural and human-made pollutants and deposits them into lakes, rivers, streams, wetlands, ground water, and other inland and coastal waters.

In January 2000, the State Water Resources Control Board, in association with the California Coastal Commission, adopted the *Nonpoint Source Program Stragegy and Implemation Plan, 1998-2012* also known as *PROSIP*. This plan and program are required to conform with the Clean Water Act (CWA) and section 6217 of the Coastal Act Reauthorization Amendments of 1990 (CZARA). The lead State agencies for the program are the State Water Resources Control Board (SWRCB), the nine Regional

Water Quality Control Boards (RWQCB), and the California Coastal Commission (designated lead coastal management agency). The program plan was submitted for approval to the U. S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA), the lead federal agencies that administer the CWA and the Coastal Zone Management Act (CZMA) respectively.

Under the Plan, the State is committed to implementing 61 mitigation measures addressing nonpoint pollution by 2013, and has adopted a three-tiered approach with priorities identified in the Watershed Management Initiative (WMI) Chapters of the Plan. The WMI, approved by the SWRCB in 1995, is used to help the SWRCB meet its goal to provide water resource protection, enhancement, and restoration. WMI uses an integrated planning approach to create and implement unique solutions for each watershed. Each RWQCB and the SWRCB revises the WMI Chapter annually to reflect the changing priorities and conditions in the State's watersheds.

Total Maximum Daily Loads (TMDLs) are another implementation planning tool used to enhance the State's ability to foster implementation of appropriate nonpoint source mitigation measures contained in the Plan. TMDLs target specific sources and corresponding corrective measures and provide a framework for using more stringent approaches that my be necessary to achieve water quality goals and maintain beneficial uses.

The State's nonpoint source program plan is the final plan submittal intended to satisfy the CWA section 319(h) requirements and CZARA requirement for a Coastal Nonpoint Pollution Control Program (CNPCP). The program plan achieves this goal by providing a coordinated statewaide approach to dealing with nonpoint source pollution structured around 61 mitigation measures for six nonpoint source categories, including:

- agriculture,
- forestry,
- urban areas,
- marinas and recreation boating,
- hydromodification, and
- wetlands/riparian areas/vegetated treatment systems.

The State Plan directives for each of these categories and the appropriate mitigation measures were reviewed for applicability to local government planning and for issues that would be approriate to address in the general plan update.

In addition to the State's PROSIP, the California Coastal Commission (CCC) has developed a companion plan for controlling polluted runoff in coastal areas (*California Management Measures for Polluted Runoff (CAMMPR)*, January 2000, which outlines the CCC's authorities to address polluted runoff and identifies actions with timelines and milestones to achieve the CCC's objective to reduce polluted runoff. Many of the actions identified in the CAMMPR Plan are incorporated into the PROSIP and are expected to facilitate implementation of the nonpoint source program in coastal areas.

General Plan Relevancy

The general plan is a local government's bais planning document. Under State planning law, each city or county must adopt a comprehensive, log-term gernal plan for physical development of the city or county and any land outside its jurisdiction that bears relation to its planning. General plans must contain seven elements: land use, circulation, housing, conservation, open space, noise, and safety.

According to PROSIP, the following elements are most relevant to nonpoint source pollution prevention and control:

- land use (density and intensity of use affect nonpoint pollution sources),
- conservation (may address watershed protection, land or water reclamation, prevention or control of the pollution of streams and other coastal waters, regulation of land uses along stream channels, etc),
- open space (applies to preservation of natural resources, including fish and wildlife habitat, rivers, streams, bays and estuaries, and other open spaces),
- circulation (plans infrastructure, including water, sewage, and storm drainage).

Local Coastal Plans

The Coastal Act directs the County to prepare for review and certification by the CCC a Local Coastal Program (LCP) for the County's portion of the coastal zone. The LCP consists of a local government's land use plans (LUPs), zoning ordinances, zoning district maps, and, within sensitive coastal resource areas, other implementing actions which, when taken together, meet the requirements of and implement the provisions and policies of the Coastal Act at the local level (PRC §30108.6). The LUPs are the relevant portions of a local government's general plan which is sufficiently detailed to indicate the kinds, location, and intensity of land uses, the applicable resource protection and development policies, and, where necessary, a listing of implementing actions. The standard of review of the LCP Implementation Plan is that it conforms with and is adequate to carry out the certified LUPs.

A local government with a certified LCP either approves, conditionally approves or denies a Coastal Development Permit (CDP) application after review of consistency with the LCP policies. In some cases, action taken by a local government on a CDP may be appealed to the CCC. In hearing appeals, the standard of review is the certified LCP and the public access policies of the Coastal Act. Because a CDP is either approved or denied depending on its conformity to a certified LCP, it is imperative that all appropriate nonpoint source mitigation measures are incorporated into the LCP and identified and included in the certification process.

Under PROSIP, the CCC is directed to train its staff in implementing the program through its *Procedureal Guidance Manual: Addressing Polluted Runoff in the California Coastal Zone*. The manual is used in screening for nonpoint source components in LCPs, Local Coastal Program Amendments, and CDP. Under this approach CCC staff are routinely requesting applicants of CDPs not already subject to NPDES permit requirements to submit Erosion and Sediment and Chemical Control Plans for the construction phase when appropriate. Further, a polluted runoff control plan with regular BMP maintenance and inspection is required of most development proposals.

The Coastal Act (section 30519.5) requires the CCC to conduct periodic reviews of certified LCPs to evaluate whether or not the LCPs are being implemented by the local governments in a manner that conforms with the act. Because of this, it is important that the County of Humboldt address the nonpoint source program requirements in the General Plan Update process. The CCC will review all new LCPs, LCPAs, and CDP applications brought before it for appropriate nonpoint source pollution prevention and control activities.

The PROSIP Implementation Plan was reviewed for those nonpoint source polution mitigation measures for which local government is identified as a lead agency or agency with responsibilty for implementation. Following are those measures which the Regional Water Quality Control Board (RWQCB 1) or local governments are directed to address in Humboldt County:

Agriculture

Management Measure 1B – Facility Wastewater and Runoff from Confined Animal Facilities
RWQCB 1 to foster a grant program for nonpoint source control on dairies.
RWQCB 1 to educate dairy industry on nonpoint source impacts and control.
Management Measure 1E – Grazing Management
RWQCB 1 to implement TMDLs for 303(d) listed waters in the Humboldt Watershed Management Area.\

At the local government level, the County of Humboldt has implemented a program addressing permit requirements for animal waste storage facilities, and developed a step-by-step instruction guide.

Forestry

All Management Measures

RWQCB 1 to monitor the effects of land application of herbicides on surface water and increase review of timber harvest plans (THPs).

For the most part, timber harvesting activities are regulated by the state. However, at the local government level, the County of Humboldt is responsible for addressing land use consistency for conversions (less than 3 acres) that involve timber removal. Nonpoint source pollution concerns may be addressed in this context. The County of Humboldt must sign-off on the conversion exemptions, and in so doing, ensure compliance with the Open Space Element of the General Plan. Within this context, conversion exemptions which encroach into streamside management areas will be required to obtain a Special Permit. The Special Permit findings shall be based on requirements that there be no advserse impacts to streamside management areas. This approach would typically require that erosion control measures be implemented as appropriate.

Urban Areas

Management Measure 3.1 – Runoff from Developing Areas

Local Planning Agenices to coordinate with developer and regulatory agencies, erosion standards for development.

This management measure will be implemented through adoption of the County's Grading, Erosion Control and Streamside Management Area Ordinance.

13.3 CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

In January 2000, the State Water Resources Control Board and the California Coastal Commission developed the *California's Management Measures for Polluted Runoff* (CAMMPR) in order to improve implementation of the California Nonpoint Source Pollution (NPS) Control Program. The measures are organized into the same six categories as the program (see page 1), and the program address two types of mangement measures: minimum management measures to be applied to land use activities known to be major causes of NPS pollution; and additional management measures to be applied when minimal measures prevent areas from meeting the Clean Water Act requirements. The CAMMPR identifies:

- Individual management measures appropriate for implementation in California;
- Various State and local agencies with authorities and programs for implementation;
- State and local backup authorities that can be used to assure implementation when self-determined programs are not followed;
- Program implementation locations; and
- Notes to clarify how the programs operate.

The CAMMPR was review for directives to local government that would be appropriate for consideration in the general plan update.

Agriculture Management Measures

Management Measure 1A: Erosion and Sediment Control – Local government to adopt ordinances and rules and make land use decisions consistent with state law.

This management measure will be implemented through adoption of the County's Grading, Erosion Control and Streamside Management Area Ordinance.

Management Measure 1B: Facility Wastewater and Runoff from Confined Animal Facility Management - Local government to adopt ordinances and rules and make land use decisions consistent with state law. Installation of practices may require a permit.

At the local government level, the County of Humboldt has implemented a program addressing permit requirements for animal waste storage facilities in the Coastal Zone, and has developed a step-by-step instruction guide.

Management Measure 1C: Nutrient Management – Develop, implement and periodically update a nutrient management plan.

Not currently implemented.

Forestry Management Measures

Like the PROSIP, the following is applicable to Forestry Management Measures of the CAMMPR, particularly Management Measure 2B Streamside Management Areas (SMAs):

For the most part, timber harvesting activities are regulated by the state. However, at the local government level, the County of Humboldt is responsible for addressing land use consistency for conversions (less than 3 acres) that involve timber removal. Nonpoint source pollution concerns may be addressed in this context. The County of Humboldt must sign-off on the conversion exemptions, and in so doing, ensure compliance with the Open Space Element of the General Plan. Timber harvesting under conversion exemption in the Coastal Zone require a Coastal Development Permit. Additionally, within the context of consistency with the Open Space Element of the General Plan, conversion exemptions which encroach into streamside management areas will be required to obtain a Special Permit. The Coastal Development Permit and Special Permit findings shall be based on requirements that there be no advserse impacts to streamside management areas. This approach would typically require that erosion control measures be implemented as appropriate.

Urban Management Measures

Measure 3.2A: Construction Site Erosion and Sediment Control - Local government to adopt ordinances and rules and make land use decisions consistent with state law.

This management measure will be implemented through adoption of the County's Grading, Erosion Control and Streamside Management Area Ordinance.

Measure 3.3A. 3. & 4.: Existing Development – Limit destruction of natural conveyance systems; and, where appropriate, preserve, enhance, or establish buffers along surface water bodies and their tributaries.

This management measure will be implemented through adoption of the County's Grading, Erosion Control and Streamside Management Area Ordinance.

Measure 3.4A & B – New Onsite Disposal Systems (OSDSs) – Local authorities determine OSDS criteria and require permits and inspections. Cities and counties can adopt ordinances/rules and make land-use decisions consistent with state law.

Currently the Division of Environmental Health implements criteria and permits for OSDSs. Areas served by onsite systems require larger minimum parcels sizes under current land use designations.

Marinas and Recreational Boating Management Measures

The major marinas within the County of Humboldt are within the jurisdictions of the Cities of Eureka and Trinidad. Exceptions include King Salmon and the Shelter Cove marina. No new or expanding marinas are anticpated for the County jurisdictional area, however, if such facilities are planned in the future, the management measures (Measures 4.1 A through H) for assessment, siting and design are relevant.

The operations and maitenance management measures (Measures 4.2 A through G) are typically issues that are addressed and/or included as conditions of approval for Coastal Development Permits for these types of facilities.

Recommendation: adopt management measures as requirements for marinas and recreational boating facilities within the local coastal plans.

Hydromodification Management Measures

Hydromodification projects include channelization/channel modification, dams, and streambank or shoreline erosion. Management measures direct responsible agencies to evaluate the potential effects on surface waters, insteam and riparian habitats, and erosion potential. The directive for local government is to adopt ordinances and rules and make land use decisions consistent with state law. There is no anticipation of hydroelectric projects within the coastal zone of the County of Humboldt, and the only recent channelization/channel modification (Moutn of the Mad River) is within the jurisdiction of the Coastal Commission. The most germane issue for Humboldt County is that of erosion potential.

This management measure will be implemented through adoption of the County's Grading, Erosion Control and Streamside Management Area Ordinance.

Wetlands, Riparian Areas & Vegetated Treatment Systems Management Measures

Measure 6A – Protection of Wetlands and Riparian Areas
Measure 6B – Restoration of Wetlands and Riparian Areas
Measure 6C – Vegetated Treatment Systems

These management measures will be implemented through continuation of LCP wetlands policies, permitting requirements, and resource protection supplemental finding requirements as well as through adoption of the County's Grading, Erosion Control and Streamside Management Area Ordinance.

13.4 LOCAL GOVERNMENT

Humboldt County's Grading, Erosion Control, Geological Hazards, Streamside Management Areas, and Related Ordinance Revisions

In May 2002, the Humboldt County Board of Supervisors adopted ordinance revisions dealing with grading, erosion control, geological hazards, streamside management areas, and related ordinance revisions. This action completes efforts to codify and implement comprehensive provisions for dealing with grading, erosion control and potential impacts to streamsides. It has the benefit of addressing nonpoint source pollution from runoff water as well.

In summary, the topics of the ordinances are as follows:

- Update Building regulations pertaining to incorporation of updated uniform codes (last updated 1977).
- Creation of a subsection within the Building Regulations pertaining to Grading, Excavation, Erosion, and Sedimentation.
- Modification of other sections relating to geologic hazards and processing of grading and building permits within or affecting Streamside Management or Other Wet Areas.
- Addition of Geologic Hazards Regulations, including the incorporation of "area of demonstration of stability" provisions.
- Streamside Management Ordinance which serves to codify the Interim Implementation Standards for the Open Space Element of the General Plan (Applicable to the Non-Coastal areas only) (Resolution 95-53, April 25, 1995).
- Ordinance revisions addressing the topic of vegetation removal or other land disturbing activities (Section 316-25), and an ordinance revision needed to assure consistency between County regulations (affects sections of the Subdivision Ordinance 323-5 and 323-6).

The purposes of the ordinance changes include:

- To Update the County Code to reflect the uniform codes in force within the County.
- To Implement various General Plan (Volume I, Framework) policies and standards pertaining to: water quality, biological resources, hazards, conservation and open space.
- To provide additional guidance in application of erosion and sediment control measures to various developments.

- To establish an Steamside Management Ordinance to implement the Open Space Element as required by State Planning Law (Government Code Section 65910).

The amendments serve to avoid significant effects upon the environment, they are in the public interest, and they maintain general plan consistency because they:

Serve to implement portions of the County's General Plan policies or standards pertaining to:

- water quality
- biological resources
- critical and sensitive habitats
- geologic hazards
- open space
- conservation
- erosion and sediment control

Maintain and enhance existing zoning regulations which conform with all local, state and federal requirements to protect property rights, sensitive habitats and coastal and other resources.
The amendments are in furtherance of the goals of minimizing risk in geologically unstable areas and improving erosion control regulations.
The revisions serve to implement to varying degrees, numerous mitigation measures included within the Environmental Impact Report prepared and adopted for the County's General Plan, Volume 1, Framework Plan.

The Revisions

Building Regulations – Revisions to the Building Regulations (Title III, Division 3, Chapter 1) do the following:

- Updates definitions and references to the standard state and national codes.
- Adds mechanical code and references to historical building code and accessibility standards (ADA) which were not previously referenced.
- Make the Planning Commission the Board of Appeals for building code issues
- Provides additional clarity and details on when permits are required and expands the list of activities which are exempt from needing building permits.
- Updates the water quantity standards per dwelling unit.

Grading, Excavation, Erosion, and Sedimentation Control – A new section added to the Building Regulations (Section 322-12). The County has historically administered grading and related activities through Chapter 70 of the Uniform Building Code. The more recent uniform code addresses grading in Appendix 33 and related sections. This ordinance codifies Appendix 33 as County Code Section 331-12. This new section is added for the purposes of:

- Regulating grading and related activities on private and public property.
- To control and reduce erosion.
- To reduce sediment delivered to drainages and streams.

- To protect fishery habitat and other biological resources by providing best erosion control and sediment management practices.

This new section provides for Definitions relevant to grading and fill permits. Specifies when permits are required and what is exempted from needing grading permits. Specifies what information is necessary to be submitted for a grading permit application. Provides Grading Standards to which grading activities shall conform including setbacks from cut and fill slopes, drainage and terracing requirements (slopes greater than 33%)

Maintenance and Inspection requirements.

Erosion and Sedimentation Control provisions required for all projects requiring building, grading, and development permits. Requires a site-specific Erosion and Sediment Control Plan (ESCP) be prepared and allows for use of a Preliminary Stormwater Pollution Prevention Plan in lieu of the specified Erosion and Sedimentation Control Plan under certain conditions (i.e. it addresses all of the standards and conditions of an ESCP). Provides for the administration of erosion and sediment control measures by the Department of Public Works following approval of a tentative subdivision map as a part of project improvement plans. Includes examples of Best Management Practices.

Geologic Hazards – Established a section within the Building Regulations pertaining to development subject to various geological hazards outside of the Coastal Zone (Note: within the Coastal Zone similar provisions are contained within the local coastal plans). Establishes a requirement to prepare a geologic report, including stability analysis, for development proposed with an "area of demonstration of stability." (I.e. expands the circumstances in which site-specific geological reports must be prepared). Specifies supplementary information for reports for development located in the coastal zone (e.g. historic, current and foreseeable cliff erosion, ground and surface water conditions, potential erodibility, mitigation measures, effects of marine erosion on seacliffs, and engineering stability analysis). Includes Development Standards applicable when a geologic report is required. Includes requirements for execution of a "Deed Restriction and Hold Harmless Agreement" to run with the land as a standard condition when a geological reprot is required.

Streamside Management Area Ordinance – This ordinance serves to codify the "Interim Implementation Standards for the Open Space Element of the General Plan (Non-Coastal Zone)." (Note: within the Coastal Zone similar provisions are contained within the local coastal plans).

- Provides standards pertaining to development within streamside management and other wet areas; Defines Streamside Management Areas (SMAs).
- Identifies allowed development and prohibited activities within SMAs, within stream channels, and within other wet areas.
- Specifies minimum mitigation measures.
- Specifies that a "Biological Report" is required for development proposed within SMAs and other wet areas.
- Identifies the required contents of a "Biological Report" necessary for delineating SMAs, identifying impacted resources, and providing recommended mitigation and monitoring.

Amendment of Related Regulations – To ensure internal consistency between regulations or to add clarity to development requirements, a number of additional minor regulation changes were adopted. These changes include provisions for:

- Removal of natural materials.
- Data on Tentative Subdivision Maps.
- Water quantity information for subdivisions.

Context within the Regulatory Framework

The Grading, Erosion Control, Geological Hazards, Streamside Management Areas, and Related Ordinance Revisions fill the Local Government niche for comprehensive regulations addressing the subject areas and address numerous resource issues relevant to: water quality, biological resources, critical and sensitive habitats, geologic hazards, open space, conservation, and erosion and sediment control. State and federal regulatory programs which serve to complete this comprehensive approach include the following:

- State Water Resources Control Board and the California Coastal Commission – California Nonpoint Source Pollution Control Program. The ordinance revisions carry out some of the directives for local government under this program.
- California Department of Forestry and Fire Protection proposed rule changes affecting riparian and related areas.
- State Water Resources Control Board – general permits to cover General Construction Activities and Industrial Activities, and Municipal Stormwater Programs.
- California Department of Fish and Game Lake and Streambed Alteration Program (recently modified to require compliance with the California Environmental Quality Act).
- US Environmental Protection Agency, in concert with the State Water Resources Control Board, program to establish Total Maximum Daily Loads (TMDLs) for designated stream.
- US Army Corps of Engineers (ACOE) changes to the Nationwide Permits affecting wetlands under Section 404 of the federal Clean Water Act. Certain activities require consultation with the US Fish and Wildlife Service and the National Marine Fisheries Service.

14 Review of Watershed Management Studies in Humboldt County

Many individuals and organizations are involved in and support various planning efforts based upon watershed boundaries. Following is a survey and review of the various approaches with notations on applicability to the General Plan Update process.

14.1 REGIONAL WATER QUALITY CONTROL BOARD

The water resource protection efforts of the State Water Resources Control Board and the Regional Water Quality Control Boards are guided by a five year Strategic Plan (updated in 2001). A key component of the Strategic Plan is a watershed management approach for water resources protection. To protect water resources within a watershed context, a mix of point and nonpoint source discharges, ground and surface water interactions, and water quality/water quantity relationships must be considered. These complex relationships present considerable challenges to water resource protection programs. The State and Regional Boards are responding to these challenges with the Watershed Management Initiative (WMI). The WMI is designed to integrate various surface and ground water regulatory programs while promoting cooperative and collaborative efforts within watersheds. It is also designed to focus limited resources on key issues.

Past State and Regional Board programs tended to be directed at site-specific problems. This approach was reasonably effective for controlling pollution from point sources. However, with diffuse nonpoint sources of pollutants, a new regulatory strategy was needed. The WMI uses a strategy to draw solutions from all interested parties within a watershed, and to more effectively coordinate and implement measures to control both point and nonpoint sources.

During initial implementation of the WMI, each Regional Board identified the watersheds in their Region, prioritized water quality issues, and developed watershed management strategies. These strategies and the State Board's overall coordinating approach to the WMI are contained in the Integrated Plan for Implementation of the WMI of which the Watershed Planning Chapter is a part.

Addressing problems on a more holistic basis with a collaborative approach involving landowners and other agencies in a watershed represents a new and challenging role for government. The WMI seeks to facilitate solutions from all interested parties in a watershed, and coordinate measures to improve watershed health, and ultimately the beneficial uses of water. Each regional board has identified watersheds in their region, prioritized water quality issues, and developed their own watershed management strategies. Each region's strategy is then a "chapter" in the statewide plan. This document constitutes the North Coast Region's WMI Chapter for that integrated statewide plan.

The North Coast region, which comprises all basins draining into the Pacific Ocean from the California-Oregon state line (including Lower Klamath Lake and Lost River Basins) south to the southerly boundary of the watershed of the Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties. The North Coast Region covers all of Del Norte, Humboldt, Trinity, and Mendocino Counties, major portions of Siskiyou and Sonoma Counties, and small portions of Glenn, Lake, and Marin Counties. The North Coast Region encompasses a total area of approximately 19,390 square miles, including 340 miles of scenic coastline and remote wilderness areas, as well as urbanized and agricultural areas.

A key component in the 1997 Strategic Plan for the State Water Resources Control Board and the nine regional water quality control boards is a watershed management approach. The Watershed Management Initiative (WMI) is intended to support the goals in the Strategic Plan to:

1. preserve, enhance and restore water resources while balancing economic and environmental impacts

2. promote cooperative relationships and to improve support for the regulated community and the public

3. encourage balanced and efficient use of water through water transfers, recycling and conservation

4. continuously improve internal efficiency and effectiveness

5. establish a more stable, and flexible mix of funding sources

The WMI seeks to facilitate solutions from all interested parties in a watershed, and coordinate measures to improve watershed health, and ultimately the beneficial uses of water. Each regional board has identified watersheds in their region, prioritized water quality issues, and developed their own watershed management strategies. The vision is to incorporate all the strategies with the State Board's coordination role into a single integrated plan. Each region's strategy is then a "chapter" in the statewide plan. This document constitutes the North Coast Region's (www.swrcb.ca.gov/rwqcb1/download.html)for that integrated statewide plan.

Six watershed management areas (WMAs) are designated in the Region: Klamath River, Trinity River, Humboldt, Eel River, Russian/Bodega, and North Coast Rivers. The Region began with a rotating basin approach, applying a sequential planning process to each WMA on a rotating basis. WMAs are first assessed, and problems, issues and concerns identified using an in-house watershed team and public meetings in the WMA. Goals and actions to address the goals are strategized and an implementation phase follows. The end of the cycle is an evaluation step that feeds into the next assessment. In general, the process has improved communication within the Regional Board, and in some watersheds has improved communication among agencies and the public.

The highest priority activities that have come from this process include:

- maintaining the core regulatory program for regulated dischargers
- increasing emphasis on stormwater runoff issues
- increasing monitoring and assessment activities
- increasing emphasis on nonpoint source issues (including forestry), especially as they affect salmonid resources
- developing and implementing Total Maximum Daily Load strategies (mostly sediment and temperature associated with salmonid resource declines)
- improving outreach and community involvement in decisions
- fostering watershed groups and volunteer monitoring

14.2 CLEAN WATER ACT SECTION 303(D) (TMDLS)

Section 303(d) of the Clean Water Act requires biennial listing of waterbodies not meeting water quality standards and prioritization of those waterbodies for waste reduction activities (TMDLs). The North Coast Regional Water Quality Control Board adopted its latest section 303(d) list on April 23, 1998.

A citizen's lawsuit against US Environmental Protection Agency produced a consent decree scheduling a number of north coast rivers for development of TMDLs, primarily for sediment and temperature. The Regional Water Board has accepted responsibility for developing and implementing waste reduction strategies in compliance with the Clean Water Act in a number of WMAs. Descriptions of the planned activities appear in this section.

In some areas, organizing and activism by citizens involved in economic enterprises that depend on access to and use of natural resources, such as agriculture and forestry, gives rise to local watershed groups. Other watersheds have seen conservation and restoration efforts that are central to a citizen' watershed group. Some watersheds are held in major part by large commercial timber enterprises or the U.S. Forest Service. In these cases, direct interagency conferring with the timber interests is often the forum of first resort. Still other cases involve a combination of any or all of these elements into a dynamic community oriented resource management planning group. Considering the variety of potentials for watershed efforts, including but not limited to the examples noted above, Regional Water Board staff must be attentive to the local, adaptive nature of all these approaches. Consequently, the formation of a "watershed group" may or may not be the primary concern of the Regional Water Board staff.

Further details on TMDLs for waterbodies in Humboldt County can be found in the North Coast Region's Watershed Management Initiative Chapter for the integrated statewide plan and in the watershed description sections of this chapter. (www.swrcb.ca.gov/rwqcb1/download.html)

14.3 STATE WATER RESOURCES CONTROL BOARD WATERSHED MANAGEMENT AREAS

Klamath WMA

In the Klamath WMA the following broad goals provide a focus for water quality control activities: 1) protect and enhance the salmonid fishery (Mainstem and tributaries below Iron Gate Dam), 2) protect and enhance coldwater, warmwater and endangered aquatic species, 3) maintain the viability of agriculture and timber uses, 4) maintain recreational opportunities, and 5) protect groundwater uses.

North Coast Rivers WMA

In the North Coast River WMA the overall emphasis is the inspection of timber harvest plans for implementation of the Forest Practice Rules and best management practices to ensure protection of water quality and beneficial uses. Through recent budget actions the timber harvest program activities on private land in concert with California Department of Forestry and Fire Protection have been expanded. The future development of a Basin Plan amendment for TMDL waste reduction strategies for sediment is another primary activity by Regional Board staff. This WMA is the focus of the first phase of the multi-agency North Coast Watershed Assessment Program effort.

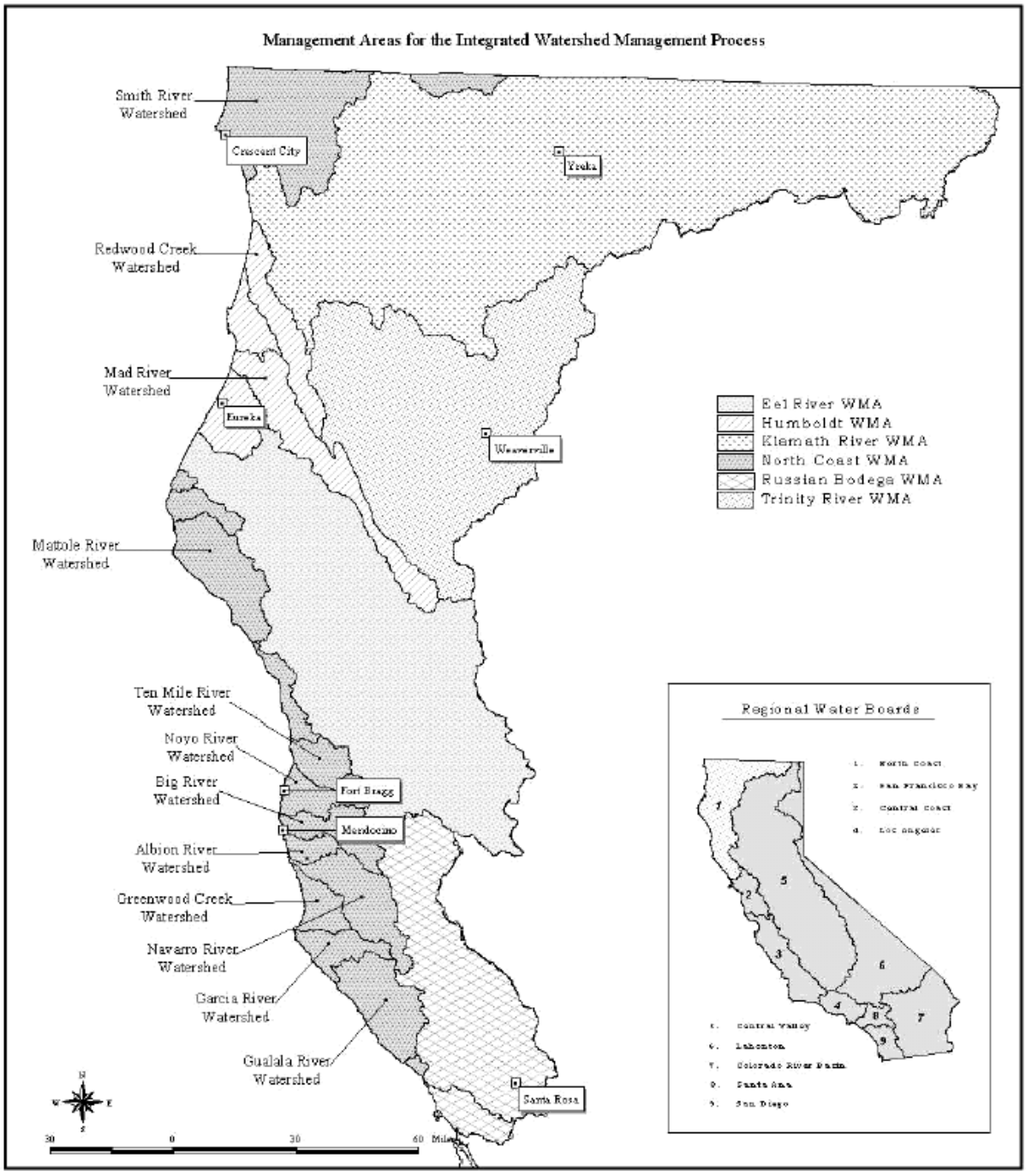
Humboldt Bay WMA

In the Humboldt Bay WMA the following broad goals provide a perspective from which to view the specific goals and actions 1) improve coordination, education, outreach, assessment, and monitoring, 2) protect surface and ground water uses for municipal supply, recreation, and industrial shellfish harvest, and 3) protect and enhance the anadromous salmonid resources.

Eel River WMA

In general, the primary issues associated with water quality in the Eel River WMA are focused on the beneficial uses for drinking water supply, recreation, and the salmonid fishery. Since the watershed is located in steep forested terrain with highly erosive soils and high rainfall, erosion and sediment production and transport are high. For most of the watershed the issues of temperature and sedimentation and their impacts on the salmonid fishery are of high concern, involving the timber and rangeland industries. Other issues include ground water contamination, dairies in the delta area near the ocean, and localized contamination of surface and ground waters.

Figure 14-1: Management Areas for the Integrated Watershed



January 2002

Trinity River WMA

The broad goals for this WMA include improving the anadromous fishery through sediment reductions and habitat enhancements and maintaining the other high beneficial uses of both surface and ground water.

The process for the North Coast Region (NCR) is responsive to the Watershed Management Initiative called for in the State Water Resources Control Board *Strategic Plan* (June 22, 1995). It essentially involves designating Watershed Management Areas (WMAs) and performing steps as described below:
assessing water quality related issues on a watershed basis, developing prioritized water quality goals for watersheds from the issues,. addressing the issues with various programs through a multi-year implementation strategy, and evaluating progress at the end of a specified time period.
The program is dynamic, and as such, represents the best information and strategy at the time of writing and for the resources made available to develop it. Also recognize that this document is an administrative management tool, and by its very nature, must be flexible and responsive to the adaptive management required in addressing issues with changing priorities and new information.

Note that the "management areas" are on a different scale than the basins and hydrologic units specified in the *Water Quality Control Plan for the North Coast Region* (Basin Plan). This is a conscious effort to reduce the number of units within this process for reasonable assessment and budgeting. The individual watersheds and hydrologic units are not ignored and may be assessed at that finer level of resolution in the process.

14.4 MATTOLE RIVER WATERSHED

The Mattole River in Mendocino and Humboldt Counties, California, is listed on California's 303(d) report as a water quality limited waterbody requiring the establishment of a Total Maximum Daily Load (TMDL) due to sedimentation and temperature. The North Coast Regional Water Board has scheduled the completion of the TMDL for sediment for late 2002 and for temperature for late 2003. The key stakeholder concern for the Mattole River is the decline of the once healthy coho and chinook salmon fisheries, thought to be associated with excess sediment load and elevated water temperatures.

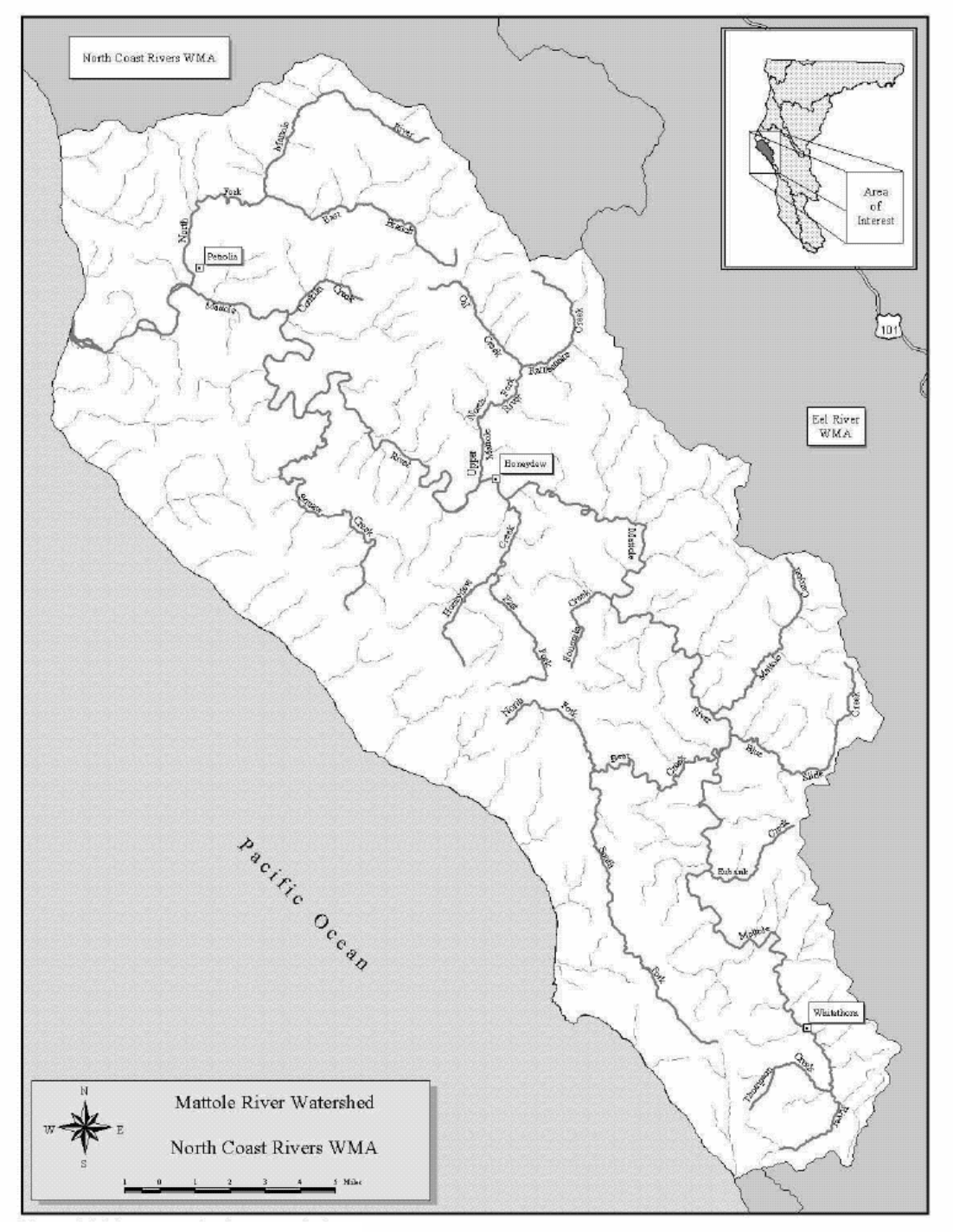
Watershed Description

The Mattole River starts in northern Mendocino County, and flows north 62 river miles, through steep, forested lands into the ocean ten miles south of Cape Mendocino. The watershed encompasses an area of approximately 194,560 acres (304 square miles) and supports a population of over 2,000 people. The main population centers are in Petrolia, Honeydew and Whitethorn, but people are scattered throughout the watershed. Small landowners (less than 450 acres) own 43 percent of the land, Bureau of Land Management (BLM) owns about 12 percent, and commercial timber companies own much of the remaining land. The area is subject to intense rainfall from 50 inches per year near the mouth to 115 inches per year near Honeydew. The main tributaries to the Mattole River include East Branch North Fork Mattole, Upper North Fork Mattole, Mill Creek, Squaw Creek, Bear Creek, Thompson Creek, Honeydew Creek, and Bridge Creek

From 1947 to 1987 an estimated 82 percent of the timber was harvested. By 1988 over 90 percent of old-growth forests had been harvested and by 1996 late seral habitats comprised less than 8 percent of the original forest cover. A large part of the late seral stage acreage lies within the King Range National Conservation Area. Twelve percent of the Mattole watershed lies within this management

which, since 1991, has been managed as a Spotted Owl Habitat Conservation Area. The "one hundred year" floods of 1955 and 1964 deposited hundred of tons of sediment into the river system from which the Mattole River has yet to recover. Floods also occurred in 1995 and 1997.

Figure 14-2: Mattole River Watershed



The Mattole is widely recognized as being a landscape prone to excessive erosion due to tectonic movement, slope instability, and high levels of rainfall. The tectonic Mendocino Triple Junction of the Pacific, North American, and Gorda Plates makes the Mattole the most seismically active watershed in the continental United States. Most of the Mattole is underlain by coastal belt rocks, is highly unstable and uplifts 1-2 cm/year. A 1993 inventory estimated 3,350 miles of active and abandoned roads in the Mattole basin, with 115 miles maintained by the county, 25 miles maintained by BLM, leaving 425 miles of active and 2,800 miles of abandoned roads that are not managed or maintained. In addition to roads that account for approximately 76 percent of human-induced erosion, logging, conversion of forestland to pasture and over grazing contribute to erosion and sedimentation of the streams in the watershed.

The Mattole Restoration Council and the Mattole Salmon Group have been active in the watershed since the early 1980's, and have conducted numerous successful restoration projects and collected valuable data on the declining fisheries. Sanctuary Forest owns about 1,100 acres of old growth forest, and BLM manages about 6,500 acres of old growth (Gillham Butte and Mill Creek Forest). Major timber landowners are Pacific Lumber Company (PALCO), the Bureau of Land Management (BLM) and Barnum Lumber Company. The federal government has classified the Mattole River as a Tier 1 Key Watershed essential to the survival of coho and chinook salmon stocks. Known fish species in the Mattole include coho and chinook salmon, steelhead trout, rainbow trout, green sturgeon, and brook lamprey. In addition to anadromous salmonids, species at high risk of extinction include the southern torrent salamander and the tailed frog.

RWQCB Assessment. The populations of anadromous salmonid species in the Mattole River watershed have declined dramatically since the 1960's. According to the California Department of Fish and Game the carrying capacity of the habitat for fish populations has been seriously degraded due to cumulative adverse impacts caused by timber operations, residential development, private road construction, agricultural operations and other land use practices. Natural events such as wildfires, floods, and earthquakes have also played a major role. Impacts to the fishery are from sedimentation caused by erosion from landslides, streambank failures, and sheet and gully erosion, loss of large woody debris for instream cover, and increased water temperatures due to removal of protective streamside shade canopy. Many tributaries have sediment in storage, in-filling of pools, streambed aggradation, siltation of spawning gravels, fewer plunge pools, reduced flows and moderate migration barriers. Coho salmon that require cool pools scoured by water flow over woody debris or rock outcrops now exist only in the headwaters and its tributaries because habitat in the lower reaches has been lost. In 1981 escapement data indicate 3,000 chinook and 500 coho were present, but by 1989 there were only 150 chinook and 50 coho present. Such information prompted the Department of Fish and Game in 1990 to recommend a zero net discharge of sediment to watercourses, retention of existing large woody debris, and no further increases in water temperature.

In addition to natural, background sediment sources, timber harvesting, salvage logging and roads also contribute sediment to streams and accelerate mass wasting and downstream flooding. The Mattole River estuary, important for fish rearing, is now shallow and warm and may have anoxic zones. Juvenile chinook are no longer found in the Mattole summer lagoon. Riparian zone management is needed on the mainstem and in some tributaries. The U S Geological Survey has been doing sediment sampling at their flow gauging station, and temperature monitoring has occurred throughout the watershed by various entities. Many roads have been inventoried and assessed in a five-county coho effort. For example, the county road upstream of Whitethorn is graded to an outside berm that can wash into the stream.

There are no NPDES permits or Waste Discharge Requirements in the watershed. Blue Slide Creek has a diesel discharge from an above ground tank. Other home heating-oil discharges in the watershed are likely. A problem with an underground tank at the Petrolia Store has been addressed. Herbicide applications on forestlands are limited to hand applications to prevent widespread drift of

toxic materials. The Queens Peak Mine on BLM property has recently been recontoured and restored. The Queens Peak mine is actually two mines next to each other—Queens Peak A and Queens Peak B. The primary issues in the Mattole River watershed are lack of large woody debris, high water temperatures, sediment buildup and siltation in the mouth of the river and in the mainstem and tributaries, and increased turbidity. Monitoring needs include water temperature, turbidity, channel morphology, sedimentation, riparian habitat health, marcoinvertebrates, bacteria, and toxics such as fuels.

Implications for Local Government Planning. Land use and development activities that could result in increased sedimentation in the watersheds steams and rivers should be regulated to prevent such discharge. This can be accomplished through the following measures:
Minimizing agricultural land conversions through the subdivision process.
Strict adherance to the requirements of the Grading, Erosion Control, and Streamside Management Area Ordinance for ministerial or principally permitted developments.

14.5 HUMBOLDT BAY WATERSHED MANAGEMENT AREA

Management Area Description

This area encompasses tributary waterbodies to the Pacific Ocean from Humboldt Bay north to, and including, Redwood Creek and all groundwater within that area. Major river systems in this area are the Mad River and Redwood Creek. Other major waterbodies include Humboldt Bay and Mad River Slough, numerous coastal lagoons (Big Lagoon, Stone Lagoon, Freshwater Lagoon), and coastal streams (Elk River, Freshwater, Jacoby, and Maple Creek, and Little River).

Land use in the WMA is primarily timber production, with agricultural uses in the non-forested areas consisting primarily of grazing and dairies. Lily bulb farms are found in the Arcata bottoms and the McKinleyville area. Urbanized areas include Trinidad on the ocean, McKinleyville and Blue Lake on the Mad River, and Arcata and Eureka on Humboldt Bay. Rural residential developments are scattered throughout the timber/grazing interface.

Freshwater streams in this unit support production of anadromous salmonids, including steelhead and cutthroat trout, coho and chinook salmon. The Mad River is the drinking water and industrial supply for the Humboldt Bay Area, and other coastal streams provide drinking water for local communities and individual homes. The deltas of the Elk River and Mad River Slough support commercial and sport shellfish production and harvesting.

Humboldt Bay includes the typical coastal values of an estuarine embayment, as well as an extensive commercial oyster industry. It is a major shipping center for the north coast, the largest such center between San Francisco and Coos Bay, Oregon, and presents the potential for water quality problems associated with industrial uses adjacent to the bay.

RWQCB Assessment. The upper hillslope areas of the WMA, while populated to varying degrees, are primarily occupied by timber production and harvesting activities, with coast redwood as the predominant harvested species.
Past practices and continued problems with harvesting techniques and road construction have added to stream sedimentation, in varying degrees, in all the drainages in the WMA.

The lower 40 percent of the Redwood Creek basin houses the Redwood National and State Park, which includes lower Redwood Creek and the Prairie Creek tributary. This protected park is a world famous attraction for tourists and researchers. Prairie Creek and its tributaries are considered by some as "reference watersheds" or ones that are in the most pristine condition for comparison to

lands that have been altered by human presence. Private landowners conduct grazing and timber harvesting activities in the estuary and upper reaches of the watershed. A small population of people lives in the town of Orick near the mouth of Redwood Creek. Sedimentation is a problem within lower Redwood Creek perhaps resulting from past harvesting activities, as noted by National Park staff. Assessments by National Park staff document problem areas and suggest follow-up coordination for implementing controls in conjunction with local landowners, USGS, and the Department of Fish and Game, and Humboldt State University. National Park and USGS staff, along with graduate students and local landowners, closely monitors fish populations, temperature, and channel changes on Redwood Creek. This watershed has won worldwide acclaim and is most likely one of the best-studied watersheds. When a Water Board Section 303(d) Water Quality Attainment Strategy ("TMDL") and implementation plan is adopted, existing efforts to monitor activities in the watershed for the benefit and enhancement of the salmonid resources will be coordinated.

Figure 14-3: Humboldt Bay WMA

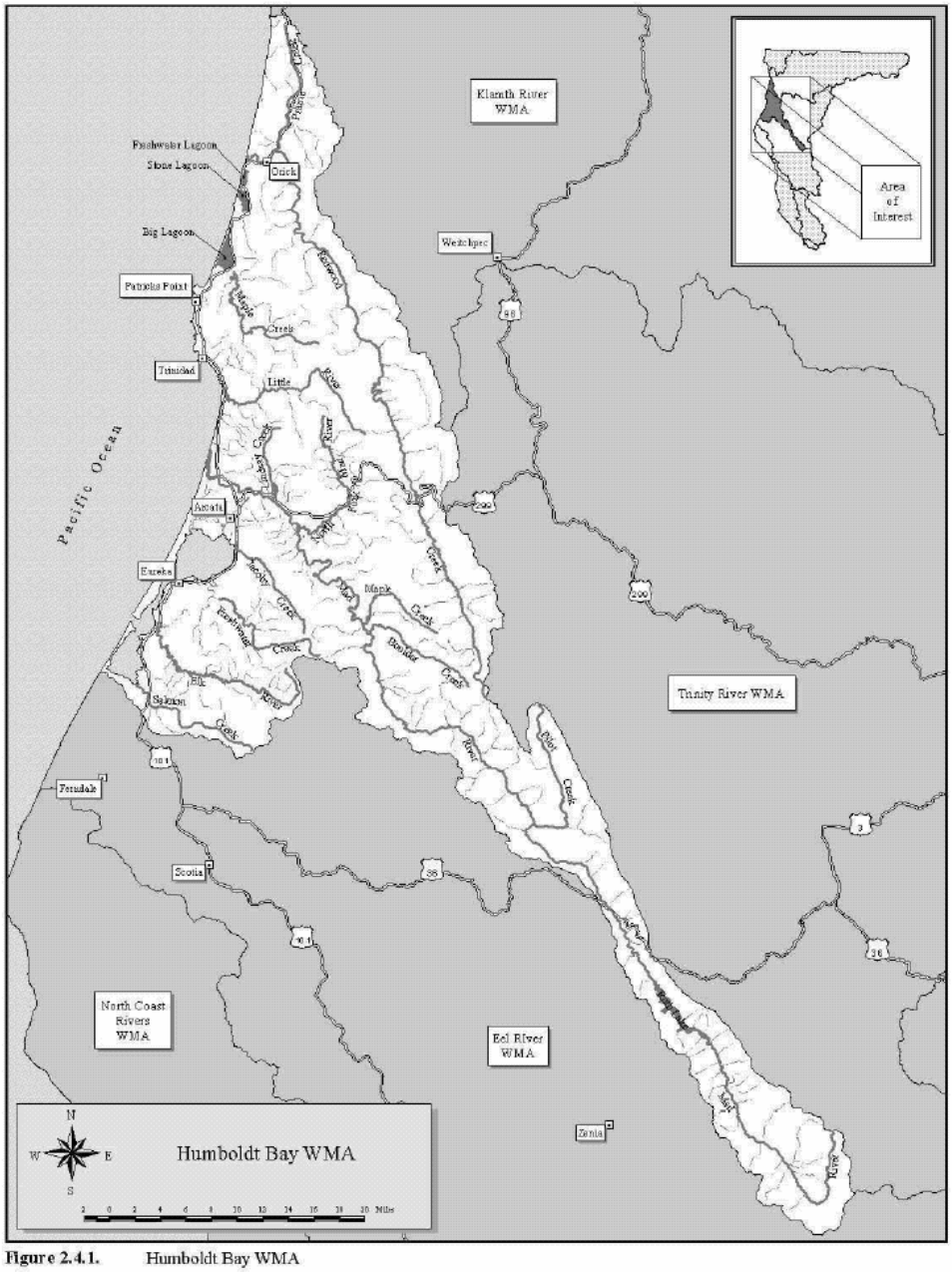


Figure 2.4.1. Humboldt Bay WMA

The Mad River watershed is mixed private and Forest Service timberland with a long history of timber harvest. Gravel mining occurs in the lower portions of the watershed. The Mad River is Section 303(d) listed for sediment and temperature impacts. The primary issues for the watershed are forestry-related, with urbanization and associated industrial and public point sources. For the Mad River and its tributaries, discharge of waste is allowed only under NPDES permit during the period of October 1 through May 14 and at 1% of the flow of the receiving water. The McKinleyville Community Services District discharges municipal effluent to the Mad River in compliance with those restrictions. The City of Blue Lake does not discharge directly, disposing of effluent in percolation/evaporation ponds.

Flooding in Freshwater Creek and Elk River has increased in frequency. The increased flood frequency may be related to stream aggradation and sediment discharges. Coastal tributaries draining to the ocean south of Redwood Creek and north of Salmon Creek face issues related to timber harvest and grazing, much like those that drain to Humboldt Bay. Humboldt Bay tributaries have experienced problems from urbanization and agricultural uses in addition to timber harvest issues. Additionally, they flow into Humboldt Bay and can impact uses there. Local concerns include sedimentation of Freshwater Creek and Elk River and subsequent flooding and domestic water supply degradation. Some industrial timberland owners are developing *Sustained Yield Plans* that will address sensitive watershed issues to some degree.

The majority of the population in this WMA lives in the Humboldt Bay area and the cities of Eureka and Arcata. Suburban growth is occurring in the unincorporated community of McKinleyville, north of Arcata. Flat land areas around the bay are predominantly pastureland with some limited cultivation, primarily lily bulb farms. Humboldt Bay is an important commercial and recreational shellfish growing area, as well as deep-water port. Historically, wastewater discharges to the Bay impacted the shellfish uses. Recent emphasis on improved treatment and reliability and the consolidation and relocation of the Eureka wastewater plants has significantly reduced the problem. Discharge of treated wastewater to Humboldt Bay is permitted from the Arcata treatment plant and marsh complex in Arcata Bay (north Humboldt Bay) and the Elk River plant which serves the greater Eureka area. The Arcata plant discharges to a constructed marsh/pond complex prior to discharge to Arcata Bay. The Elk River plant times its discharges to out-going tidal flow so that effluent promptly exits the bay. The College of the Redwoods operates a small sewage treatment plant that discharges indirectly to south Humboldt Bay. Contamination from collection system overflows of raw sewage during high intensity rainfall events is a continued threat to commercial and recreational uses of the Bay.

Storm water runoff from all watersheds draining to the Bay convey indicators of bacterial contamination that impacts shellfish harvest. Seasonal and rainfall-based shellfish harvesting closures are in effect to mitigate the effects of nonpoint source runoff. A shellfish Technical Advisory Committee was established in November of 1995 to address nonpoint source runoff issues.

Implications for Local Government Planning. Land use and development activities that could result in increased sedimentation in the watersheds steams and rivers should be regulated to prevent such discharge. Additionally, these more urban areas are subject to potential impacts of urbanization, including increased stormwater runoff resultant from further subdivision and development for resediential and commercial uses. The following measures should be considered to address such impacts:

- Minimizing agricultural land conversions through the subdivision process.
- Strict adherance to the requirements of the Grading, Erosion Control, and Streamside Management Area Ordinance for ministerial or principally permitted developments.

- Development of standards for stormwater runoff control to be met by new discretionary projects (subdivision, use permits, etc.).
- Development of a model urban runoff program for areas in the County that meet the criteria of Phase II stormwater permitting requirements.

14.6 EEL RIVER WATERSHED MANAGEMENT AREA

Management Area Description

The Eel River Watershed encompasses roughly 3,684 square miles in highly erodable soils in the steep coastal mountains of the NCR, supporting a variety of water uses including municipal and agricultural supply systems, salmonid fisheries, and recreation. Surface water in many areas is intimately connected with the ground water along the nearby alluvial valleys, thereby having a profound effect on local groundwater supplies. The Eel River Watershed is also a prime recreational area boasting numerous state and private campgrounds along its length with both contact and non-contact uses such as boating and swimming. The Eel River is the third largest producer of salmon and steelhead in the State of California and supports a large recreational fishing industry. The erodable soils, steep terrain, and timber production evoke a high level of concern for the anadromous fishery resource. Coho salmon were listed as endangered under the federal Endangered Species Act in 1997.

It is heavily forested and as such, heavily utilized for timber production. Numerous activities occur within the watershed that may result in potential adverse effects to the beneficial uses of the Eel River Watershed. Municipal, agricultural, and recreational uses may be impaired through discharges to surface water bodies from chemical, biological, and sedimentary materials entering the surface water system. A few of the many activities which, if conducted improperly, are likely to impair surface water beneficial uses include: illegal waste disposal, vehicle and railroad maintenance yard operations, herbicide application, gravel extraction, timber harvesting, road building, dairy operations, automotive wrecking yard activities, wood treatment facilities, publicly owned treatment works, and failing septic systems.

RWQCB ASSESSMENT (Humboldt County Portion). In general, the primary issues associated with water quality in the Eel River WMA are focused on the beneficial uses for drinking water supply, recreation, and the salmonid fishery. Since the watershed is located in steep forested terrain with highly erosive soils and high rainfall, erosion and sediment production and transport are high. For most of the watershed the issues of temperature and sedimentation and their impacts on the salmonid fishery are of high concern, involving the timber and rangeland industries. Other issues include ground water contamination, dairies in the delta area near the ocean, and localized contamination of surface and ground waters.

In the town of Garberville there is a gas station with leaking underground tanks and a bulk oil tank that is also leaking. In the surrounding areas private growers have problems with fuel tanks on electrical generators leaking and contaminating soil and possibly surface and ground water. Unical has a Waste Discharge Requirement for sparging ozone. The dam at Benbow may present fish passage problems that will have to be addressed by the Department of Fish and Game. At Humboldt Redwoods State Park near Weott there has been considerable restoration work done, especially in Bull Creek. The California Department of Transportation is also involved in restoration, erosion control and runoff projects in this area. The area along Highway 36 has soil stability problems and there is concern about the small communities along the highway that may have waste disposal problems.

Figure 14-4: Eel River WMA

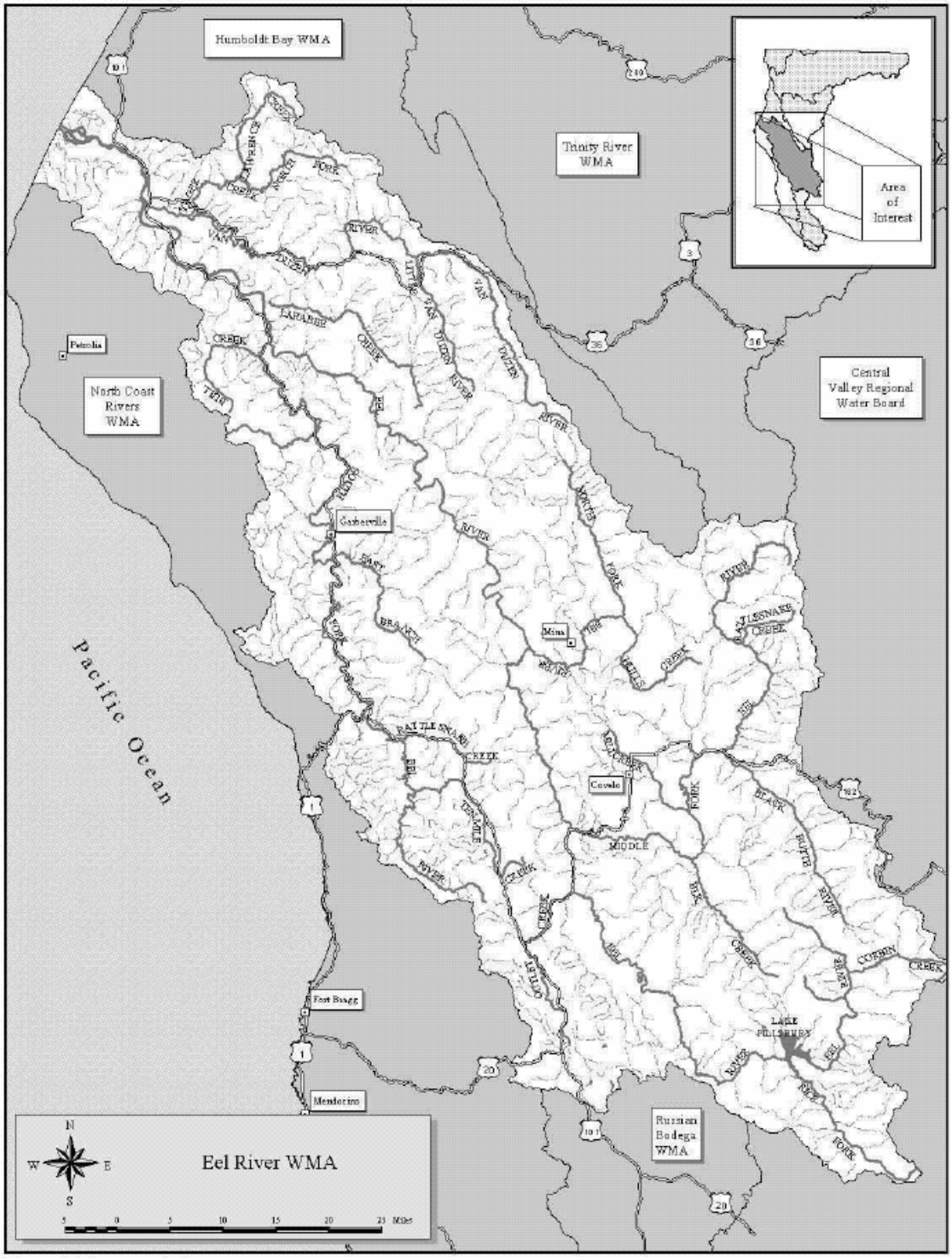


Figure 2.5.1. Eel River WMA

In the lower Eel River area, the town of Scotia has a municipal runoff problem and Pacific LumberCompany has a permitted ash dump where Regional Water Board staff is currently takingenforcement action. There are also upland and in-stream quarries near Scotia that need investigation.

At Rio Dell there are discharge problems from the municipal treatment plant in the summer and a sludge disposal problem. Eel River Saw Mill, which is being sold, has a NPDES storm water permit. The towns of Scotia, Ferndale, and Rio Dell will get Phase II NPDES storm water permits. At the town of Redcrest there is an underground tank that is leaking MTBE to the river and a failing onsite disposal system that needs investigation. In the Ferndale and Fortuna areas there are about 85 dairies many with manure management problems and some where cows have direct access to streambanks. Pacific Lumber Company (PALCO) is harvesting heavily, above quantities in the Sustained Yield Plan, in the lower Eel River and Van Duzen River watersheds including Bear, Stitz and Jordan Creeks. PALCO is currently conducting a watershed analysis in this area and there is extensive Regional Water Board oversight. However, since harvesting is so heavy the Regional Board will be issuing an enforcement order to stop harvesting in Bear Creek. There is also cattle grazing on PALCO land and many roads that are poorly maintained and are contributing sediment to local creeks which are aggrading and causing flooding and domestic water supply problems. The Regional Water Board is conducting a watershed analysis in the lower Eel River area and conducting effectiveness monitoring downstream of where PALCO has installed BMPs.

Implications for Local Government Planning. Land use and development activities that could result in increased sedimentation in the watersheds steams and rivers should be regulated to prevent such discharge. This can be accomplished through the following measures:

- Minimizing agricultural land conversions through the subdivision process.
- Strict adherance to the requirements of the Grading, Erosion Control, and Streamside Management Area Ordinance for ministerial or principally permitted developments.

14.7 TRINITY RIVER WATERSHED MANAGEMENT AREA

Management Area Description

The Trinity River, a wild and scenic river located in northwestern California, is the largest tributary to the Klamath River. Its basin drains an area of about 2900 square miles of mountainous terrain, with its headwater streams originating in the Klamath and Coast Ranges. From its headwaters, the river flows 172 miles south and west through Trinity County, then north through Humboldt County and the Hoopa Valley and Yurok Indian reservations. The confluence with Klamath River at Weitchpec is about 43 miles upstream from the Pacific Ocean. In the early 1950's two major water-development features: Lewiston Dam and its reservoir and related facilities and Trinity Dam and its reservoir, known as Trinity Lake, which are jointly known as the Trinity River Division of the Bureau of Reclamation's Central Valley Project (CVP) were installed above River-Mile 112 and the community of Lewiston. Water stored and released from the Trinity Dam reservoir is used for power-generation and diverted to out-of-Basin multiple uses throughout the Central Valley of California.

Lewiston Dam is, since installation of the Trinity River Division (TRD) works, the uppermost limit of natural salmon and steelhead fish-migration. A fish hatchery and rearing facilities were constructed and operate, as part of the TRD, to mitigate for the loss of upstream habitat. Trinity Lake has been stocked with a variety of non-native fish, including warmwater, Smallmouth and Largemouth bass and Kokanee (landlocked Sockeye salmon). Trinity River downstream of TRD is habitat for not only the anadromous salmonids and other native species, but also has populations of Brown trout. The public lands that adjoin the TRD facilities are managed for multiple uses as part of the Whiskeytown-Shasta-Trinity National Recreation Area; those in upper portions of the basin are managed as components of the US Shasta-Trinity and Six Rivers National Forests. Private timberlands, ranches and residential properties are mostly near the Highway 3-Highway 299 corridors in the southeastern part of the basin. The Hoopa Valley Reservation occupies about 170 square miles on both sides of the lowest 15 miles of the river.

This WMA is mostly rural with human population centered near Trinity Center, Weaverville, Lewiston, Hayfork and Hyampom. The only large-scale agriculture is cattle grazing. Timber harvest continues but at a much reduced level than in the past on Federal lands. However, the intensity and scope of logging appears to be increasing in private lands. Toxicity concerns center around acid mine drainage (AMD) from abandoned mines and past mining activities, sediment release from subdivision development and eroded roads in areas with unstable soil and decomposed granite (DG), septic tank use, aboveground and underground tanks, and lumber mills. The U.S. Forest Service and the Bureau of Land Management federally manage approximately 80 percent of the land in the Trinity WMA. Of the remaining 20 percent of the basin, which is privately owned, approximately half are industrial timberlands. Old existing access roads that are not maintained or properly decommissioned are a continual source of sedimentation into the Trinity River and its tributaries. Tourism including rafting, especially on the lakes, is part of the economy of this area.

RWQCB Assessment - Lower Trinity/Humboldt Section. This portion of the Trinity River is designated as a wild and scenic river. This area has experienced hydraulic mining in the past. Current mine practices consist of small placer sluicing and hard rock milling operations. An assessment of abandoned mines, past and present mining activities needs to be conducted. A formal inventory needs to be compiled with exploratory site information on the disposition of acid mine drainage, sedimentation, waste handling and remediation as appropriate, to meet long-term water quality standards.

The Hoopa Tribe's governing body, The Hoopa Valley Tribal Council, has been recognized by the United States with sovereignty similar to that of a State. One element of that sovereignty is the Tribe's authority and duty to administer the Clean Water Act (CWA) within its reservation's borders. Trinity River flows across the southern border of the Tribal land and remains within the Tribe's jurisdiction until the confluence with Klamath River. The Tribe has prepared and adopted its CWA-based Water Quality Management Plan and submitted it to US EPA for review and approval. The tribe conducts timber harvesting without state or federal oversight. Logging in the Lower Trinity by private industry is moderate.

The North Coastal Watershed Assessment Program (NCWAP) is currently scheduled to focus on watershed assessment in the WMA in FY 2001-02. That program will gather existing data and collect new data on private and state lands in the WMA. The final product will be an interactive computerized format including the data and watershed assessment.

Figure 14-5: Trinity River WMA

Figure 2.6.1. Trinity River WMA

National Marine Fisheries Service (NMFS)

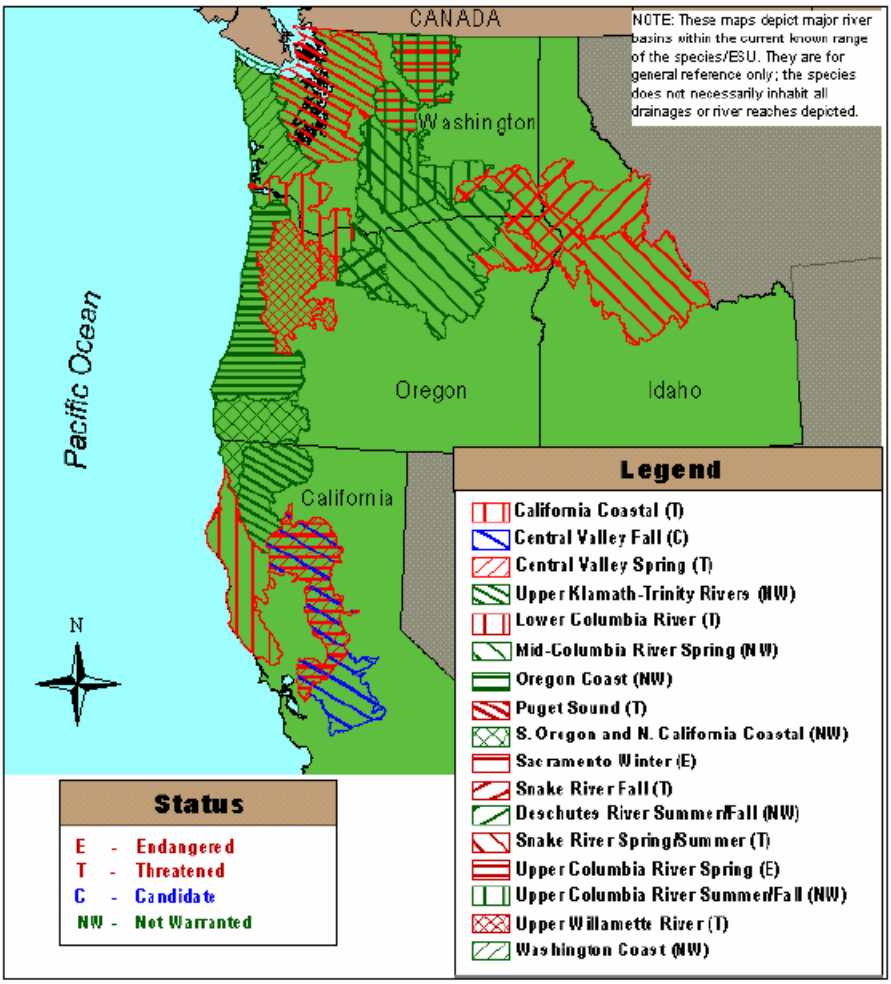
Ryder[7] proposed the evolutionarily significant unit (ESU)* as the minimal unit of conservation management. It is an attractive idea because it avoids problems associated with species definitions -- or at least it seems to. An ESU is simply

- a set of populations that is morphologically and genetically distinct from other similar populations or
- a set of populations with a distinct evolutionary history.

This captures the idea that in most groups of plants and animals there are "units" of some sort above the level of individuals and populations that are worthy of concern. NMFS has used this concept in designation of the status of salmon stocks in the Pacific Northwest. Following are the salmonid ESU listings within portions of Humboldt County.

Figure 14-6: Steelhead Listing Status Map

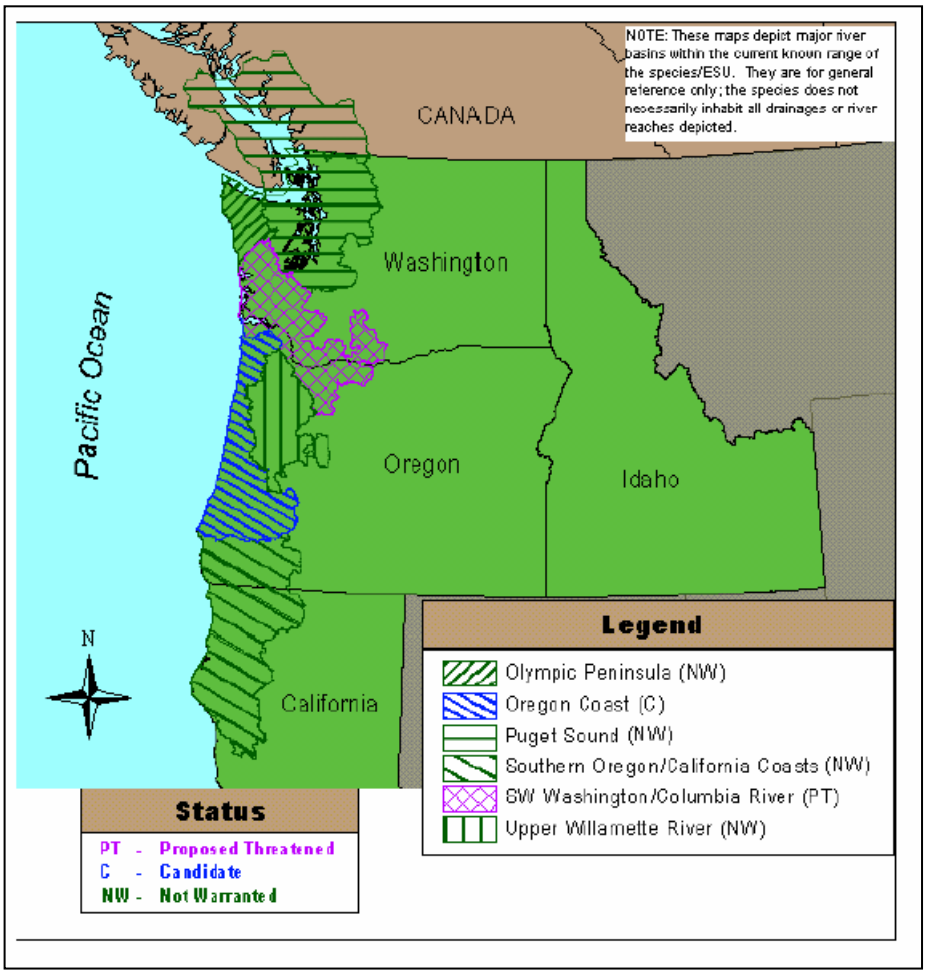
** An Evolutionarily Significant Unit or "ESU" is a distinctive group of Pacific salmon or steelhead.*



[7] O. A. Ryder. Species conservation and systematics: the dilemma of subspecies. Trends in Ecology Evolution, 1:9-10, 1986.

Figure 14-7: Trout Listing Status Map

COASTAL CUTTHROAT TROUT* *Oncorhynchus clarki clarki*
CUTTHROAT LISTING STATUS MAP
*U.S. Fish and Wildlife Service now has jurisdiction over Sea-run Cutthroat Trout.



California Coasts Cutthroat Trout ESU listing not warranted.

The ESUs of salmon stocks are not strictly related to watersheds, but may encompass all or parts of several watersheds where a particular species stock may be found or is known to have occupied.

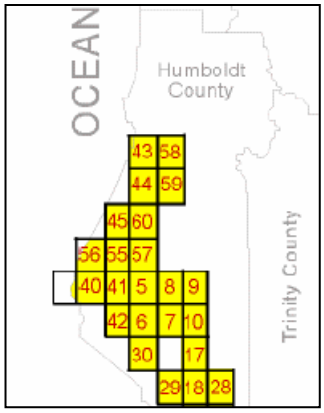
Waterhsed approaches to address listed stocks of salmonids are inherent in the Watershed Management Initiative approach of the Regional Water Quality Control Board, as fisheries represents one of the beneficial uses which water quality plannning efforts are geared to protect. Consequently, management measures and recommendations included in the RWQCB discussion above are appropriate for addressing local government land use and planning issues relevant to listed salmonids. Additionally, these salmon species are included in the California Natural Diversity Database and as such would be addressed as appropriate for individual discretionary project reviews and CEQA analyses.

California Department of Conservation and California Department of Forestry and Fire Protection

During the early 1980s, under the provisions of Section 208 of the Federal Water Pollution Control Act, the Environmental Protection Agency (EPA) funded a number of water protection projects that involved the geologic mapping of sensitive watersheds along California's north coast. Since then, the California Department of Conservation, Division of Mines and Geology (DMG) has been contracted by the California Department of Forestry and Fire Protection (CDF) to produce maps for parts of Mendocino, Humboldt, and Del Norte counties, and other selected watersheds throughout the state

The long-range goals of the watersheds mapping projects are: 1) to retain productive forest soils, reduce sedimentation of north coast streams, and protect fish habitat; 2) to provide planning guides for timber harvesting and other forest management activities; 3) to comply with the Clean Water Goals of the Federal Water Pollution Control Act; and 4) to achieve the objectives in the state's water quality control plans and other forest practice rules.
The maps provide information on the geology and geomorphic features affecting landslides for each of the watersheds studied. Physical characteristics that can be correlated to landslide potential, soil erosion potential and streambank erosion potential were mapped at a scale of 1:24,000. Sixty 7.5-minute quadrangles were completed by DMG between 1981 and 1985. Additional mapping in selected watersheds identified by CDF includes interpretative evaluations of relative slope stability for long-term planning purposes (see DMG Note 40).

Approximately half of the County has been mapped in this way, including the more populated areas of the County:

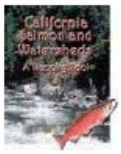


The maps are currently available at www.consrv.ca.gov/dmg/ws/, and will be used as appropriate in the general plan assessment of geological hazards.

The California Department of Forestry and Fire Protection has additionally identified a watershed approach as important for planning purposes, particularly with regards sensitive species (http://frap.cdf.ca.gov/publications/california_watersheds.html).

That agency has further implemented a GIS based salmon and watershed mapping tool available on the internet (http://frap.cdf.ca.gov/projects/esu/esumapframes.html) :

Abstract



From July 1, 2000, any timber operator in a planning watershed identified as 'threatened and impaired' must comply with additional regulations designed to provide further protection for anadromous salmonid habitat. The 'Protection for Threatened and Impaired Watersheds, 2000' addition to the California Forest Practice Rules apply only to specific areas of the State. The determination of where the new rules will apply is related to the following definition in the amendments to 'Section 895.1 Definitions':

> *"Watersheds with threatened or impaired values" means any planning watershed where populations of anadromous salmonids that are listed as threatened, endangered, or candidate under the State or Federal Endangered Species Acts with their implementing regulations, are currently present or can be restored.*

A delineation of this area requires 1) the official designation by the National Marine Fisheries Service of the range of the listed or candidate salmonids included in the Code of Federal Regulations (CFR), 2) the CalWater delineation of planning watersheds (roughly 10,000-acre areas), and 3) a determination by the California Department of Fish and Game (CDFG) that the salmonids are currently present or can be restored. In addition to developing a full list of the more than 3,000 planning watersheds covered by the rule, we have developed a tool to allow anyone with access to the Internet to determine whether a specific area would be covered by the rules.

The above ESU Internet Map Server and the Salmon and Watershed Query Tool are designed to allow anyone with a modem and a web browser to easily identify if a specific area is within a threatened or impaired watershed for the purpose of the new Forest Practice Rules. Both tools will return the same information: Watershed identifier, Watershed name, and ESU status. Users needing quick access to this information and those on slower internet connections should use the Salmon and Watersheds Query Tool. This database query tool allows three ways to lookup watershed information: by CalWater ID, by public land survey (township & range) or by searching for watershed names in a particular county. The interface is simple to use and watershed information is returned quickly.

The Salmon and Watershed Mapping Tool uses a map interface to allow browsing geographically. This tool requires a fast internet connection to be useful. Detailed instructions for using the tool are available on the 'Click Here' text of the Map Server page. The mapping system includes the outer boundary of the three listed or candidate salmonid species (coho, chinook, and steelhead) provided by NMFS, the latest CalWater data showing planning watersheds and larger aggregations, as well as county boundaries and 1:100,000 scale topographic maps that should allow landowners or project submitters to identify if their ownership would be covered by the new rules. If a whole planning watershed is above an impassable barrier such as a tall waterfall, it is expected that CDFG would make a determination that the planning watershed could not be restored since salmonids could never travel from the ocean up the waterfall. These modifications will be integrated into the official list and map of "watersheds with threatened or impaired values" over time.

This mapping effort mirrors and is of a less detailed scale as that information to be in other sources identified above or in the California Natural Diversity Database.

California Spatial Information Library

The California Mapping Coordinating Committee (CMCC) is in the process of developing a series of GIS-related web pages to provide information on State government GIS activities, access to statewide GIS data, and links to the larger California GIS community. ***This website and the Spatial Information Library are works in progress.***

Starting July 1, 2001 some of California's physical and cultural geospatial information, formerly distributed by the Teale Data Center, is being distributed to the public by the California Mapping

Coordinating Committee through servers at the California Environmental Resources Evaluation System (CERES) in the Resources Agency and National Aeronautical and Space Agency (NASA) Ames Research Center. In addition, CERES and CMCC are working with *ESRI* to develop an Internet Map Server, linked to the *Geography Network* to provide another browsing and distribution mechanism to the public:
http://gis.ca.gov/meta.epl?data_title=California%20Watersheds%20(Calwater%202.2)&&name=calw22a
LIBRARY : CA LAYER NAME : CALWATER22 COVERAGE NAME : CALW22A COVERAGE

DESCRIPTION: The California Watershed Map (CALWATER version 2.2) is a set of standardized watershed boundaries meeting standardized delineation criteria. The hierarchy of watershed designations consists of six levels of increasing specificity: Hydrologic Region (HR), Hydrologic Unit (HU), Hydrologic Area (HA), Hydrologic Sub-Area (HSA), Super Planning Watershed (SPWS), and Planning Watershed (PWS). The primary purpose of Calwater is the assignment of a single, unique code to a specific watershed polygon. While there are 7022 polygons in the ARC/INFO coverage, there are actually fewer watershed codes. This is due to cases of multiple polygons bearing the same watershed code (Channel Islands, split polygons due to other boundary integration, e.g. ground water basins). Another confusing factor is that not all Hydrologic Units are subdivided into Hydrologic Areas, not all Hydrologic Areas are subdivided into Hydrologic Sub-Areas, and so on. Therefore, a nominal count of watershed codes in Calwater 2.2 is: Hydrologic Regions: 10 Hydrologic Units: 190 Hydrologic Areas: 522 Hydrologic Sub-Areas: 655 Super Planning Watersheds: 1623 Planning Watersheds: 6271 Primary purposes for Calwater 2.2 include but are not limited to mapping, reporting, and statistical analysis of water resources, water supply, water quality, wildlands, agriculture, soils, forests, rangelands, fish habitat, wildlife habitat, cross-referencing state and federal hydrologic unit or watershed codes and names.

CALWATER version 2.2 is the third version of Calwater (after versions 1.2 and 2.0), and is a descendent of the 1:500,000-scale State Water Resources Control Board Basin Plan Maps drawn in the late 1970's. Version 1.2 was completed in 1995 by Tierra Data Systems (Jim Kellog). Linework was captured by overlaying the Basin Plan Maps on 1:24,000-scale USGS quad sheets, redrawing and digitizing lines to match 1:24,000-scale watershed boundaries, and subdividing the 4th level Hydrologic Subareas (HSAs) into 5th level Super Planning Watersheds (SPWS) and 6th level Planning Watersheds (PWS). Version 2.0 called for the removal of the 5th level Super Planning Watersheds and 6th level Planning Watersheds, introduction of the groundwater line around the Central and Salinas valleys, and was subject to an extensive cooperative planning and review effort by the Interagency California Watershed Mapping Committee (ICWMC), which includes the following agencies state and federal agencies with water resources, water quality, soils, forest, watershed, fish, and wildlife habitat responsibilities: California Department of Water Resources (DWR) California Department of Forestry and Fire Protection (CDF) California Department of Fish and Game (DFG) California State Water Resources Control Board (SWRCB) USDA Forest Service (USFS) Pacific Southwest Region (R5) USDA Natural Resources Conservation Service (NRCS) USDI Geologic Survey (USGS) USDI Bureau of Reclamation (USBR) USDI Bureau of Land Management (BLM) US Environmental Protection Agency (USEPA) Region IX Stephen P. Teale Data Center (Teale) These agencies plan to adopt a draft Memorandum of Understanding (MOU) titled "Regarding the Use and Maintenance of the California Watershed Map" (DWR 3/5/97) which has been prepared for the purpose of promoting the use, management, and maintenance of a common watershed map of California. In Calwater version 2.2 the Super Planning and Planning Watersheds were reinstated and verified to properly nest withing the watershed hierarchy. All Super Planning Watershed and any missing Planning Watershed names were populated, and where suitable, watershed boundaries were adjusted to linework provided by the following National Forests: Klamath, Lassen, Mendocino, Shasta, Trinity, and Six Rivers.