SECTION B
SURFACE AND POINT SOURCE EROSION
(Roads/Skid Trails)

INTRODUCTION

The surface and point source erosion module examines the past and present soil erosion from roads and skid trails of the Mendocino Redwood Company (MRC) ownership in the Gualala River watershed, the Gualala River watershed analysis unit (WAU). This module also provides a hazard assessment of the potential for future surface and point source erosion from roads in the Gualala River WAU. The road data that is the basis for this analysis was collected by MRC to give a general indication of erosion from roads and skid trails in the WAU prior to a future 100% road inventory of the Gualala River WAU. When the 100% road inventory is performed in the Gualala WAU it will replace this analysis. The erosion estimates were developed from a combination of field observations and the use of the surface erosion model presented in the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices).

Surface erosion is defined as the removal of soil particles from the surface of the soil. Processes such as rill erosion, sheetwash, biogenic transport (animal burrows, treefall, etc.) and ravel are considered surface erosion. Gullies, road crossing washouts, bank erosion and large erosion features created from overland flow of water are considered point source erosion. In contrast, the largest discrete erosion event, landslides, are considered mass wasting.

This module examines road and skid trail associated surface and point source erosion delivering sediment into watercourses. Excessive levels of fine sediments from surface and point source erosion can get trapped in porous streambed gravels; and can increase water turbidity and suspended sediment concentrations. Excessive coarse sediments from point source erosion can adversely affect stream channel morphology. These can reduce the survival of salmonids or affect habitat needs and physiological characteristics of aquatic organisms. Excessive surface and point source erosion when delivered to a watercourse can also affect other downstream uses such as water supplies, agricultural diversions and recreation users. It is important that best management practices be utilized in forest management operations to minimize the impacts of surface and point source erosion.

ROAD SURFACE AND POINT SOURCE EROSION
Methods

Past, current and potential surface and point source erosion from roads was determined from field observations and a road surface erosion model. The road data presented in this report is based on a sampling of the Gualala River WAU road network. This analysis is to provide a general characterization of past erosion and future risk of erosion prior to a full road inventory. The field observations yielded a 39% sampling of the Gualala River WAU road network.

Field observations were collected to achieve a representative sample of roads by planning watershed, hillslope class and use (mainline or secondary roads). The hillslope classes were: 1) lower slopes, representing the lower 20% of the hillslope between a watercourse and a ridge, 2) mid slopes, representing the middle 20-80% portion of a hillslope between a watercourse and a ridge, and 3) top slopes, representing the upper 20% of the hillslope near the ridge. Roads adjacent to watercourses typically deliver more erosion than upper slope roads making this segregation for field sampling useful.

The field observations comprised of gathering the length of roads that can contribute sediments to a watercourse, road surface type, and vegetative cover on cut- and fill-slopes to aid in surface erosion model calculations. Road surface erosion was not directly measured in the field. The contributing length, the extent of road that delivers erosion to a watercourse, is measured in the field then used for surface erosion calculations. A road prism's contributing length drains water and associated eroded soil into a watercourse. Thus it defines the length of surface erosion of any particular site on the road. The model used to calculate surface erosion from roads is from the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board) with its use described below.

Field observations included past delivered point source erosion volume estimates for road features sampled in the field (watercourse crossings, landings, road fill, etc.). Delivered point source erosion from a road is defined as either gully, bank erosion or extensive rill erosion which was observed to erode directly into a watercourse. Smaller landslides at watercourse crossings, those that are considered undistinguishable from aerial photographs, and road watercourse crossing washouts were also included in the deliverable point source erosion estimates. These measurements were used to calculate the volume of point source erosion delivered from the road. The volume of erosion was converted to a weight (in tons) assuming a soil bulk density of 100-lbs./cubic foot.

Future or potential point source erosion observations were collected for high treatment immediacy sites observed during the road sampling. These were sites that appeared to have an immediate need for maintenance to control potential point source erosion. These high treatment immediacy sites should not be considered an all inclusive list of high priority sites. Rather, it is a documentation of high treatment immediacy sites observed in our sample of field observed roads.

The potential future point source erosion is called controllable erosion; a term developed by the North Coast Regional Water Quality Control Board for Total Maximum Daily Load (TMDL) purposes. Controllable erosion is defined as soil that could potentially deliver to a watercourse in the next 40 years (the duration of a TMDL), is human created, and can be reasonably controlled by human actions. Typically controllable erosion is a measure of the fill material from a road that could erode if a road feature is not maintained or fails in the next 40 years. Controllable erosion can include bank erosion, gully and road washouts. The controllable erosion amount is the volume of soil that can be controlled with high design standards for a road feature (i.e. watercourse crossing, side-cast fill, etc.).

Surface erosion from the road surface is influenced by the amount of road traffic (high use mainline, moderate use active secondary, etc.), the type of road surface material, precipitation, width and size of road (the more surface area to erode the more erosion), and vegetative cover (Reid, 1981). Field observations determined the length of a sampled road delivering sediment to a watercourse (contributing length), the road surface material, the percentage of vegetative cover on the cut and fill slopes, and the type of road (mainline or secondary) to aid in the surface erosion calculations. None of the roads within the Gualala WAU has sufficient traffic to be considered a mainline road with heavy traffic. If a landing area was considered to deliver sediment to a watercourse, the dimensions were included in the surface erosion calculations. Typically culverts that drain an inside ditch of a road (cross-drain culverts) put the water and eroded soil on a hillslope and do not deliver to a watercourse. The exception to this is when the cross drain culvert is in close proximity to a watercourse. Near stream cross-drain culverts were included in the surface erosion calculations.

The Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board) provides relationships based on the factors to estimate the amount of surface erosion from different road types and conditions. For a complete description of all of the parameters used in calculating surface erosion from roads see the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board).

The following parameters were used to calculate surface erosion from roads in the Gualala River WAU. All of the observed roads were assumed to have a base erosion rate of 60 tons/acre/year. This initial value was modified to represent the local road segment by using field-gathered observations and applying them to a factor in the surface erosion calculations. The factors include traffic intensity, cut- and fill-slope vegetation cover, road surface type, annual precipitation and road type. The resulting equation attempts to model the actual sediment volume contributed by a given road segment. The road tread width was assumed to be 16 feet and 40% of the road prism. The cut- and fill-slopes were assumed to comprise the remaining 60% of the road prism; their dimensions for the surface erosion model were determined by multiplying the tread width by 1.5.

In order to more accurately represent the road conditions considerations were made when applying factors to the surface erosion calculations. The majority of hauling on roads occurs during drier times of the year (i.e. late spring, summer and early fall). Therefore the lowest annual precipitation category is used (<47 in. precipitation annually). Landing areas have a factor of 0.1; these areas receive moderate to high usage only 1-2 times per every 1-2 decades with little to no use in between. A road with at least a 6-inch rocked surface is given a 0.2 factor, a 3 to 6-inch rocked surface is given a 0.5 factor, while a native surface road has a factor of 1. In the rare occurrence of estimating a paved road surface, a 0.03 factor was used.

The following 3 traffic factors used in surface erosion modeling in the Gualala WAU:

1) *Mainline roads with moderate traffic* have a factor of 2; these roads are used for log haul traffic 2-3 times each decade.
2) *Seasonal roads* have a traffic factor of 1.2; these are tributary roads which receive moderate log haul traffic 1-2 years each decade and light traffic the remainder of the time.
3) *Temporary roads* receive a traffic factor of 0.61; these roads receive moderate log haul traffic 1-2 times per every 1-2 decades with little to no use in between.

The results of the surface erosion modeling is added to the total past point source erosion observed during the road inventory from a given road and presented as tons/year of sediment delivery (see Appendix B for erosion estimates of sampled roads in the Gualala River WAU). To arrive at an estimate of sediment delivery for the roads not observed in the field we extrapolated data from the field observed roads. The non-field observed roads had the lengths summed into hillslope classes of low, middle and top slope roads within each planning watershed boundary. The contributing proportion of road, by hillslope class, as determined from field observations was used to estimate the length of road contributing sediment from roads not observed in the field. The surface erosion for the non-field checked roads was estimated by using the average contributing road length, a traffic factor and a road surface that approximated the same types of road observed in the field. An estimate of point source erosion for the non-field observed roads was calculated by extrapolating the amount of point source erosion by road length and hillslope class to the non-field observed roads.

To calculate relative sediment contributions by planning watershed the road sediment delivery estimates were totaled by planning watershed and normalized by dividing by the MRC ownership, in square miles, for the planning watershed. The result is an estimate of road surface and point source erosion in tons/square mile/year in the Gualala River WAU.

From the estimated sediment delivery information the roads in the Gualala River WAU are assigned an erosion hazard class. The erosion hazard class is used to classify the roads in the Gualala River WAU by their current and potential erosion hazard. The erosion hazard class was determined by the amount of erosion a road produced and the likelihood for that erosion to be delivered to a watercourse. High levels of traffic, road surface, proximity to the stream, high past point source erosion, and high modeled surface erosion all were considered when ranking roads for their erosion hazard. The roads with the highest risk of sediment delivery and soil erosion were given a high erosion hazard classification. The roads with medium risk of sediment delivery and soil erosion were given a moderate erosion hazard classification. The roads with the lowest risk of sediment delivery and soil erosion were given a low erosion hazard classification. A description of each erosion hazard classification can be found in the Results and Discussion sub-section of this Surface and Point source Erosion report.

ROAD SURFACE AND POINT SOURCE EROSION
Results and Discussion

Roads within MRC's ownership of the Gualala River WAU are estimated to generate, on average, 400 tons/mi^2/yr of sediment from road-associated surface and point source erosion (Table B-1). Tobacco Creek and Annapolis planning watersheds are estimated to yield 2800 and 900 tons/year of sediment, respectively; the highest amounts of sediment delivery in the Gualala River WAU. When normalized by area Tobacco Creek and Flat Ridge Creek contribute the highest rate of sediment delivery, 800 and 500 tons/mi^2/yr respectively. The Annapolis planning watershed has a sediment delivery rate of 200 tons/mi^2/yr.

Point source erosion was found to be a significant factor for the erosion rates in planning watersheds. The highest proportion of point source erosion comes from the Tobacco Creek planning watershed at 600 tons/mi^2/yr (Table B-1).

It must be noted that an observation of road point source erosion at one point in time does not accurately reflect the characteristics of the road over time. For example, a culvert or road erosion site may have failed several times over its life, but it is not possible to determine that from current observations. Therefore the sediment yield from point source erosion is only an estimate, that should be carefully interpreted.

Table B-1. Road Associated Surface and Point Source Erosion Estimates by Planning Watershed for the Gualala River WAU (rounded to nearest 100 tons).

Planning Watershed	**Total Road Assoc. Erosion (tons/yr)**	**MRC Owned Acres**	**Road Assoc. Erosion Rate ($tons/mi^2/yr$)**	**Surface Erosion Rate ($tons/mi^2/yr$)**	**Point source Erosion Rate ($tons/mi^2/yr$)**
Annapolis	900	3154	200	100	100
Flat Ridge Creek	700	883	500	400	100
Haupt Creek	100	614	200	100	100
Tobacco Creek	2800	2335	800	200	600
Doty/Robinson Creeks	500	945	300	100	300
Gualala River WAU totals	**5000**	**7931**	**400**	**200**	**200**

A road segment's slope class is an influential parameter of the surface and point source erosion amounts that are delivered to a watercourse. Though the Gualala River WAU's low sloped roads constitute only 32% of all contributing road area (Table B-2), they makeup only 21% of the total road length in the watershed bloc. The mid and top sloped roads compromise 46% and 22% of all contributing road area, respectively. For total road length the mid and top sloped roads represent 47% and 31%, respectively. Comparing the tons/yr. in slope class with the total lengths yields the low sloped roads delivering 0.016 tons/yr/ft, the mid slope 0.010 tons/yr/ft and the top slope 0.009 tons/yr/ft. With 92% of all contributing road area coming from the low sloped roads, the Flat Ridge Creek planning watershed has the greatest percentage of low slope roads delivering. The highest sediment rate, by foot of road, is in the lowest slope class however the highest amount of sediment is coming from mid-slope roads (Table B-3). This is from the higher number of roads within this slope class.

Table B-2. Contributing Road Area and Proportions Estimates by Slope Class for Planning Watersheds of Gualala River WAU.

Planning Watershed	Contributing Road Area (acres) Low-Slope	Percent Low-Slope	Contributing Road Area (acres) Mid-Slope	Percent Mid-Slope	Contributing Road Area (acres) Top-Slope	Percent Top-Slope
Annapolis	1.3	28%	2.6	54%	0.8	17%
Flat Ridge Creek	2.3	92%	0.2	7%	0.0	1%
Haupt Creek	0.0	3%	0.2	61%	0.2	36%
Tobacco Creek	1.0	32%	1.4	46%	0.7	22%
Doty/ Robinson Creeks	0.0	2%	0.3	64%	0.2	34%
Gualala River WAU	**4.7**	**32%**	**4.7**	**46%**	**1.8**	**22%**

Table B-3. Surface and Point Source Erosion Estimates by Slope Class for Planning Watersheds of Gualala River WAU.

Planning Watershed	**Tons/yr**		
	low	mid	high
Annapolis	250	450	200
Flat Ridge Creek	550	100	50
Haupt Creek	<50	50	50
Tobacco Creek	600	1300	900
Doty/ Robinson Creeks	100	200	150
Gualala River WAU	**1500**	**2100**	**1350**

The erosion rate, though only an estimate, provides a good indicator of where road associated surface and point source erosion issues are currently occurring. However, the timing and amount of road use affects the amount of erosion estimated from a road. If the assumptions on the timing or amount of road used change, the erosion rate estimates may lose their reliability as an indicator of problem areas. Another indicator that can help in interpreting a potential road associated surface or point source erosion risk of sediment delivery is the amount and density of road, and the amount of road that contributes erosion to a watercourse (contributing area). The road density and road surface area totals are presented for each planning watershed in Table B-4 for the Gualala River WAU.

Road length, road surface area and contributing road area are highest in the Annapolis planning watershed (Table B-4). Compared to Annapolis, the total amount of contributing road area is lower in the Flat Ridge Creek planning watershed, but proportionately Flat Ridge contributes a greater percent of road area on MRC land in the watershed. It should be a goal to lower the contributing road area in the Gualala River WAU particularly in the Flat Ridge Creek, Annapolis and Tobacco Creek planning watersheds, where the greatest proportions of contributing road area exists.

Table B-4. Road Surface Areas, Contributing Road Surface Areas, Road Lengths and Road Densities for the Gualala River WAU.

Planning Watershed	**Road Surface Area (ac)**	**Road Contributing Area (ac)**	**Road Contributing Area/MRC Owned (%)**	**Road Length (miles)**	**Road Density (mi/sq mi)**
Annapolis	90.3	4.7	0.15	46.6	9.4
Flat Ridge Creek	20.5	2.5	0.28	10.6	7.7
Haupt Creek	20.6	0.4	0.07	10.6	11.1
Tobacco Creek	46.9	3.1	0.13	24.2	6.6
Doty/ Robinson Creeks	13.1	0.4	0.04	6.8	4.6
Gualala River WAU Total	***191.5***	***11.1***	***0.14***	***98.7***	***8.0***

The road erosion hazard classification for each sampled road in the Gualala River WAU is presented on Map B-1 and for each individual road in the appendix of this module. The categorizing of roads into hazard classes is intended to identify current problem areas, consider reconstruction and prioritize maintenance. The following are the definitions for each road erosion hazard class.

High Road Erosion Hazard Class - These roads have the highest amount of recent deliverable surface erosion to watercourses and a high potential for future deliverable erosion. These roads can be active, abandoned or closed. Often roads in this class are close to watercourses creating a high sediment delivery potential. Erosion is typically due to long contributing road lengths or native surfaces near watercourses: a result of too few waterbars and/or rolling dips or lack of rock surface. Erosion may also be a product of problem areas such as watercrossing wash-outs, poor road drainage, plugged road watercrossings, water diverted down the road surface, culverts not fitted with downspouts, etc. Active roads in this class should get the highest priority for maintenance or improvements. Closed roads in this class will need improvements before opening again. Opening abandoned roads in this class should be avoided.

Moderate Road Erosion Hazard Class - These roads have moderate amounts of recent deliverable surface erosion to watercourses and potential for future deliverable erosion. These roads can be active, abandoned or closed. Erosion problems on roads in this class can usually be handled with good road maintenance. Erosion is typically from problem areas such as poor road drainage, water diverted down the road surface, culverts not fitted with downspouts, and an occasional plugged culvert or watercourse crossing wash-out. Active roads in this class should be a priority for maintenance. Closed or abandoned roads in this class will need some improvements before opening again.

Low Road Erosion Hazard Class - These roads have low amounts of recent deliverable surface erosion to watercourses and low potential for future deliverable erosion. These roads can be active, abandoned or closed. Active roads in this class do not need to be a priority for maintenance. Closed or abandoned roads in this class will need only some improvements before opening again.

A few high treatment immediacy point source erosion sites were identified in the Gualala River WAU. The road site numbers and road numbers are found on Map B-1. The road number, site number, amount controllable erosion and description of the site are in Table B-5.

Table B-5. Select High Treatment Immediacy Road Sites within the Gualala Watershed Analysis Unit.

Site ID#	**Planning Watershed**	**Controllable Erosion (yd^3)**	**Description**
SA-1	Annapolis	110	Culvert failing
SA-2	Annapolis	20	Gully erosion
SA-3	Annapolis	390	Shotgun culvert creating erosion
SA-4	Annapolis	90	Gully erosion
SA-6	Annapolis	160	Road associated landslide
ST-1	Tobacco Creek	80	Gully erosion
ST-4	Tobacco Creek	60	Road associated landslide
ST-5	Tobacco Creek	130	Gully erosion
SR-1	Flat Ridge	10	Gully erosion
SR-2	Flat Ridge	60	Culvert plugged
SR-3	Flat Ridge	10	Gully erosion

SKID TRAIL SURFACE AND POINT SOURCE EROSION
Methods

Skid trail sediment delivery from surface and point source erosion was determined from aerial photograph interpretation and sediment delivery estimates developed in previous MRC watershed analysis reports (MRC, 1998 and MRC, 2000). Aerial photographs from 1961, 1971, 1980, 1990 and 2000 were used to identify skid trail activity. The aerial photographs were taken at an altitude that yielded 1:62,500, 1:24,000, 1:24,000, 1:41,760 and 1:13,000 scales, respectively. The 1961, 1971, 1980 and 1990 aerial photographs were checked out at the Sonoma County Assessor's Office in Santa Rosa. The 2000 aerial photographs are from Mendocino Redwood Company's collection.

The aerial photograph interpretation for skid trail activity consisted of determining the area by density of skid trails (high, moderate, low) for each photo year. Light skid trail density has less than 50 watercourse crossings per square mile or were trails with significant re-vegetation observed in the aerial photograph. Moderate-density skid trail activity is defined as having between 50-100 watercourse crossings per square mile. High-density skid trail activity is defined as having greater than 100 watercourse crossings per square mile.

The amount of sediment delivery from the various densities of skid trail activity was estimated from sediment delivery rates estimated during previous watershed analysis by MRC (L-P, 1998 and MRC, 2000). A combination of surface erosion modeling and field observations of point source erosion from skid trails were used to develop the skid trail estimates. High skid trail density is estimated to contribute 300 tons/square mile/year of sediment. Moderate skid trail density is estimated to contribute 200 tons/square mile/year of sediment, while low skid trail density contributes 50 tons/square mile/year.

For each photo year the area in each skid trail density category was multiplied by the sediment delivery rate for that density. The estimated rate was then assumed to represent the decade previous to the photo year observed (i.e. 1961 photo represent activity in the 1950s).

In the case where aerial photographs were missing from a collection, we extrapolated the calculated delivery rates within the same planning watershed to the missing area. For the Gualala watershed, this occurred with the 1961 aerial photographs. The 1961 aerial photograph collection was missing approximately 600 acres from a 6986-acre total area.

SKID TRAIL SURFACE AND POINT SOURCE EROSION
Results and Discussion

The skid trail sediment delivery estimate results, by time period, are summarized in Table B-6 and Figure B-1. The estimates should be considered a minimum sediment delivery for skid trails constructed and used in the decade. Undoubtedly, some if not many, sediment delivering skid trails were vegetated enough to be overlooked during the inventory. In particular are those trails constructed or used greater than five years prior to aerial photograph reconnaissance and may not have been observed.

In the Gualala WAU the portion that was harvested using tractor based yarding during the 1950s and 1960s produced a high level of sediment delivery. This high impact skid trail construction and usage brought high sediment delivery rates on those particular acres. The sediment delivery estimated from skid trails in Annapolis, Tobacco Creek and Haupt Creek is by far the highest in the 1950s (Figure B-1). Flat Ridge Creek had fairly high levels of sediment delivery during the

1950s, 1970s and 1980s. After a 600 acre parcel of Haupt Creek was harvested in the 1950s, sediment delivery rates dropped dramatically in the remaining decades. Of all four planning watersheds, Annapolis generally had the greatest sediment delivery rates.

In the late 1970s and 1980s a change in skid trail design likewise changed sediment delivery rates. The Herringbone design abandoned the low-slope trail designs of earlier times and placed the trails along ridges and branched out down the slopes. This produced a significant drop in skid trail watercrossings. The Herringbone pattern affected the designation of low, moderate and high skid trail usage in the Gualala WAU.

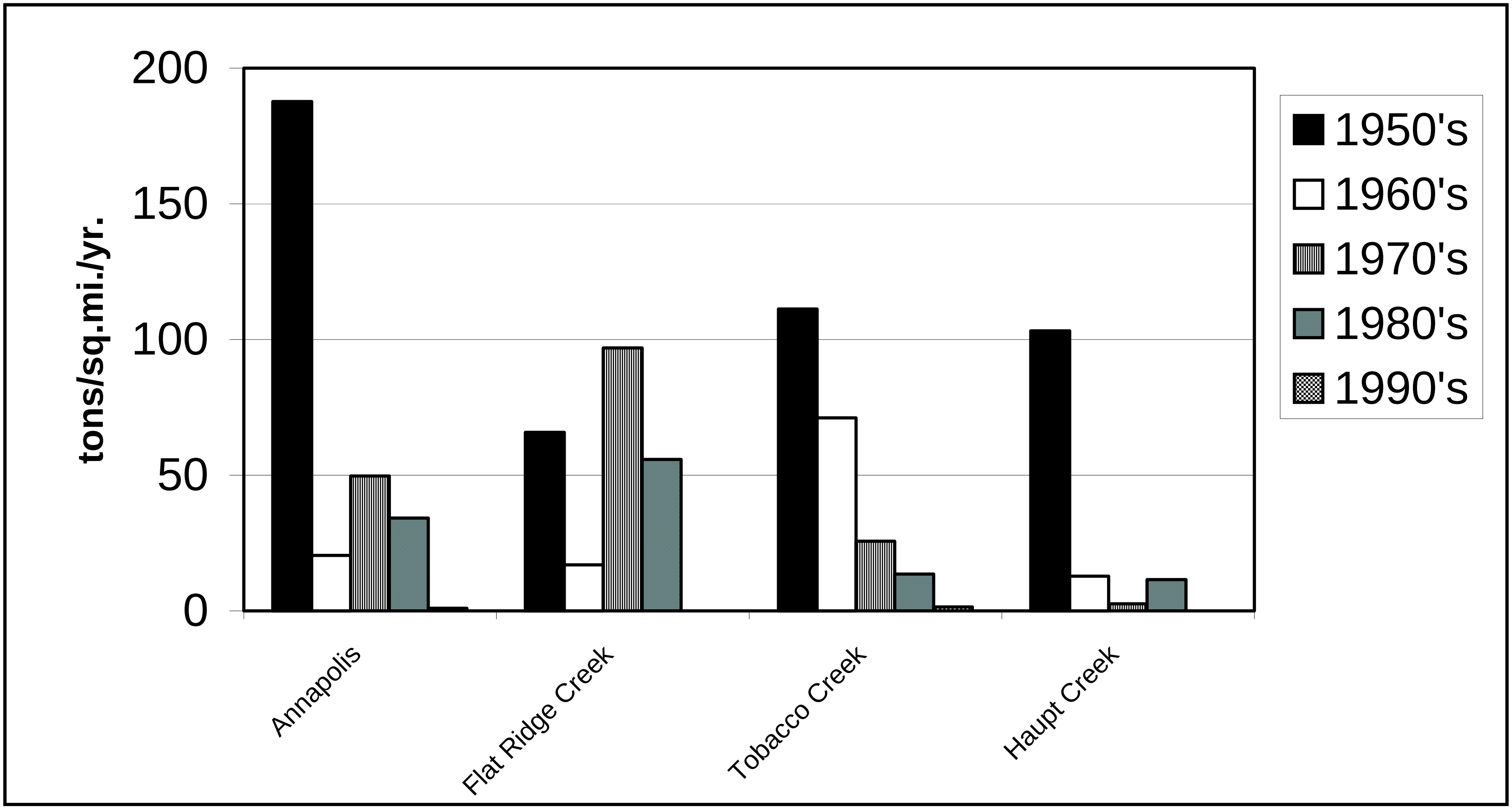
In the 1990s skid trail sediment delivery rates diminished in all watersheds. This is a result of a combination of less harvest activity and stricter regulations on tractor based yarding. Future skid trail sediment delivery rates will be lower than past rates because California Forest Practice Rules and MRC policy mandate improved tractor yarding activities. Better erosion control measures are used on skid trails such as increased water bar spacing and a practice by MRC of packing the trails with logging debris (slash), when available, after operations to prevent surface erosion. Furthermore, skid trail operation is limited next to watercourses and prohibited directly in watercourses, practices that were common up through the 1970's.

Table B-6. Skid Trail Use and Sediment Delivery Estimates for Gualala WAU by Decade.

	1950s		1960s		1970s		1980s		1990s		1950s-1990s
	Skid Trail Use Area (acres)	Sediment Delivery (t/mi²/yr)	Skid Trail Use Area (acres)	Sediment Delivery (t/mi²/yr)	Skid Trail Use Area (acres)	Sediment Delivery (t/mi²/yr)	Skid Trail Use Area (acres)	Sediment Delivery (t/mi²/yr)	Skid Trail Use Area (acres)	Sediment Delivery (t/mi²/yr)	Avg. Sediment Delivery (t/mi²/yr)
Annapolis	2189	188	762	20	956	50	568	34	64	1	59
Flat Ridge Crk.	360	66	299	17	428	97	489	56	0	0	47
Tobacco Crk.	1399	111	932	71	658	26	638	14	71	2	45
Haupt Crk.	317	103	158	13	32	3	142	12	0	0	26

Gualala River Total Tons/Sq.Mi./Yr.
(1950s – 1990s) = 50

Figure B-1. Estimated Skid Trail Sediment Delivery Rate by Watershed and Decade for the Gualala WAU.



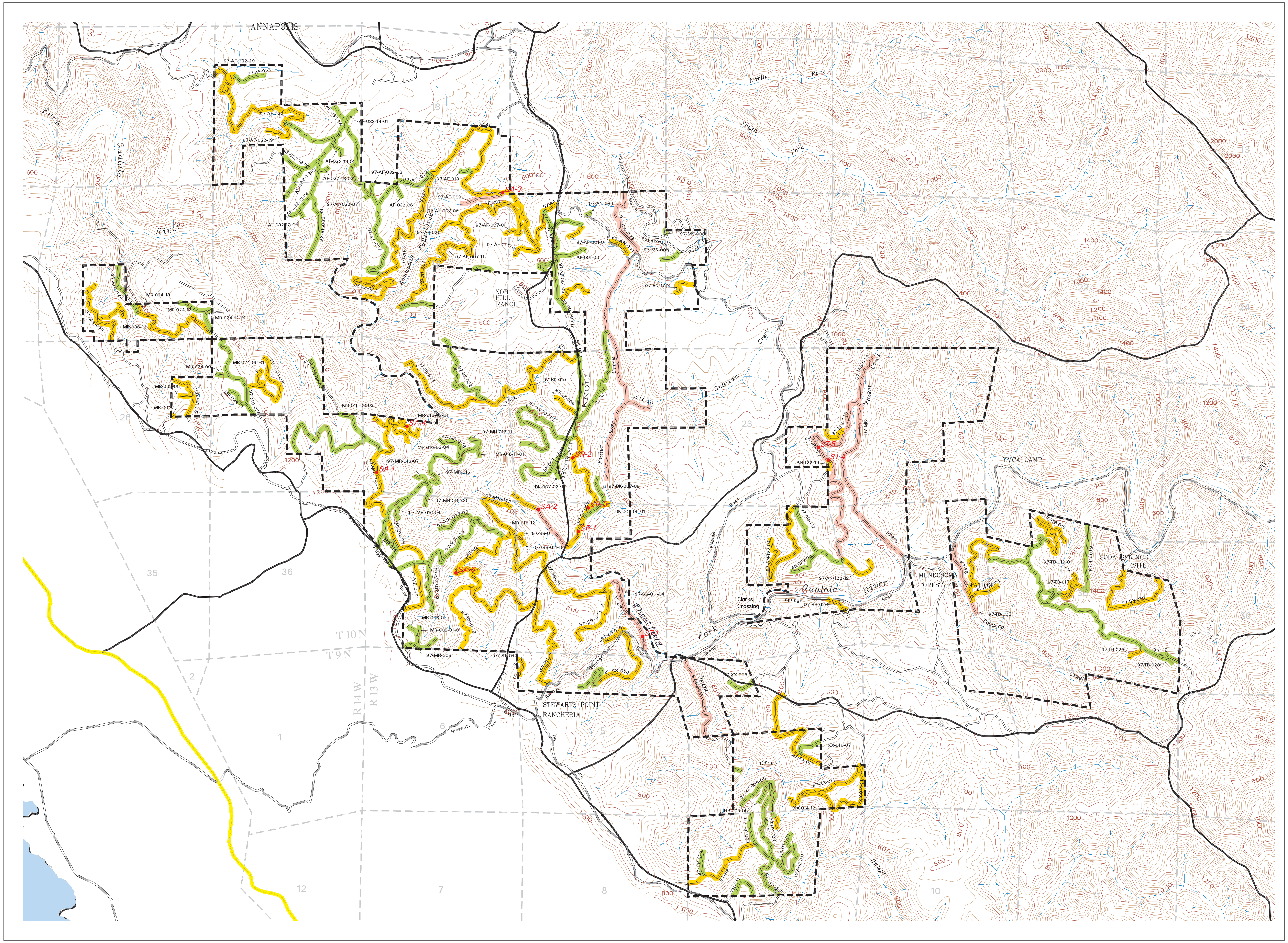
Literature Cited

Louisiana-Pacific Corporation. 1998. Garcia River watershed analysis. Internal report, Fort Bragg, CA.

Mendocino Redwood Company. 2000. Noyo River watershed analysis. Internal report, Fort Bragg, CA.

Reid, Leslie M. 1981. Sediment production from gravel-surfaced forest roads, Clearwater Basin, Washingtion. M.S. Thesis, University of Washington. 247 pp.

Washington Forest Practice Board. 1995. Standard methodology for conducting watershed analysis. Version 4.0. WA-DNR Seattle, WA.



Gualala River Watershed Analysis Unit

Map B-1 Road Erosion Hazard Classifications

This map presents an erosion hazard rating for the MRC roads and some select high treatment immediacy sites. High erosion hazard roads have the highest amount of recent deliverable surface erosion to watercourses and a high potential for future deliverable erosion. Moderate erosion hazard roads have moderate amounts of recent deliverable surface erosion to watercourses and potential for future deliverable erosion. Low Erosion Hazard roads have low amounts of recent deliverable surface erosion to watercourses and low potential for future deliverable erosion.

Erosion Hazard Rating

- Low
- Moderate
- High

- Known High Treatment Sites

Transportation

- Paved Road
- Rocked Road
- Native Road
- Jeep Trail

- MRC Ownership
- Planning Watershed Boundary
- Gualala River Watershed Boundary

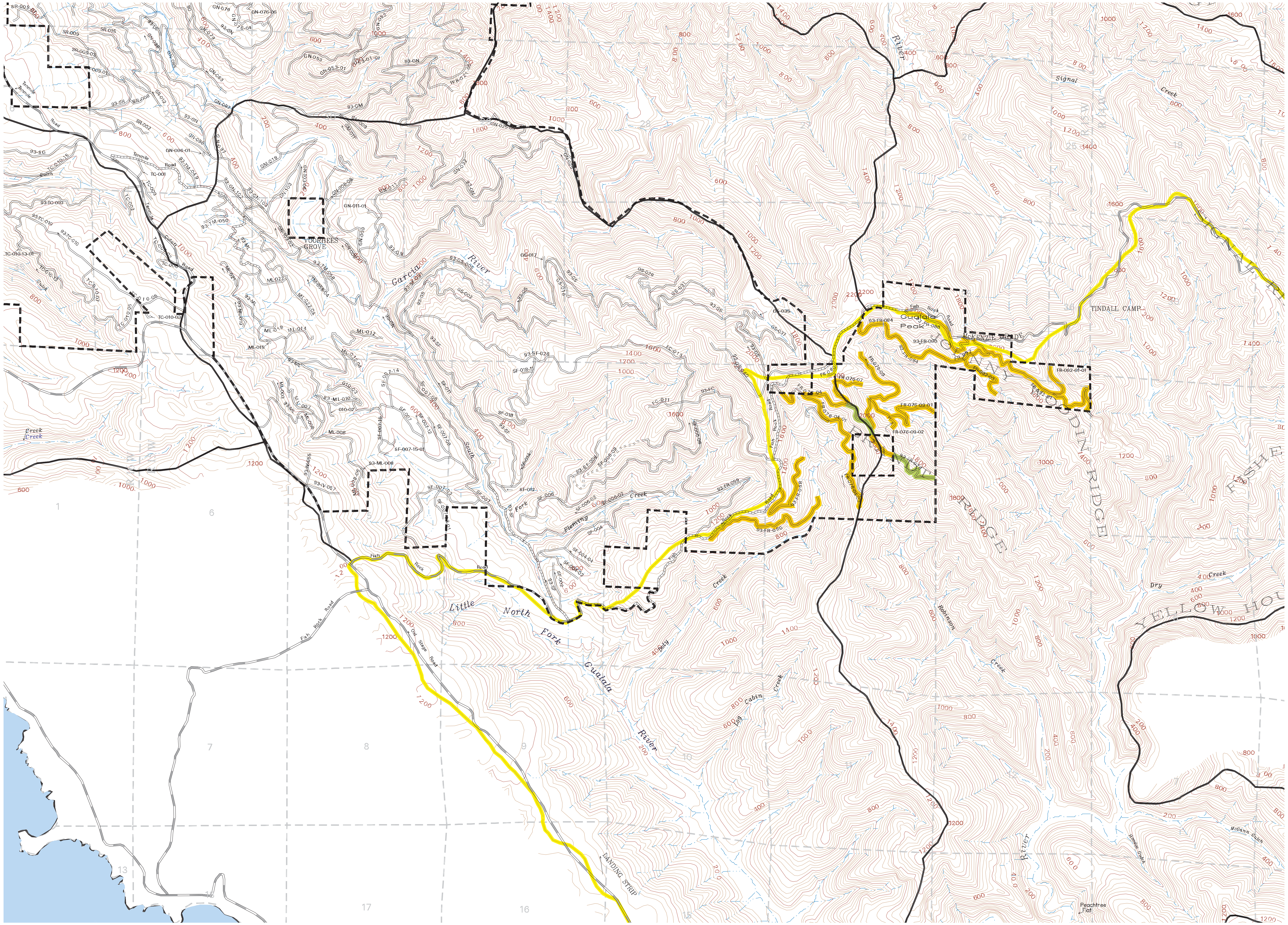
Flow Class

- Class I
- Class II
- Class III

Sheet 1

0 1/2 1 Mile

June 2003



Gualala River Watershed Analysis Unit

Map B-1
Road Erosion Hazard Classifications

This map presents an erosion hazard rating for the MRC roads and some select high treatment immediacy sites. High erosion hazard roads have the highest amount of recent deliverable surface erosion to watercourses and a high potential for future deliverable erosion. Moderate erosion hazard roads have moderate amounts of recent deliverable surface erosion to watercourses and potential for future deliverable erosion. Low Erosion Hazard roads have low amounts of recent deliverable surface erosion to watercourses and low potential for future deliverable erosion.

Erosion Hazard Rating

- Low
- Moderate
- High
- Known High Treatment Sites

Transportation

- Paved Road
- Rocked Road
- Native Road
- Jeep Trail
- MRC Ownership
- Planning Watershed Boundary
- Gualala River Watershed Boundary

Flow Class

- Class I
- Class II
- Class III

Sheet 2

0 1/2 1 Mile

June 2003