# EXECUTIVE SUMMARY

## Watershed Analysis for Mendocino Redwood Company's Ownership in the Garcia River Watershed

This report presents the results of a watershed analysis performed by Louisiana-Pacific Corporation (the previous landowner) on their ownership in the Garcia River watershed in 1997-9 and updated by Mendocino Redwood Company (MRC) with information collected from 2000-2003. This report replaces the previous watershed analysis performed by Louisiana-Pacific Corporation. The MRC ownership in the Garcia River is considered the Garcia watershed analysis unit (WAU). This section presents a brief overview of the watershed analysis results. More specific information is found in the individual modules of this report.

The Garcia River is on the 303(d) list as sediment impaired and a total maximum daily load (TMDL) has been developed for sediment reduction in the river. The Garcia River and its tributaries support populations of coho salmon and steelhead trout, fisheries of concern in Northern California. For this reason MRC conducted a watershed analysis to assist in their efforts to reduce non-point source pollution, evaluate current and past land management practices and establish a baseline for monitoring of watershed conditions over time. The watershed analysis will also be used to identify needs for site-specific management planning in the watershed to reduce impacts to aquatic resources and potentially to improve fish and stream habitat conditions.

MRC's approach to the Garcia River watershed analysis was to perform resource assessments of mass wasting, surface and point source erosion (roads/skid trails), hydrology, fish habitat, riparian condition and stream channel condition. Mass wasting, riparian condition, and surface and point source erosion modules address the hillslope hazards. The fish habitat and stream channel condition modules address the vulnerability of aquatic resources. Prescriptions are developed to address the issues and processes identified in the watershed analysis. Finally, monitoring is suggested to determine the efficacy of the prescriptions to protect sensitive aquatic resources. The monitoring will provide the feedback for MRC's adaptive management approach to resource conservation.

The Garcia River watershed encompasses approximately 114 $mi^2$ of area. MRC owns approximately 16 percent of the land in the Garcia River watershed, approximately 11,509 acres.

### RESULTS

#### *Mass Wasting*

A total of 365 shallow-seated landslides (debris slides, torrents, or flows) were identified and characterized in the Garcia WAU. A total of 25 deep-seated landslides (rockslides or earthflows) were mapped in the Garcia WAU. Of the 365 shallow-seated landslides in the Garcia WAU, 103 are determined to be road-associated.

A total of 768,435 tons of mass wasting sediment delivery was estimated for the time period 1943-2000 in the Garcia WAU. This equates to approximately 752 tons/sq. mi./yr. Of the total estimated amount,

117,512 tons (15% of total) occurred from 1943-1952, 144,461 tons (19% of total) occurred from 1953-1966, 264,628 tons (34% of total) occurred from 1967-1978, and 241,834 tons (32% of total) occurred in the 1979-2000 time period.

Road associated mass wasting was found to have contributed 153,709 tons (150 tons/sq. mi./yr) of sediment over the 58 years analyzed (1943-2000) in the Garcia WAU (Table A-6). This represents approximately 20% of the total mass wasting sediment inputs for the Garcia WAU for 1943-2000. In the South Fork Garcia planning watershed, road associated sediment delivery was a major sediment source, contributing 31% of the sediment delivered from mass wasting. In the Inman Creek planning watershed, road related mass wasting contributed 80% of the sediment delivered, however, only six landslides had been mapped and inventoried, the largest of which was road related.

The landscape was partitioned into six Mass Wasting Map Units (MWMU) representing general areas of similar geomorphology, landslide processes, and sediment delivery potential for shallow-seated landslides (see Map A-2, Section A). The mass wasting map unit with the highest sediment delivery is MWMU 1, which is estimated to deliver 68% of the total sediment input for the Garcia WAU. This is due to the large amount of sediment being delivered by landsliding within the inner gorge.

***Surface and Point Erosion (Roads/Skid Trails)***

It was determined that there are 123 miles of truck roads in the Garcia WAU (skid trails not included) this represented an average road density of 6.7 miles of road per square mile.

The sediment delivery rate for roads in the planning watersheds shows a slight reduction through time(Table ES-2). The higher sediment delivery rates occurring during the 1952-1966 and 1967-1978 time periods. The higher sediment delivery rates occur primarily because most of the road construction in the WAU occurred during these early time periods.

Table ES-2. Road Associated Surface and Point Source Erosion Estimates by Planning Watershed and Hydrologic Unit for the Garcia WAU.

| Planning Watershed | Hydrologic Unit | 1952-1966 (t/sq mi/yr) | 1966-1978 (t/sq mi/yr) | 1978-1997 (t/sq mi/yr) | Total (t/sq mi/yr) |
|---|---|---|---|---|---|
| **South Fork** | South Fork | 458 | 449 | 416 | 437 |
| | Main Stem Tributaries | 382 | 332 | 320 | 340 |
| | Total SF PLWS | 407 | 398 | 367 | 387 |
| **Rolling Brook** | Rolling Brook | 225 | 214 | 182 | 203 |
| | No Name | 150 | 142 | 136 | 141 |
| | Lee Creek | 293 | 316 | 250 | 281 |
| | Hutton Gulch | 261 | 154 | 182 | 195 |
| | Main Stem Tributaries | 383 | 378 | 342 | 371 |
| | Total RB PLWS | 256 | 259 | 226 | 244 |
| **NF Garcia** | Total PLWS | 0 | 112 | 82 | 64 |
| **w11370021** | Total PLWS | 71 | 88 | 78 | 78 |
| **w11370022** | Total PLWS | 0 | 198 | 129 | 116 |

Controllable (point source) erosion sites on roads were identified and prioritized in the Garcia WAU. For roads in the Garcia WAU 49 controllable erosion sites have high treatment immediacy and 63 controllable erosion sites have moderate treatment immediacy. In addition to these controllable erosion sites 79 culverts in the Garcia WAU have a diversion potential. These diversion potential sites need to

be considered a high priority for road improvement as they can represent a significant potential point source erosion hazard. Total controllable erosion for road point sources in the Garcia WAU is estimated to be 128,000 cubic yards. This controllable erosion is represented by 29,400 cubic yards in high treatment immediacy sites, 13,200 cubic yards in moderate treatment immediacy sites, and 85,400 in low treatment immediacy sites. Since completion of the road inventory 43,734 cubic yards of controllable erosion has been controlled through road upgrades and decommissioning in the Garcia WAU.

The sediment delivery rate for skid trails in the Garcia WAU shows the highest sediment delivery rate occurring during 1952-1966. The higher sediment delivery rate occurs because the majority of the skid trail construction in the WAU occurred during this early time period, there was more area harvested and some of the skid trails were next to or directly in watercourses. Much of the skid trail erosion in the WAU came from skid trail use on steep terrain before the current Forest Practice Rule restrictions. Furthermore, skid trail operation next to or directly in watercourses is restricted.

An inventory of controllable erosion sites for skid trails, conducted in 2003, found 18 controllable erosion sites representing a total of 515 cubic yards.

### *Hydrology*

Using the synthesized record from 1952-1995, the flood of record is 1995 (37,000 cfs) considered to be close to a 50 year event for the Garcia River (Table C-2). Before the 1995 flood, the second highest flood is the 1974 event (30,300 cfs). Throughout the period of modern forest management in the Garcia WAU, post 1950, there have been numerous flood events (>2 year recurrence). These flood events have the capacity to re-shape river or stream channels and transport large sediment loads. The meteorological events which created these large floods also can be assumed to be a major contributor to the erosion and mass wasting delivered to the watercourses in the WAU.

#### *Riparian Function*

The riparian function assessment is divided into two groups: 1) the potential of the riparian stand to recruit large woody debris (LWD) to the stream channel along with the level of concern about current LWD conditions in the stream, and 2) a canopy closure and stream temperature assessment.
LWD riparian recruitment potential in the Garcia WAU is generally low. The majority of the riparian stands within the Garcia WAU are classified as low LWD recruitment potential. The majority of the stream segments in the Garcia River WAU are in the high in-stream LWD demand classification. The high in-stream LWD demand in the WAU is primarily due to stream channels that are moderately or highly responsive to LWD input adjacent to riparian stands with moderate to low LWD recruitment potential. Even in the smaller channels that met the LWD target, poor recruitment potential makes in-stream LWD demand high or moderate.

Canopy closure over watercourses is generally favorable throughout the Garcia River WAU. The mainstem Garcia River has poor canopy cover but this is to be expected of a wide, large channel. Water temperatures in the South Fork Garcia, Fleming Creek, and Rolling Brook are within the preferred temperature ranges for coho salmon. The mainstem Garcia water temperatures are above the preferred range for salmonids. It should be noted that the mainstem Garcia River water temperature cools after the water travels through the MRC lands. This is probably from cool water tributaries feeding the mainstem within MRC lands and proximity to the coast with lower air temperatures.

#### *Stream Channel Condition*

Baseline information on the stream channels of the Garcia WAU was collected and reported (see Stream Channel Condition module). Individual channel segments were categorized into geomorphic units using

the baseline stream channel information, topography the channel segments are found in, position in the drainage network, and gradient/confinement classes. Seven stream geomorphic units were established to represent the range of channel conditions and sensitivities to input factors of coarse and fine sediment and LWD (Table ES-3).

Table ES-3. Stream Geomorphic Units and Sensitivities for the Garcia WAU.

| Stream Geomorphic Unit | Channel Sensitivity | | |
|---|---|---|---|
| | Coarse Sediment | Fine Sediment | LWD |
| I. Alluvial Mainstem of Garcia River | Moderate | Low | Moderate |
| II. Low Gradient Depositional Segments of V-Shaped Valleys | High | Moderate | High |
| III. Moderate Gradient Depositional Segments of V-Shaped Valleys | Moderate | Low | Moderate |
| IV. Moderate Gradient Transport Segments of V-Shaped Valleys | Moderate | Low | Moderate |
| V. High Gradient Transport Segments of V-Shaped Valleys | Low | Low | Low |
| VI. Moderate Gradient Segments of Moderate Sloped Valleys | Moderate | Moderate | High |
| VII. High Gradient Segments of Moderate Sloped Valleys | Low | Low | Moderate |

***Fish Habitat Assessment***

The anadromous fish species inhabiting the Garcia WAU are coho salmon (*Oncorhynchus kisutch*), steelhead trout (*Oncorhynchus mykiss*), chinook salmon (*Oncorhynchus tshawytscha*) and pacific lamprey (*Lampetra tridentata*). Other non-salmonid species include the three spine stickleback (*Gasterosteus aculeatus*), Sacramento sucker (*Catostomus occidentalis*), and sculpin (*Cottus spp.*).

Streams in the Garcia WAU were habitat typed then rated for spawning, rearing, and over-wintering habitat quality. Generally spawning habitat has fair to good, rearing habitat was fair to good, while over-wintering habitat was poor to fair.

## *Sediment Budget*

A sediment budget was estimated for the Garcia WAU. Both Rolling Brook and No Name Creek show a negative net change between total coarse sediment inputs and terrace storage. Observations of current channel morphology in both of these hydrologic units suggest the channels are currently degrading. South Fork of the Garcia River showed a positive net change between total coarse sediment inputs and terrace storage. This high level of coarse sediment within the channel network is affecting current channel morphology and streambed substrate. It could be many years before this high level of coarse channel sediments are routed through the channel network and the morphology of the South Fork returns to a less aggraded condition.

The sediment inputs evaluated in the Garcia WAU from 1952-1997 have come from mass wasting, surface and point source erosion, and to a lesser extent mass wasting scarps (Table ES-4). Mass wasting shows the highest input proportion in the Garcia WAU.

Table ES-4. Percent of Total Sediment Delivered from 1952-1997 by Input Source for MRC Ownership in each Planning Watershed of the Garcia WAU.

| Planning Watershed | Mass Wasting | Road Surface and Point Source Erosion | Skid Trail Surface and Point Source Erosion | Mass Wasting Scarps |
|---|---|---|---|---|
| South Fork | 59% | 26% | 15% | 1% |
| Rolling Brook | 67% | 17% | 15% | 1% |
| NF Garcia | 9% | 20% | 69% | 1% |
| East of Eureka Hill | 66% | 9% | 24% | 1% |
| Inman Creek | 62% | 12% | 25% | 0% |

In every planning watershed of the Garcia WAU, except for East of Eureka Hill, the rate of sediment delivery is greatest in the 1966-1978 time period. We hypothesize that heavy tractor logging and road building in the 1950's and 1960's left many unstable road and skid trail areas. This combined with a large hydrologic event in 1974 (about 30 year recurrence interval) created a large influx of mass wasting sediment observed in the 1978 photos. If this is the case much of the sediment from the 1966-1978 time period could be attributed to the 1950's and 1960's.

***Land Management Prescriptions***

The following prescriptions were specifically prepared for use in the Garcia WAU. These prescriptions are meant to help address issues to aid in the stewardship of aquatic resources of the Mendocino Redwood Company ownership in the Garcia WAU. The prescriptions are meant to be used in addition to the current California Forest Practice Rules and company policies. At the time of the publication of this watershed analysis MRC's forest management policies are governed by a planning agreement prior to the issuance of a Natural Community Conservation Plan (NCCP). Mendocino Redwood Company is also working on a Habitat Conservation Plan (HCP). Further, MRC has been drafting an Erosion Control Plan and Site Specific Management Plan (ECP/SSMP) to meet the Garcia Total Maximum Daily Load implementation plan. Once these plans are approved, the conservation strategies set forth in these documents will become the company policies. A prescription is only presented if it deviates from or adds clarification to these policies.

Mass Wasting

*Mass wasting map unit 1 – Inner gorge or steep streamside slopes adjacent to low gradient watercourses*

MWMU 1 Road construction:

- If inner gorge topography, no new road or landing construction unless field reviewed and approved by a California Registered Geologist. If not inner gorge topography road construction shall be minimized. If road construction must occur, the road must utilize the highest design standards to lower risk of mass wasting sediment delivery.

MWMU 1 Existing Roads:

- Existing roads and landings shall be abandoned when no longer needed. If abandoning is not feasible, then roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery.

MWMU 1 Tractor Yarding:

- Equipment exclusion zones on inner gorge slopes. Equipment exclusion zones on non-inner gorge slopes except for existing roads or where alternative yarding method creates potential for greater sediment delivery.

MWMU 1 Skid Trail Construction or Reconstruction:

- No new tractor trail construction on inner gorge slopes, no new tractor trail construction or reconstruction on non-inner gorge slopes unless field reviewed and approved by a California Registered Geologist.

MWMU 1 timber harvest:

- MWMU 1 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist. On other areas (non-inner gorge slopes) within MWMU 1, in addition to the riparian protections set as company policy, timber harvest must retain a minimum of 50% overstory canopy dispersed evenly across the slopes.
    - The MWMU 1 protections will extend from the edge of the watercourse transition line up to the break in slope of the inner gorge and 25 feet of additional slope distance after the break in slope of the inner gorge.
    - For those areas that do not have well defined inner gorge topography in MWMU 1 timber harvest must retain 50% canopy[1].

*Mass wasting map unit 2 – Inner gorge or steep streamside slopes adjacent to moderate to high gradient watercourses*

MWMU 2 Road construction:

- If inner gorge topography, no new road or landing construction unless field reviewed and approved by a California Registered Geologist. If not inner gorge topography road construction shall be minimized. If road construction must occur, the road must utilize the highest design standards to lower risk of mass wasting sediment delivery.

*MWMU 2 Existing Roads:*

- Existing roads and landings shall be abandoned when no longer needed. If abandoning is not feasible, then roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery.

MWMU 2 Tractor Yarding:

- Equipment exclusion zones on inner gorge slopes. Equipment exclusion zones on non-inner gorge slopes except for existing roads or where alternative yarding method creates potential for greater sediment delivery.

[1] Only trees greater than 30 feet in height count towards canopy measurement.

MWMU 2 Skid Trail Construction or Reconstruction:

- No new tractor trail construction on inner gorge slopes, no new tractor trail construction or reconstruction on non-inner gorge slopes unless field reviewed and approved by a California Registered Geologist.

MWMU 2 Timber Harvest:

- No harvest on inner gorge slopes unless approved by a California Registered Geologist. On other areas (non-inner gorge slopes) within MWMU 1, in addition to the riparian protections set as company policy, timber harvest must retain a minimum of 50% canopy (see footnote 1) dispersed evenly across the slopes.
  - The MWMU 1 protections will extend from the edge of the watercourse transition line up to the break in slope of the inner gorge and 25 feet of additional slope distance after the break in slope of the inner gorge.
  - For those areas that do not have well defined inner gorge topography in MWMU 1 timber harvest must retain 50% canopy (see footnote 1).

*Mass wasting map unit 3 – Steep dissected terrain*

MWMU 3 Road construction:

- No new road construction across MWMU 3 unless field reviewed and approved by a California Registered Geologist unless it is the best road alternative[2].

MWMU 3 Existing Roads:

- Existing roads and landings shall be abandoned when no longer needed. If abandoning is not feasible, then roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery.

MWMU 3 Tractor Yarding:

- Equipment limited to existing roads or stable trails[3].

MWMU 3 Skid Trail Construction or Reconstruction:

- No new tractor trail construction or reconstruction unless field reviewed and approved by a California Registered Geologist.

MWMU 3 Timber Harvest:

- Retain 50% canopy (see footnote 1) with trees dispersed evenly across slope. Tree retention shall be emphasized in the axis of headwall swales. Deviations from this default must be field reviewed and approved by a California Registered Geologist.

[2] Best road alternative – the placement has a lower potential for sediment production and greater cost effectiveness.
[3] Stable trail – skid trail that has >85% of trail's tread intact, fill cracks or settling can have occurred provided the trail is still 85% intact and can have corrective action such that the trail presents little risk of future sediment delivery after use. Cut bank slumps can occur on stable trails, however, the slump cannot be removed if it buttresses failure of upslope soils, soils from slump must be either removed or retained in trail prism if trail is used.

*Rockslides*

No harvest or new road construction will occur on active portions of rockslides with a risk for sediment delivery unless approved by a California Registered Geologist.

Water flow from roads, skid trails and landings will not be concentrated across the toe, head, or lateral margin of any unstable area.

Roads

*Roads and skid trail use associated with watercourses*

The following table (Table ES-5) defines the Aquatic Management Zone within the Garcia WAU.

Table ES-5. Dimensions of the AMZ Bands.

| Watercourse | Slope Class (%) | AMZ Band Widths (slope distance in feet from watercourse) | | |
|---|---|---|---|---|
| | | Inner | Middle | Outer |
| Class I* | 0-30 | 0-50 | 50-100 | 100-130 |
| | 30-50 | 0-50 | 50-130 | 130-150 |
| | >50 | 0-50 | 50-150** | 150**-190 |
| Large Class II | 0-30 | 0-25 | 25-50 | 50-100 |
| | 30-50 | 0-25 | 25-75 | 75-130 |
| | >50 | 0-25 | 25-100** | 100**-150 |
| Small Class II | 0-30 | - | - | 50 |
| | 30-50 | - | - | 75 |
| | >50 | - | - | 100 |
| Class III | 0-30 | - | - | 25 |
| | >30 | - | - | 50 |

** - Subtract 20 and 25 feet for cable or helicopter yarding operations adjacent to Class I and Class II AMZ, respectively.

Roads within the Aquatic Management Zone (AMZ; see Table ES-5 for definition) will receive special consideration for stabilization of the road surface to prevent sediment delivery.

- Permanent and seasonal roads within the inner and middle bands (see Table ES-5 for definition) of the Class I AMZ will be surfaced with competent rock to a sufficient depth to minimize fine sediment from discharging into watercourses.
- Permanent roads within the inner and middle band of Class II AMZ will be surfaced with competent rock to a sufficient depth to minimize fine sediment from discharging into watercourses.

- Temporary roads that are within a Class I AMZ will have the surface stabilized with rock, grass, mulch and /or slash prior to the winter period.
- Temporary or seasonal roads that are within a Class II AMZ will have the surface stabilized with rock, grass, mulch and /or slash prior to the winter period.
- All roads that are within a Class III AMZ will have the surface stabilized with rock, grass, mulch and /or slash prior to the winter period.
- All new watercourse crossings will be sized to pass the 100-year flood. Any existing watercourse crossing that currently will not pass the 50-year flood will be upgraded to pass the 100-year flood according to the schedule in the Erosion Control Plan.
- The outlet of all road drainage structures within 100 feet of a watercourse and with less than 90 percent vegetation buffer will have slash piled, rock rip-rap placed, silt-fences or straw bale check dams installed prior to the winter period to create a sediment trap or filter prior to a watercourse.
- All soil disturbances within an AMZ greater than 100 square feet in area will be treated with mulch or slash to provide cover to reduce soil loss. This treatment will occur prior to October 15 unless the disturbance occurs after October 15 then the site will be treated following use or prior to a 30% chance of precipitation as forecasted by the National Weather Service.
- There shall be no construction, reconstruction, or use of roads within the channel of any watercourse. This measure does not apply to watercourse crossings.
- Temporary watercourse crossings that will not carry water or debris that pass the 100 year flood discharge shall be removed prior to October 15 of the year of installation or immediately after use if after October 15. Use of temporary crossings after October 15 must:
  -be removed if 30% of chance of rain is forecasted by the National Weather Service.
  -be discontinued following 2 inches of cumulative rainfall in a water year.
  -not be re-installed for 48 hours following ½ inch of rainfall.

Skid trail use on slopes greater than 40% within 200 feet of a watercourse must follow these guidelines:

- Skid trail use will be limited by the equipment exclusion zones (EEZ) and equipment limitation zones (ELZ) shown in Table ES-6.
- When skid trails are used outside of the EEZ and ELZ on slopes over 40% within 200 feet of a watercourse, only stable existing trails[4] can be used.
- No construction of new skid trails or reconstruction of unstable trails will occur on slopes greater than 40% within 200 feet of a watercourse unless developed in consultation with NCRWQCB.
- Following use, the portion of the existing stable skid trail within 100 feet of a watercourse will be stabilized with mulch, grass, or packed with slash prior to the wet period. NCRWQCB can review additional need for stabilization beyond 100 feet during Timber Harvest Plan review.

[4] Stable trail – skid trail that has >85% of prism intact, fill cracks or settling can have occurred provided the trail is still 85% intact and can have corrective action such that the trail presents little risk of future sediment delivery after use.

- MRC will include in Timber Harvest Plans when skid trial use occurs within 200 feet of a watercourse for NCRWQCB to review.

Table ES-6. Equipment Exclusion Zones (EEZ) and Equipment Limitation Zones (ELZ) for Watercourses in the Garcia WAU. (Distances are slope distances in feet for each side of the watercourse)

| | **Class I EEZ** | **Class II EEZ** | **Class III ELZ** |
|---|---|---|---|
| **<30% slope** | 150’ | 50’ | 25’ |
| **30-50% slope** | 150’ | 75’ | 50’ |
| **>50% slope** | 150’ | 100’ | 50’ |

The equipment exclusion zones will be allowed a few exceptions. These exceptions would be proposed in a timber harvest plan as an in-lieu practice and would be explained and justified. These exceptions are for existing crossings, for erosion control or restoration purposes, or where sediment delivery is determined to be less when using trails, designated crossings or landings in this zone. The use of a skid trail, landing or designated crossing in these areas is allowed if it can be shown that alternative yarding practices would create a greater risk and magnitude of sediment delivery and the cost of implementing those alternatives are not reasonable. Existing roads can be used in these zones.

*High and Moderate Erosion Hazard Roads*

The roads with a high erosion hazard rating should be given special attention for maintenance or erosion control. These roads should be considered high priority roads for rock surface, improved and increased road drainage relief, design upgrades or decommissioning.

The moderate erosion hazard roads should be given similar attention, but not as high a priority as the high erosion hazard roads.

*Known high and moderate treatment immediacy sites for roads in the Garcia WAU*

The high and moderate treatment immediacy controllable erosion sites will be the highest priority for erosion control, upgrade, or modifications to existing design. These sites will be scheduled for repair based on operational considerations of harvest scheduling, proximity and availability of equipment, magnitude of the problem, and accessibility to the site.

Riparian

*Large woody debris recruitment*

The company policies for streamside stand retention are considered to be appropriate at this time for LWD recruitment. Monitoring of LWD recruitment will be done to determine if this is correct.

In the interim MRC will promote attempts to place LWD in stream channels to provide habitat structure. The stream locations with high instream LWD demand should be considered the highest priority for LWD placement. The moderate instream LWD demand segments would be next.

*Stream Shade*

The company policies for promoting streamside canopy and riparian management are considered to be appropriate at this time to improve stream canopy. Monitoring of stream temperatures and canopy will be done to determine if this is correct.

Along the mainstem Garcia River the following guidelines apply:

- Tree planting along the river for restoration of riparian vegetation should be emphasized.
- Restoration harvest within the AMZ will not remove trees providing effective shade.
- Stream temperatures will be monitored to determine if temperatures are lowering as canopy grows in over time.

***Monitoring***

Aquatic resources monitoring will be conducted in the Garcia WAU. This monitoring is to assist Mendocino Redwood Company to assess impacts to aquatic resources associated with past or future timber harvest and related forest management activities in the Garcia WAU. The monitoring suggested in this plan is monitoring that MRC conducts across all its lands including the Garcia WAU. However, other monitoring efforts not mentioned here may be conducted by MRC in the Garcia WAU. Currently a comprehensive monitoring plan is being developed for the MRC lands. Once that plan is finalized it will supercede the monitoring presented here.

*Monitoring Plan Goals:*

- Test the efficacy of the Garcia WAU prescriptions to address impacts to aquatic resources from timber harvest and related forest management activities.
- To assess long term channel conditions. Are current and future forest management practices inhibiting, neutralizing or promoting stream channel conditions for aquatic habitat?

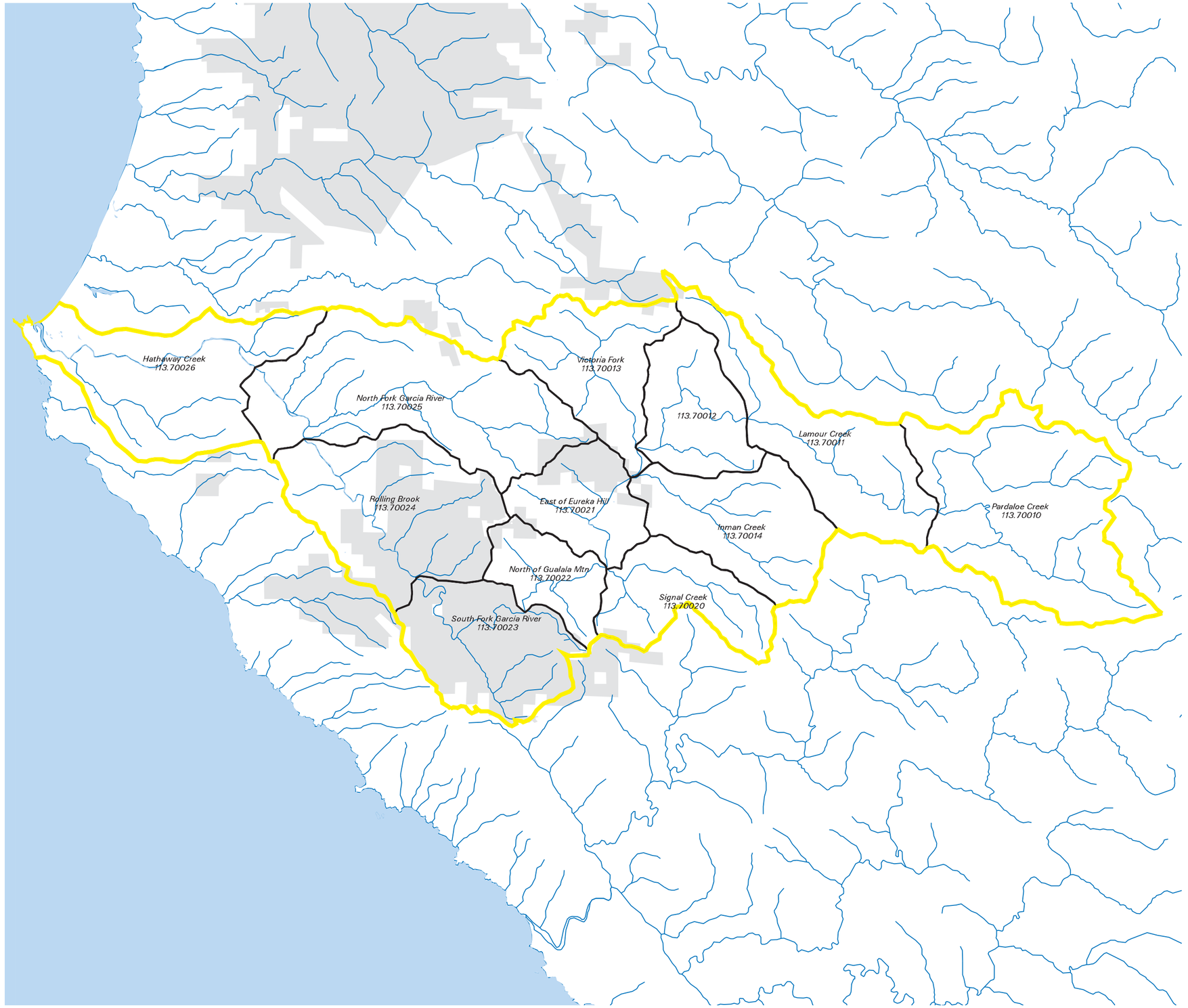
A monitoring report will be produced each year that monitoring is conducted in the Garcia WAU. The report will cover the monitoring and analysis that has occurred up to that year; if no monitoring is conducted in a given year than no report will be produced. The goal will be to have a report completed by February of the year following the monitoring. Table ES-7 summarizes some of the monitoring to be conducted in the Garcia WAU over time.

Table ES-7. Monitoring Matrix for Mendocino Redwood Company Lands Including the Garcia Watershed Analysis Unit.

| **Monitoring Objectives** | **Reasoning, Comments** | **Technique** |
|---|---|---|
| 1. Determine effectiveness of measures to reduce management created mass wasting. | Management created mass wasting is significant contributor of sediment delivery. | Evaluation of mass wasting following a large storm event or after approximately 20 years. |
| 2. Determine effectiveness of erosion control practices on high and moderate surface erosion hazard roads and landings. | Roads provide sediment delivery in the Garcia WAU. | Evaluation of watercourse crossings, landings, and road lengths for erosion evaluation. |
| 3. Determine in-stream large woody debris amounts over time. | Large woody debris is needed for stream channel and aquatic habitat improvement in the Garcia WAU. | Stream LWD inventories and mapping of LWD designation areas in select stream reaches and long term channel monitoring sites. |
| 4. Determine if stream temperatures are staying within properly functioning range for salmonids. | Stream temperature can be a limiting factor for salmonid growth and survival. | Stream temperature probes and assessment conducted in strategic locations. |
| 5. Determine if fine sediment in stream channels is creating effects deleterious to salmonid reproduction. | Many forest practices can produce high fine sediment amounts. Need to ensure fine sediments are not impacting salmonid reproduction. | Permeability measurements on select stream reaches (bulk gravel samples if necessary). |
| 6. Determine long-term channel morphology changes from coarse sediments. | Channel morphology can be altered from sediment increases, possibly affecting aquatic habitat. | Thalweg profiles and cross section surveys on select stream reaches. |
| 7. Determine presence and absence of fish species in Class I watercourses. | Management practices and resource protections can affect distribution of aquatic organisms. | Electro-fishing and snorkeling observations at select locations to determine species composition and presence. |

# Garcia River Watershed Analysis Unit

## Garcia River Watershed Overview




Major Streams

Planning Watershed

Garcia River Watershed Boundary

Ocean, Lake, Pond

MRC Ownership


0 2.5 5 Miles



September 2003