

## SECTION I

# CAUSAL MECHANISMS AND PRESCRIPTIONS

### INTRODUCTION

The following Causal Mechanism Reports and Prescriptions were specifically prepared for use in the Greenwood Watershed Analysis Units (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 Greenwood 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 interim guidelines prior to the issuance of a Habitat Conservation Plan and Natural Community Conservation Plan (HCP/NCCP). Once the HCP/NCCP is 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.

The land management prescriptions presented here are the protections that Mendocino Redwood Company will pursue to provide protection of aquatic resources. The causal mechanism reports present the situations where watershed conditions have a likelihood of affecting a vulnerable resource. By addressing each of these situations with an appropriate prescription the situations that could impact sensitive resources will either be removed or their impact significantly lessened. This is to attempt to provide protection to watershed values from receiving significant or cumulative impacts from future management actions.

Monitoring will be conducted in the Greenwood WAU to ensure that these prescriptions are providing necessary protection to aquatic resources (see Section J, Greenwood WAU Monitoring Plan). This monitoring is part of an adaptive management approach that tests the hypothesized protections the prescriptions are developed to meet. If it is found that the prescriptions are not providing the appropriate protections, then they will be updated and improved.

### CAUSAL MECHANISMS AND PRESCRIPTION REPORTS

Each Causal Mechanism Report and Prescription has specific headings to provide background on the watershed situation and prescription. The following is the description of these headings.

*Resource Sensitive Area:* the area or topic encompassed by the prescription.

*Input Variable and Process:* this briefly states what is the source variable or input to a vulnerable resource.

*Situation Sentence:* presents the situation that will be addressed by the prescription.

*Prescriptions:* specific land management actions or recommendation for the proposed causal mechanism.

**Causal Mechanism Report and Prescription #1**

**Resource Sensitive Area:** Terrain Stability Unit (TSU) 1

**Input Variable(s):** Coarse and fine sediment from mass wasting.

**Situation Sentence:**

Shallow seated landslides are common within the over-steepened slopes of the TSU 1 topography. The immediate proximity of watercourses to landslides of this TSU 1 provides direct delivery of fine and coarse sediment. Coarse sediment inputs can impact summer rearing habitat for aquatic species by filling pools or creating aggradation in riffles and flat water. Fine sediment inputs can reduce spawning habitat quality. Fine sediment can also create higher than natural turbidity during storm flows potentially affecting fish physiology, reduce feeding or in the worst cases increase mortality.

**Prescriptions:**

The general location of terrain stability units are mapped in Map A-1 but final determination of the unit existence and boundaries will be determined from field observations.

Where there is inner gorge within TSU 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.

**TSU 1 Road construction:**

- No new road or landing construction unless field reviewed and approved by a California Registered Geologist.

**TSU 1 Existing Roads:**

- Roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery. Existing roads and landings within TSU 1 should be considered for abandonment if no longer needed.

**TSU 1 Tractor Yarding:**

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

**TSU 1 Skid Trail Construction or Reconstruction:**

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

**TSU 1 Timber Harvest:**

- TSU 1 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist. On steep streamside slopes within TSU 1, in addition to the riparian protections set as company policy, timber harvest must retain a minimum of 50% canopy<sup>1</sup> dispersed evenly across the slopes.

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<sup>1</sup> Only trees greater than 30 feet in height count towards canopy measurement.

**Causal Mechanism Report and Prescription #2**

**Resource Sensitive Area:** Terrain Stability Unit (TSU) 2

**Input Variable(s):** Coarse and fine sediment from mass wasting.

**Situation Sentence:**

The incised topography adjacent to watercourses of TSU 2 has high risk for shallow seated landslide sediment delivery. The landslides in TSU 2 are typically associated with destabilization of the toe of a watercourse's steep side slopes. Landslides or soil failures could be aggravated by soil disturbance by heavy equipment, road building or removal of ground stabilizing vegetation. The immediate proximity of watercourses to these hillslope failures provides direct delivery of fine and coarse sediment. Coarse sediment inputs can impact summer rearing habitat for aquatic species by filling pools or creating aggradation in riffles and flat water. Fine sediment inputs can reduce spawning habitat quality. Fine sediment can also create higher than natural turbidity during storm flows potentially affecting fish physiology, reduce feeding or in the worst cases increase mortality.

**Prescriptions:**

The general location of terrain stability units are mapped in Map A-1 but final determination of the unit existence and boundaries will be determined from field observations.

Where there is inner gorge within TSU 2 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.

**TSU 2 Road construction:**

- If inner gorge topography, no new road or landing construction unless field reviewed and approved by a California Registered Geologist. If steep streamside slope 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.

**TSU 2 Existing Roads:**

- Roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery. Existing roads and landings within TSU 2 should be considered for abandonment if no longer needed.

**TSU 2 Tractor Yarding:**

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

**TSU 2 Skid Trail Construction or Reconstruction:**

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

**TSU 2 Timber Harvest:**

- No harvest on inner gorge slopes unless approved by a California Registered Geologist. On steep streamside slopes within TSU 2, in addition to the riparian protections set as company policy, timber harvest must retain a minimum of 50% canopy (see footnote 1, page I-2) dispersed evenly across the slopes.

**Causal Mechanism Report and Prescription #3**

**Resource Sensitive Area:** Terrain Stability Unit (TSU) 3

**Input Variable(s):** Coarse and fine sediment from mass wasting.

**Situation Sentence:**

Steep and/or convergent slopes of TSU 3 can have shallow seated landslides associated with them. These landslides can travel moderate distances across hillslopes to reach streams where sediment delivery and sometimes debris torrents or flows occur. When sediment delivery occurs with these landslides, sediments will travel down the watercourses and are delivered to river and stream channels. If the frequency and amount of shallow seated landslides are increased from management actions in TSU 3 this can contribute to poor rearing habitat, downstream aggradation or high stream turbidity.

**Prescriptions:**

TSU 3 Road construction:

- No new road construction across TSU 3 unless field reviewed and approved by a California Registered Geologist unless it is the best road alternative<sup>2</sup>.

TSU 3 Existing Roads:

- Roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery. Existing roads and landings within TSU 3 should be considered for abandonment if no longer needed.

TSU 3 Tractor Yarding:

- Equipment limited to existing roads or stable trails<sup>3</sup>.

TSU 3 Skid Trail Construction or Reconstruction:

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

TSU 3 Timber Harvest:

- Retain 50% canopy (see footnote 1, page I-2) 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.

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<sup>2</sup> Best road alternative – the placement has a lower potential for sediment production and greater cost effectiveness.

<sup>3</sup> 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.

**Causal Mechanism Report and Prescription #4**

**Resource Sensitive Area:** Rockslides

**Input Variable(s):** Coarse and fine sediment from mass wasting.

**Situation Sentence:**

Rockslides are deep-seated landslides within the Greenwood WAU. These features can be active, dormant or have sections of the landslide active with other sections of the landslide dormant. Increases in sub-surface water from loss of evapo-transpiration or concentrated water from road drainage can activate or accelerate movement and sediment delivery from these features. The increased sediment delivery could contribute to adverse fish habitat by pool filling, increased channel scour, fine sediments smothering spawning gravel and loss of stream channel complexity.

**Prescriptions:**

The general location of rockslides is mapped in Map A-1 but final determination of the rockslide existence and/or activity will be determined from field observations.

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.

**Causal Mechanism Report and Prescription #5**

**Resource Sensitive Area:** High and Moderate Erosion Hazard Roads

**Input Variable(s):** Coarse and fine sediment from surface and point source erosion.

**Situation Sentence:**

The erosion hazard ratings suggest the likelihood and amount of future sediment delivery to be delivered from a road. The high erosion hazard roads would be considered the greatest risk, with the moderate erosion hazard roads next.

These roads commonly have areas of long un-drained road lengths, unstable fill or are directly adjacent to watercourses. These roads can create surface or point source erosion contributing both fine and coarse sediment deliveries to watercourses. If the frequency and amount of erosion is increased from management actions this can contribute to poor rearing habitat, high turbidity or decreased spawning habitat quality.

**Prescriptions:**

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.

**Causal Mechanism Report and Prescription #6**

**Resource Sensitive Area:** High and moderate treatment immediacy sites for roads

**Input Variable(s):** Sedimentation from surface and point source erosion.

**Situation Sentence:**

Individual culverts, landings and road erosion sites were identified that had a high likelihood of near-term sediment delivery. If the frequency and amount of erosion is increased from management actions this can contribute to poor rearing habitat, or degradation of spawning habitat quality.

**Prescriptions:**

The high 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.

The moderate treatment immediacy controllable erosion sites will be the next highest priority (relative to the high treatment immediacy sites) for erosion control, upgrade, or modifications to existing design. The moderate treatment immediacy sites will typically be addressed when in close proximity to high treatment immediacy sites.

Priority of treatments will often be associated with forest harvest activities the WAU.

**Causal Mechanism Report and Prescription #7**

**Resource Sensitive Area:** Culvert #C51 on road 84-LG-048

**Input Variable(s):** Migration blockage

**Situation Sentence:**

The culvert draining the seep on at site #C51 on road 84-LG-048 does not provide the ability for torrent salamanders to migrate upstream. The seep has many torrent salamander observations, if the animal were to travel downhill of the seep they may not be able to negotiate the crossing as it is currently configured.

**Prescriptions:**

Assess the culvert for replacement to a rocked ford or new culvert placement with an over-sized pipe placed at grade to facilitate torrent salamander migration.

**Causal Mechanism Report and Prescription #8**

**Resource Sensitive Area:** Road 84-MB-053 and 84-CP-008-03

**Input Variable(s):** Sedimentation from surface and point source erosion.

**Situation Sentence:**

These roads were abandoned over 20 years ago. Most of the watercourse crossings have failed and contributed sediment to Big Tree Creek. Some additional controllable erosion remain on these roads. Unfortunately the roads are currently inaccessible to heavy equipment

**Prescriptions:**

Assess these roads for feasibility of heavy equipment and controllable erosion repairs. Properly decommission these roads if feasible.

**Causal Mechanism Report and Prescription #9**

**Resource Sensitive Area:** Riparian Areas

**Input Variable(s):** Large woody debris recruitment

**Situation Sentence:**

Large woody debris (LWD) is an important component of stream habitat. Large woody debris provides sediment storage in channels, creates areas of scour for pool creation, provides cover for fish habitat and adds channel roughness for habitat complexity. Historic forest management practices did not require watercourse protection measures like current California Forest Practice Rules mandate. Historic removal of LWD from the Greenwood WAU has created a deficiency of LWD available for fish habitat and stream channel diversity. Historic harvesting practices have removed many of the large conifer trees which provide the current and future large woody debris recruitment needed in these areas.

This watershed analysis has presented, by stream segment, the instream LWD demand based on riparian stand recruitment potential and instream LWD conditions. The majority of streams in the Greenwood WAU have a high LWD demand, suggesting lack of LWD and short term LWD recruitment potential

**Prescriptions:**

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.

**Causal Mechanism Report and Prescription #10**

**Resource Sensitive Area:** Canopy closure over Class I and II watercourses

**Input Variable(s):** Canopy closure and stream temperature

**Situation Sentence:**

Stream temperatures in the Greenwood WAU range are generally within the preferred range for rearing steelhead trout. The range of stream temperatures in the Greenwood WAU reflects a range of environmental conditions. A few areas of the Greenwood WAU do have stream canopy conditions below what would naturally be expected in those locations. High water temperature can be deleterious and even fatal to many fish and aquatic species and warrant concern. Therefore, promoting appropriate stream canopy cover is important.

**Prescriptions:**

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 conducted to determine if this is correct.

**Literature Cited**

Weaver, W. and D. Hagans. 1994. Handbook for forest and ranch roads, a guide to planning , designing, constructing, reconstructing, maintaining and closing wildland roads. Prepared for: The Mendocino Resource Conservation District, Ukiah, CA.