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As part of a Memorandum of Agreement between the National Marine Fisheries Service (NMFS), Southwest Region and the State of California (State) on North Coast Steelhead Trout, NMFS and the State agreed to conduct an analysis of the California Forest Practice Rules (FPR). The purpose of this review, as described in the MOA, was to:

"jointly review the adequacy of existing California Forest Practice Rules, including implementation and enforcement, to achieve properly functioning habitat conditions."

The following document is the NMFS review of the FPRs to the State, and the State response to NMFS analysis.

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Resources Agency's Response to NMFS California Forest Practice Rules July 10, 1998

The California Resources Agency has reviewed a "Draft" titled "Effectiveness of the California Forest Practice Rules to Conserve Anadromous Salmonids". The document makes extensive reference to various sections of the California Forest Practice Rules (FPR), Title 14, California Code of Regulations (CCR). Taken in isolation the individual sections of the rules may not appear to provide adequate protection for watercourses or the habitat and species that rely on watercourses. California relies on an adaptive management approach in regulating timber harvesting. This approach weighs heavily on mitigating any significant adverse impact on environmental resources. It is a process that allows the reviewing agencies to ask the question "How is coho being protected?" and ends up with a plan that fully protects the species and its habitat. A commonly referred to compilation of the rules prepared by the California Department of Forestry and Fire Protection (CDF) for California Timber Operators, January 1998, contains 211 pages of text in relatively small print. It is difficult for anyone unfamiliar with this volume of material to scan these pages and glean a complete picture of all the avenues available to the review agencies for the protection of the varied resources of California.

Please note that the rules are applied to a wide variety of possible conditions. These rules apply to a landowner with ten acres of flat ground with no watercourses, archaeological sites, or other constraints, as well as to the large industrial timberland owners with many watersheds to manage, listed species, many watercourses, archaeological sites, erosion sources predating the current FPRs, and numerous other constraints. Regulation of timber harvesting on private and state-owned lands in California occurs under the Z'berg-Nejedly Forest Practice Act of 1973 (FPA). The nine member Board of Forestry (BOF) adopts regulations under authority of the FPA, and CDF administers those rules.

The FPA is intended to regulate timberlands to achieve two goals: (1) to enhance, restore and maintain the productivity of timberland wherever feasible; and (2) to achieve maximum sustained production of high-quality timber while giving consideration to values relating to recreation, watershed, wildlife, range and forage, fisheries, regional economic vitality, employment and aesthetic enjoyment.

Because the approval of individual timber harvest plans (THP) by CDF involves the exercise of discretion and judgment and because the timber harvesting has the potential to affect the environment, the California Environmental Quality Act (CEQA) applies to the process also. This act is similar to the National Environmental Policy Act (NEPA) and requires analysis of the environmental effects of individual projects and of alternatives and mitigation measures to avoid or lessen any significant environmental effects of the project.

CEQA requires that public agencies not approve a project as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially

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lessen the significant environmental effects of the project. The applicant must disclose and identify the significant effects of a project for state agency and public review.

The FPA emphasizes decision making based on the rules. The FPRs have been evolving over the last 23 years in response to changing environmental considerations. CEQA, in contrast, emphasizes case-by-case, open-ended analysis of environmental impacts, alternatives, and mitigation measures. The review of THPs is a melding of the two processes. This results in an adaptive management process where any issue that is raised such as protection of the coho must be discussed, and if a significant adverse impact is found, CDF is required to mitigate to a level of insignificance. If the action cannot be mitigated to insignificance, CDF may disapprove the plan or approve the plan with overriding considerations. In the case of a listed species, overriding considerations is not an option.

Through this process the Registered Professional Forester (RPF), with the help of appropriate professionals develops the THP that they believe will not have a significant effect on environmental resources. Normally, it has more than the rule minimums as protection for environmental resources. CDF and the review team agencies review the RPF's work and make their independent judgment on whether the plan, with mitigation will in fact not have a significant effect on environmental resources. This adaptive management process allows the RPF and review agencies to adapt the plan to provide for the needs of fish, as new information surfaces.

The question is how well does all this work to protect coho and other resources? The state is working towards an effective monitoring program. Throughout this document some preliminary results are reported.

A Monitoring Study Group (MSG) was formed by the BOF in 1989 to develop a Long Term Monitoring Program (LTMP) for assessing the effectiveness of the FPRs in protecting water quality. The group is made up of members of the public, resource agencies and the timber industry. Several projects have been carried out over the past five years that have allowed the LTMP to proceed.

The primary objective of the LTMP is to provide an ongoing assessment of the effectiveness of the FPRs, as implemented, in protecting beneficial uses of water (i.e., coldwater fisheries and domestic water supplies) through implementation, effectiveness, and project monitoring.

The LTMP results will be provided to the BOF and the public in a timely manner to contribute effectively to BOF's program for reviewing and, where necessary, strengthening the rules' performance and best management practices (BMP).

The LTMP has an in-stream and hillslope component. The first year of data collection on the hillslope component was completed in 1996 on THPs. The data collection continues on another 50 THPs in 1997. A summary of the 1996 data should be available later this year.

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CDF is developing a compliance monitoring form for use during the mandatory completion inspection on each THP. Trend monitoring will be the responsibility of the Department of Fish and Game (DFG).

A good example of the state's monitoring program is south of San Francisco. The listing of coho in that area by the state initiated a process to address timber harvesting and its effect on coho. This process includes compliance, effectiveness, and trend monitoring. Compliance monitoring is done by the state's forest practice inspectors. Effectiveness is reported by the private RPF and trend monitoring is done by DFG. Results of this monitoring will assist in fine tuning the process to assume all concerned that timber harvesting is protecting coho and other resources.

The following is the Agency's response to each of the items of concern found in the draft document. The response to the first section "General Concerns" contains additional summary material, concerning mainly the preparation and review process associated with THPs. The material in italic print has been copied directly from the National Marine Fisheries Service (NMFS) document. Each section is followed by a response printed in plain block lettering.

General Concerns

Two areas of concern that the National Marine Fisheries service has with the implementation of the California Forest Practice Rules relate to the large number of rules under which adequate conservation for anadromous salmonids depends heavily on the Registered Professional Forester (RPF) having a high level of biological, ecological, and/or geological expertise. It is unrealistic to expect all RPFs have such knowledge. Often, the conservation of ecological resources, including anadromous salmonids, depends upon protective measures that are inserted into Timber Harvesting Plans (THPs) during the review process. Two state agencies, the California Department of Fish and Game (CDFG) and the Regional Water Quality Control Board (RWQCB) have been given statutory responsibility to review THPs for compliance with the California Fish and Game Code and Clean Water Act, respectively. The Division of Mines and Geology also reviews THPs. No integrated guidelines or policies are available to provide a framework for treatment of THPs through the review process (Little Hoover Commission 1994). In addition, the agencies can review only a small fraction of the THPs, and thus are forced to rely on RPFs, not agency personnel, to determine problems and design mitigation measures. Furthermore, even when these agencies participate in a review, there is no requirement that the agencies recommendations must be incorporated into THPs.

Response: This passage has overlooked the role CDF plays in the review process of THPs. Within this Department every plan goes through several levels of review by agency personnel.

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Prior to a plan being submitted to CDF, it is prepared by RPF. California requires its professional foresters to register and obtain a license to practice. To be eligible for a license, a candidate must have at least seven years of experience in forestry and must pass a comprehensive examination. In the preparation of a THP, the RPF must include a description of the site to be harvested, the types of timber operations to be conducted, and mitigation measures to be used consistent with BOF rules. Also included must be information concerning silvicultural systems, yarding methods, reforestation methods, erosion control methods, stream protection, road building, and erosion hazard rating. The RPF must conduct a field investigation to apply the rules with respect to watercourse classification and protection measures, location of sensitive terrain, and development of appropriate mitigation measures or alternatives. From the DFG the RPF may obtain, if necessary, a "No Take" document regarding the northern spotted owl or marbled murrelet, a Streambed Alteration Permit, and/or a listing of species of wildlife likely to be in the area from the Natural Diversity Data Base. The RPF is required by the Forester's Licensing Law to consult with other experts when the RPF does not have the required expertise. RPFs do consult with wildlife or fisheries biologists, botanists, geologists, engineers, or other resource professionals regarding various facets of the plan. The state is offering to RPFs and agency staff a four-day watershed academy to impart (or review) specific hands-on skills that RPFs can use to improve THPs and monitoring from a watershed/fisheries perspective. Skills will include learning to recognize potential mass wasting problems from air photos and ground conditions, geomorphic features of both healthy and damaged aquatic habitat, good and bad crossing placement and design, and when to call in more expertise. The course will increase the students' awareness and knowledge of watershed processes and values and increase their awareness of how their actions can effect the processes and values.

When a plan is submitted, CDF immediately initiates review. Title 14 CCR 1037 states: "Within ten (10) days of the receipt of a plan, the Director shall determine if the plan is accurate, complete and in proper order..." In the Santa Rosa Headquarters office (responsible for the review of all plans in the Coast Forest District which runs from the Oregon border to Santa Cruz County – described in detail in 14 CCR 907) there are two full-time staff foresters. Each of these foresters and their supervisor are RPFs. These individuals have had many years of experience reviewing THPs. They are familiar with which watersheds in the Coast Forest District have required additional protections for a variety of resources in the past, and items which might indicate the need for additional information or protective measures. The other Forest Districts have similar arrangements. Title 14 CCR 1037 continues, stating "When the Director finds a plan inaccurate, incomplete or otherwise not in proper order, the plan shall be returned to the submitter with written specifications of the deficiencies." A plan can be returned to the RPF for corrections or additional information two or three times before it is found to be accurate, complete and in proper order for filing. Once accepted for filing the plan is sent to DFG, WQ, Division of Mines and Geology (DMG) and any interested public. These agencies paper review nearly 100% of the plans and pass on their concerns and question to the review team.

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With this first hurdle passed, a multidisciplinary review team conducts the first review team meeting to assess the plan. The review team normally consists of, but is not necessarily limited to, representatives of CDF, DFG, and the WQ. DFG and WQ may choose to participate in this meeting by sending a list of concerns or questions about the plan via fax, email, or telephoning the review team chair prior to the meeting.

The purpose of the first review team meeting is to assess the proposed logging plan and determine on a preliminary basis, whether it conforms to the rules of the BOF. If a plan is very simple with a very low potential for environmental impacts, it may be determined that a field inspection (preharvest inspection) is not necessary. However, it is generally the case that questions arise at the review team meeting. Some of these questions are returned to the RPF who prepared the plan for response. Others are formulated which are to be answered by a field inspection team. The nature of the questions raised and interest of the various agencies results in a list of agencies that will be contacted to attend the preharvest inspection.

The DMG also reviews each THP for indications of potential slope instability, and other potential geologic concerns. The Santa Rosa Headquarters office has two DMG staff members. Each of these is a Certified Engineering Geologist. Each harvest plan filed is routed to one of these geologists who indicate whether a field geologic evaluation should be required during the preharvest inspection. In the Coast Forest District, there are four Mines and Geology Certified Engineering Geologists, two in Santa Rosa and one each in Mendocino and Humboldt Counties. All four of these geologists work primarily with the evaluation of THPs. Of the 520 plans submitted in the Coast Forest District in 1997, there were 131 Engineering Geological Reviews. For each of the reports, at least one of the four geologists mentioned above had visited the plan area on at least one occasion.

Next, a pre-harvest inspection (PHI) is normally conducted to examine the THP area and the logging plan. All review team members may attend, as well as other experts and agency personnel whom CDF may request. CDF has on staff several specialists who may also attend PHIs. There are two wildlife biologists stationed within the Coast Forest District, one in Santa Rosa and one in Fortuna in Humboldt County. In Sacramento and/or Redding, CDF has a hydrologist, entomologist, plant pathologist, as well as additional wildlife biologists and other resource specialists who can be called upon for plan review. CDF's biologists are normally not called on to participate in a PHI unless DFG cannot attend and there is a pressing fisheries or wildlife issue.

As a result of the PHI, additional recommendations may be formulated for site-specific conditions to ensure environmental protection, or additional questions raised that are directed to the RPF who prepared the plan. Questions raised during the first review team meeting to be answered by the field inspection team are answered in field inspection reports prepared by CDF and any other agencies that may have attended the field inspection.

After a PHI, a second review team meeting is conducted to examine the field inspection reports and to finalize any additional recommendations or changes in the THP. The

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review team chairperson transmits these recommendations to the RPF who developed the harvesting plan. The RPF must address and respond to each recommendation. To reach a decision on approval or denial of a proposed plan, the Director's representative considers public comment, the adequacy of the RPF's response, the recommendations of the review team chairperson, and the legal authority of the FPA/FPRs and CEQA before reaching a decision to approve or deny a plan. CEQA and its substantive criteria for the evaluation of a proposed project's environmental impact apply to the timber harvesting and must be melded with the FPA/FPRs when making a decision on the plan.

If a participating agency has a recommendation that the review team chairperson (CDF) did not include in the final list of recommendations, there are measures that the agency can take. The first action that can be taken is to file a non-concurrence. This is described in 14 CCR 1037.5(e):

“Non-Concurrence: If a member of the review team does not concur with the chairperson's recommendation to the Director, the member shall submit in writing, within five days of the review team meeting and before the action required by 14 CCR 1037.4, the specific reasons why the recommendation does not provide adequate protection of the resources for which his or her agency has responsibility. The submission to the Director shall also include recommendations on measures or actions the Director should take to address the deficiency, as provided by the rules of the Board. A non-concurring member's comments shall be considered based on the comment's specificity and relation to the member agency's area(s) of expertise and statutory mandate, as well as the level of documentation, explanation or other support provided with the comments. If a non-concurrence is filed on a plan, the review team chairperson shall prepare a written report explaining how the concerns cited in the non-concurrence have been addressed in the plan and how the natural resources of concern will be protected during timber operations.”

A higher level of action that can be taken by the State Water Resources Control Board or the Director of DFG would be a Head of Agency Appeal, 14 CCR 1056. This must be filed no later than ten days from the date of THP approval. 14 CCR 1056.1 to CCR 1056.6 discuss the steps of this process in detail.

Before commencing operations, the plan submitter must notify CDF. During operations, CDF periodically inspects the logging area for compliance with the specifications of the THP and for compliance with the FPRs. The number of the inspections will depend upon the plan size, duration, complexity, regeneration method, and the potential for impacts. The contents of the THP and the FPRs provide the criteria CDF inspectors use to determine if violations exist. While CDF cannot guarantee that a violation will not occur, it is CDF's policy to pursue vigorously the prompt and positive enforcement of the FPA, the FPRs, related laws and regulations, and environmental protection measures applying to timber operations on the non-Federally owned lands in California. This enforcement policy is directed primarily at preventing and deterring forest practice violations and secondarily at prompt and adequate correction of violations when they occur. The mitigation measures required or incorporated in this THP will be monitored during the

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inspections conducted by CDF as authorized or required by the FPA [Public Resources Code (PRC) 4513-4628]. The inspections include but are not limited to inspections during operations pursuant to PRC 4604, inspections of completed work pursuant to PRC 4586, erosion control auditing as per PRC 4585(a), and stocking inspections pursuant to PRC 4588.

Most forest practice violations are correctable and CDF's enforcement program assures correction. Where non-correctable violations occur, criminal action is taken. Depending on the outcome of the case and the court in which the case is heard, environmental corrective work is done. This is intended to offset non-correctable adverse impacts.

Once harvesting operations are finished, a completion report must be submitted certifying that the area meets the requirements of the rules. CDF inspects the area to verify that all aspects of the applicable rules and regulations have been followed, including erosion control work. A prescribed maintenance period begins once CDF has approved the completion report.

Specific Concerns

895.1 Definitions

Abandonment means leaving a logging road reasonably impassable to standard production four wheel-drive highway vehicles, and leaving a logging road and landings in a condition which provides for long-term functioning of erosion controls with little or no continued maintenance.

Analysis

- *Definition does not necessarily provide for full decommissioning of roads. It does not require complete closure of road; off-highway vehicles, bicycles, horses, etc. can still use the road. Surface erosion from impacted roads could continue. Vehicles on abandoned roads may also break down erosion controls, such as waterbars, rendering them ineffective. Continued use of abandoned roads could increase sediment inputs into nearby streams.*
- *Definition does not require removal of all road features that may reroute hillslope drainage, restrict or confine stream flow, and/or present slope stability hazards (culverts, cross drains, inside ditches).*
- *Stream crossing structures may be degraded over time or may become perched, blocked, or wash out. No requirement to periodically check these erosion control measures to assure they are maintaining full function.*

Potential Biological Impacts

- *Surface erosion from road systems deliver sediments to watercourses that can diminish pool quality and quantity, increase turbidity, smother coho salmon eggs and larvae, increase gravel embeddedness, decrease invertebrate abundance, and disrupt social and feeding behavior (Cordone and Kelly 1961, Everest et al. 1987; Hicks et al. 1991; Kelsey et al. 1981; Lloyd et al. 1987; Megahan 1982)*

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- *Roads that are not properly decommissioned can alter hillside drainage; intercepting, diverting, and concentrating surface and subsurface flow, and increasing the drainage network of watersheds (Hauge et al. 1979, Wemple et al. 1996). This can lead to changes in peak and base flows in streams.*
- *Improperly maintained roads may still fail, causing a large amount of sediment to enter into watercourses.*
- *Culverts may block migration of anadromous salmonids, preventing adult access to spawning areas and restricting movement of juveniles between habitats.*

Response: The definition is just that, a statement of the meaning of a word or group of words used elsewhere in the rules, it is not an enforceable standard. The appropriate rules regarding enforceable standards associated with the abandonment of roads is 14 CCR 923.8 [943.8, 963.8]:

923.8, 943.8, 963.8 Planned Abandonment of Roads, Watercourse Crossings, and Landings [All Districts]

Abandonment of roads, watercourse crossings and landings shall be planned and conducted in a manner which provides for permanent maintenance-free drainage, minimizes concentration of runoff, soil erosion and slope instability, prevents unnecessary damage to soil resources, promotes regeneration, and protects the quality and beneficial uses of water. General abandonment procedures shall be applied in a manner which satisfies this standard and include the following:

- (a) Blockage of roads so that standard production four wheel-drive highway vehicles cannot pass the point of closure at the time of abandonment.
- (b) Stabilization of exposed soil on cuts, fills, or sidecast where deleterious quantities of eroded surface soils may be transported in a watercourse.
- (c) Grading or shaping of road and landing surfaces to provide dispersal of water flow.
- (d) Pulling or shaping of fills or sidecast where necessary to prevent discharge of materials into watercourses due to failure of cuts, fills or sidecast.
- (e) Removal of watercourse crossings, other drainage structures, and associated fills in accordance with 14 CCR 923.3(d). Where it is not feasible to remove drainage structures and associated fills, the fill shall be excavated to provide and overflow channel which will minimize erosion of fill and prevent diversion of overflow along the road should the drainage structure become plugged.

The Director may approve an exception to a requirement set forth in (b) through (e) above when such exceptions are explained and justified in the THP and the exception would provide for the protection of the beneficial uses of water or control erosion to a standard at least equal to that which would result from the application of the standard rule.

The above rule requires that surface erosion be minimized during and following the abandonment of a road. Where a road to be abandoned is near a watercourse, there may be chronic erosion associated with leaving the road in place, abandonment may result in a decrease in material being delivered to the watercourse.

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Complete closure of a road may not be physically possible. Horses and bicycles in particular as well as some of the all terrain vehicles (ATVs) available today can easily navigate areas where there have never been any roads. However, as seen in the rule language cited above, road and landings surfaces as well as fills and sidecast may be reshaped to promote drainage. Crossings are to be removed. This would also minimize the remaining level surface for travel by later users.

It should be noted that the majority of THPs are on private property, either owned by one or more citizens or by a commercial landowner. Most of these ownerships are not open to the public for recreation. What limited use by horses, bikes and off-road vehicles that might take place is generally done by trespassers and not encouraged by the landowner(s).

It is true that the definition does not require removal of all road features that may reroute hillslope drainage, restrict or confine stream flow, and/or present slope stability hazards (culverts, cross drains, inside ditches) but the provisions of the rule quoted above do. Likewise the stream crossing structures that may become degraded over time or may become perched, blocked, or wash out are also generally removed as per the rule quoted above.

The term of a THP is generally three years (five years maximum if extended). Once a plan has been completed a maintenance period begins. 14 CCR 914.6 [934.6, 954.6] (h) and (i) addresses this (emphasis added):

“(h) Waterbreaks or any other erosion controls on skid trails, cable roads, layouts, firebreaks, abandoned roads, and site preparation areas shall be maintained during the prescribed maintenance period and during timber operations as defined in PRC Sections 4527 and 4551.5 so that they continue to function in a manner which minimizes soil erosion and slope instability and which prevents degradation of the quality and beneficial uses of water. The method and timing of waterbreak repair and other erosion control maintenance shall be selected with due consideration given to the protection of residual trees and reproduction and the intent of 14 CCR 914 [934, 954].

(l) The prescribed maintenance period for waterbreaks and any other erosion control facilities on skid trails, cable roads, layouts, firebreaks, abandoned roads, and site preparation areas, shall be at least one year. The Director may prescribe a maintenance period extending as much as three years after filing of the work completion report in accordance with 14 CCR 1050.”

14 CCR 1050 also addresses the maintenance period:

“1050 Erosion Control Maintenance

(a) Where necessary to minimize soil erosion or slope instability or to prevent degradation of the quality and beneficial uses of water, the department may

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require that erosion controls be maintained prior to the beginning of a winter period and prior to filing of a work completion report.

- (b) The Director may deem completion report as described in PRC 4585 to have been filed upon the date of receipt if the department finds that all erosion controls have been constructed and maintained in compliance with the Forest Practice Rules upon the first inspection after receipt of the completion report. Otherwise, the Director shall accept a work completion report for filing only after the department finds that all erosion controls have been constructed in compliance with the Forest Practice Rules.
- (c) The LTO is responsible for proper construction, inspection and maintenance of erosion control during the prescribed maintenance period until the work completion report as described in PRC 4585 is approved by the Director. The landowner is responsible for inspection and any needed repair and maintenance of erosion controls during the remainder of the prescribed maintenance period. Responsibility for erosion control maintenance may be assumed at an earlier date by the landowner or can be delegated to a third party, provided that the assuming party acknowledges such responsibility in writing to the Director.
- (d) Upon approving a work completion report, the Director may prescribe a maintenance period which extends for as much as three years after filing the work completion report based on physical evidence (such as location of erosion controls in disturbed areas with high or extreme erosion hazard, on steep or unstable slopes, or within or adjacent to the standard width of a watercourse or lake protection zone) that erosion controls need to be maintained for the extended maintenance period in order to minimize soil erosion or slope instability or to prevent degradation of the quality and beneficial uses of water.
- (e) After approving the work completion report, the Director may extend the prescribed maintenance period for as much as three years after filing of the work completion report if subsequent inspections by the department during the prescribed maintenance period show that erosion controls have failed or are likely to fail to minimize soil erosion or slope instability or to prevent the degradation of the quality and beneficial uses of water."

It is the CDF's intent that all maintenance periods be three years in watersheds containing salmonid habitat. Since the listing of coho, all prescribed maintenance periods have been three years which is the extent allowed by the present statute.

Specific Concerns

895.1 Definitions

Canopy means the more or less continuous cover of branches and foliage collectively by the crowns of adjacent trees and other woody species.

Analysis

- *Under this definition, canopy could include understory trees and shrubs. Riparian overstory canopy provides shade to streams and regulates microclimate. Inadequate*

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overstory canopy left after timber harvesting could impact microclimate and water temperature.

Potential Biological Impacts

- *Overstory canopy is more effective at providing the protections from solar radiation, buffering microclimate, etc.*
- *Removal of riparian canopy can increase maximum stream temperatures and increase diel (sic) fluctuations (Beschta et al. 1987; Beschta et al. 1995).*
- *Increased water temperatures can obstruct adult migration and limit spawning success, trigger early juvenile outmigration resulting in decreased survival rates (Beschta et al. 1987), change juvenile sheltering behavior (Taylor 1988), reduce disease resistance, and increase metabolic requirements (Beschta et al. 1987).*
- *Loss of riparian canopy can also lead to increases in evaporation and convective exchanges (Brown 1969).*
- *Riparian vegetation provides the majority of the energy for the food web in heterotrophic systems by providing the allochthonous inputs supporting aquatic macroinvertebrates (Cummins et al. 1983).*
- *Removal of riparian vegetation also impacts air temperature due to changes in convection and evaporation (Ledwith 1996, Chen et al. 1995). Air and water temperatures are highly correlated, particularly during times of maximum daily temperatures (Sullivan et al. 1990).*

Response: As with the previous response, it should be noted that a definition is just that, a statement of the meaning of a word or group of words used elsewhere in the rules, it is not an enforceable standard. The appropriate rules regarding enforceable standards associated with canopy retention standards are found in 14 CCR 916.5 [936.5, 956.3](e), items “G”, “H”, and “I”. This code section was evaluated on pages 29-31 of the draft document and will not be repeated here. See the response to the discussion regarding 14 CCR 916.5 [936.5, 956.3] regarding the topic of canopy retention and monitoring.

Shade canopy retention has been monitored by CDF on completed harvest operations by field inspectors and audit inspectors. In a letter to the Executive Officer of BOF (Anthony, 1997) shade canopy on class I (fish bearing) watercourses was reported to average 82.6 percent. The measurements were taken using a canopy measuring instrument and represents percent of total shade covering the surface of the ground at the point of measurement. Similar results have been reported from preliminary data collected as part of the state’s Long Term Monitoring Program (LTMP). It is interesting to note these operations audited where completed before CDF issued their coho consideration document.

Specific Concerns

895.1 Definitions

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Late Succession Forest Stands means stands of dominant and predominant trees that meet the criteria of WHR class 5M, 5D, or 6 with an open, moderate or dense canopy closure classification, often with multiple canopy layers, and are at least 20 acres in size.

Analysis

- *Definition uses the California State Wildlife Habitat Relationship (WHR) classification to define “late successional”. A WHR class 5M equates to a stand with medium/large trees greater than 24” dbh with a minimum of 40% canopy cover. A forested stand exhibiting these characteristics will not, in many stream systems, provide adequate shade, microclimate regulation, bank and slope stability, and woody debris inputs to maintain properly functioning aquatic habitat.*

Potential Biological Impacts

- *Incorrect definition is misleading as to what stand conditions are appropriately considered “late successional”.*
- *Measurements of shade in old-growth forests reported canopy densities from 75% in northern California (Erman et al. 1977) to between 80 to 90% in western Washington (cited in Beschta et al. 1987). Removal of riparian canopy can increase maximum stream temperatures and increase diel (sic) fluctuations (Beschta et al. 1987; Beschta et al. 1995).*

Response: This definition is used to screen for stands with certain characteristics to allow specific wildlife protection measures to be applied. It is true that some stands which may receive the “late succession” classification may not exhibit all of the characteristics desired by any one group or agency or that would provide optimal habitat for all species dependent upon late succession forest stands.

See the response to the discussion regarding 14 CCR 916.5 [936.5, 956.3] and the topic of canopy retention and monitoring. Shade canopy retention has been monitored by CDF on completed harvest operations by field inspectors and audit inspectors. In a letter to the Executive Officer of the BOF (Anthony, 1997) shade canopy on class I (fish bearing) watercourses were reported to average 82.6 percent.

Once a stand has been identified as a late succession forest stand there are specific rules which must be applied. These rules allow for the protection of functional wildlife habitat. 14 CCR 919.16 [939.16, 959.16] addresses the protection of wildlife resources in late succession stands:

“919.16, 939.16, 959.16 Late Succession Forest Stands [All Districts]

- (a) When late succession forest stands are proposed for harvesting and such harvest will significantly reduce the amount and distribution of late succession forest stands or their functional wildlife habitat value so that it constitutes a significant adverse impact on the environment as defined in Section 895.1, the RPF shall provide habitat structure information for such stands. A statement of objectives over time shall be included for late succession forest stands on the ownership. The THP, SYP, or NTMP shall include a discussion of how the

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proposed harvesting will affect the existing functional wildlife habitat for species primarily associated with late succession forest stands in the plan or the planning watershed, as appropriate, including impacts on vegetation structure, connectivity, and fragmentation. The information needed to address this subsection shall include, but is not limited to:

- (1) – A map(s) showing A) late succession forest stands within the planning watershed and any other stands that provide functional wildlife habitat for species primarily associated with late succession forest stands that are on the ownership, B) those stands which are currently proposed to be harvested, and C) known stands on other ownerships.
 - (2) – A list of fish, wildlife and listed species known to be primarily associated with the late succession forest stands in the planning watershed(s) compiled by the RPF or supervised designee using the 'California Wildlife Habitat Relationships System' (WHR), the California Natural Diversity Database, and local knowledge of the planning watershed.
 - (3) – Description of functional wildlife habitat elements that are important for fish, wildlife and listed species primarily associated with late succession forest stands within the planning watershed(s).
 - (4) – A description of the structural characteristics for each late succession forest stand and any other stands that provide functional wildlife habitat for species primarily associated with late succession forest stands within the planning watershed including a discussion of important functional wildlife habitat elements identified in (3). Methods used to develop the description, which may be an ocular estimate, shall also be described.
 - (5) – A description of the functional wildlife habitat objectives, such as anticipated long-term landscape patterns, stand structure for late succession forest stands and any other stands that provide functional wildlife habitat for species primarily associated with late succession forest stands, and a discussion of anticipated recruitment procedures for important functional wildlife habitat elements. Coordination of functional wildlife habitat objectives on landscape features among ownerships within mixed-ownership planning watersheds is encouraged.
 - (6) – An analysis of the long-term significant adverse effects on fish, wildlife, and listed species known to be primarily associated with late succession forests.
- (b) Where timber operations will result in long-term significant adverse effects on fish, wildlife, and listed species known to be primarily associated with late succession forests in a THP, SYP, NTMP or planning watershed, feasible mitigation measures to mitigation or avoid such long-term significant adverse effects shall be described and incorporated in the THP, SYP, or NTMP. Where long-term significant effects cannot be avoided or mitigated, the THP, SYP, or NTMP shall identify the measures that will be taken to reduce those remaining effects and provide reasons for overriding concerns pursuant to 14 CCR Section 898.1(g), including a discussion of the alternatives and mitigation considered.
- (c) A THP, SYP, or NTMP submitter may request that the Director waive subsection(a) above. The Director, after conferring with review team agencies with

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jurisdiction, may waive subsection(a) above with substantial evidence is presented that would support a determination that post harvest late succession forest stands or functional wildlife habitat will continually provide adequate structure and connectivity to avoid or mitigate long-term significant adverse effects on fish, wildlife, and listed plant species known to be primarily associated with late succession forest stands within the planning watersheds.”

Specific Concerns

895.1 Definitions

Past Projects means previously approved, on-going, or completed projects which may add to or lessen impact(s) created by the THP. These generally include, but may not be limited to, projects completed within the last ten years.

Projects are activities which have the potential to cause a physical change in the environment, directly or ultimately, and that is: 1) undertaken by a public agency, or 2) undertaken with public agency support, or 3) requires the applicant to obtain a lease, permit, license, or entitlement from one or more public agencies.

Analysis

- *This definition is primarily used in the analysis of cumulative impacts. Although the definition of past projects does not, in theory, limit the scope of this analysis, in practice, analysis of past practices for purposes of determining cumulative impacts is constrained to the last 10 years even though impacts from historical activities may still be occurring.*
- *The term “projects” doesn’t include all activities. Projects, by this definition, are limited to actions that are carried out or otherwise permitted by an agency. This excludes current and past actions that have no agency involvement. Past actions that are still impacting the environment may be of particular concern, as there is less chance that these activities were permitted by an agency. By definition these activities need not be included in the analysis of cumulative effects.*

Potential Biological Impacts

The lack of a complete analysis of all past projects that may be contributing towards cumulative impacts may lead to an incorrect determination of cumulative watershed effects (CWEs). CWEs associated with forest practices and natural processes affect geomorphological processes and products in watersheds. Changes in inputs such as wood, water, sediment, and shade can impact biological communities through:

- *Changes in peak flows and the timing of discharge, which could alter aquatic habitat and interfere with migration.*
- *Higher sediment loading arising from erosion and mass wasting that fills pools and silts up gravels.*
- *Reductions in large organic debris recruited to channels, leading to habitat simplification, loss of pools, and unstable stream beds.*
- *Changes in water quality, including temperature, nutrient levels, and turbidity.*

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- *Changes subsurface flow and pressure, possibly leading to increased instability and mass wasting. (Berg et al. 1996; Bisson et al. 1992; Menning et al. 1996; Montgomery et al. 1995; Peterson et al. 1992; Reid 1993; Washington Forest Practices Board 1997)*

Response: This concern actually combined two definitions. The definition of Projects above is incomplete. An additional sentence in the definition is “This includes Timber Harvesting Plans.”

CEQA and its substantive criteria for the evaluation of a proposed project’s environmental impact apply to the evaluation of watershed resources. Within Technical Rule Addendum No.2 (an addendum to the FPRs) there is also a detailed section addressing the evaluation of watershed resources. Evaluation of the conditions listed in this section, as part of the cumulative impacts assessment, identify the impacts from past activities even if the activities themselves were not specified. That section states:

“A. WATERSHED RESOURCES – Cumulative watershed effects (CWEs) occur within and near bodies of water or significant wet areas, where individual impacts are combined to produce an effect that is greater than any of the individual impacts acting alone. Factors to consider in the evaluation of cumulative watershed impacts are listed below.

1. Watershed impacts shall be based on significant on-site and down-stream cumulative effects on the beneficial uses of water, as defined and listed in applicable Water Quality Control Plans.

2. Watershed effects produced by timber harvest and other activities may include one or more of the following: Sediment, Water temperature, Organic debris, Chemical contamination, Peak flow. The following general guidelines may be used when evaluating watershed impacts. ...

- a. Sediment Effects: ...
- b. Water Temperature Effect: ...
- c. Organic Debris Effects: ...
- d. Chemical Contamination Effects: ...
- e. Peak Flow Effects: ...

3. Watercourse Condition: The watershed impacts of past upstream and on-site projects are often reflected in the condition of stream channels in the project area. The following is a list of channel characteristics and factors that may be used to describe current watershed conditions and to assist in the evaluation of potential project impacts:

- Gravel Embedded – Spaces between stream gravel filled with sand or finer sediments. Gravel are often in tightly packed arrangement.
- Pools Filled – Former pools or apparent pool areas filled with sediments leaving few areas of deep or ‘quiet’ water relative to stream flow or size.
- Aggrading – Stream channels filled or filling with sediment that raises the channel bottom elevation. Pools will be absent or greatly diminished and gravel may be embedded or covered by finer sediments. Streamside vegetation may be partially

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or completely buried, and the stream may be meandering or cutting into its banks above the level of the former streambed. Depositional areas in aggrading channels are often increasing in size and number.

- Bank Cutting – Can either be minor or severe and is indicated by areas of fresh, un-vegetated soil or alluvium exposed along the stream banks, usually above the low-flow channel and often with a vertical or undercut face. Severe bank cutting is often associated with channels that are downcutting, which can lead to over-steepened banks, or aggrading, which can cause the channel to migrate against slopes that were previously above the high flow level of the stream.
- Bank Mass Wasting – Channels with landslides directly entering the stream system. Slide movement may be infrequent (single events) or frequent (continuing creep or periodic events).
- Downcutting – Incised stream channels with relatively clean, uncluttered beds cut below the level of former streamside vegetation and with eroded, often undercut or vertical banks.
- Scoured – Stream channels that have been striped of gravel and finer bed materials by large flow events or debris torrents. Streamside vegetation has often been swept away, and the channel has a raw, eroded appearance.
- Organic Debris – Debris in the watercourse can have either a positive or negative impact depending on the amount and stability of the material. Some stable organic debris present in the watercourse helps to form pools and retard sediment transport and downcutting in small to medium sized streams with relatively steep gradients. Large accumulations of organic debris can block fish passage, block or divert streamflow, or could be released as a debris flow.
- Stream-Side Vegetation – Stream-side vegetation and near-stream vegetation provide shade or cover to the stream, which may have an impact on water temperature, and provides root systems that stabilize streambanks and floodplains and filter sediment from flood flows.
- Recent Floods – A recent high flow event that would be considered unusual in the project area may have an impact on the current watercourse condition.”

CDF determines if the plan is accurate, complete and in proper order prior to filing. If enough information on the existing watershed condition was not found in the plan, at that point, it could be returned to the RPF and additional information requested prior to filing. At first review, additional information could also be requested of the RPF preparing the plan. If conditions were identified at the preharvest inspection that were not fully addressed in the plan, the reviewing agencies could request additional information at that point as well. Finally, at second review, if the reviewing agencies felt that the cumulative impacts had not been adequately addressed, additional information could be requested. If the reviewing agencies were still not satisfied that the cumulative impacts had been adequately addressed, there would be grounds to deny the plan under 14 CCR 898.2(c) which states that the Director shall disapprove a plan if (emphasis added); “There is evidence that the information contained in the plan is incorrect, incomplete or misleading in a material way, or is insufficient to evaluate significant environmental effects. ...” The information described in Technical Rule Addendum #2, above and beyond the simple listing of past projects, allows for the consideration of cumulative effects.

Specific Concerns

895.1 Definitions

Permanent Watercourse Crossing means a watercourse crossing that will be constructed to accommodate the estimated fifty-year flood flow and will remain in place when timber operations have been completed.

Analysis

- *Stream crossing design should incorporate the anticipated road life and use. The risk of flows exceeding flood design for a culvert should be considered. A 50-year flood flow design may not be adequate for long-term roads.*
- *Definition lack the requirement that the crossing does not alter the channel geometry, interfere with sediment transport, change the velocity of water, or block adult and juvenile fish passage if on a Class I stream. A crossing can accommodate a fifty-year flood flow without failing, yet still inhibit these other factors that are important to maintaining functioning habitat.*

Potential Biological Impacts

- *Stream crossings can restrict channel geometry. Restricted geometry can prevent or interfere with migration of adult and juvenile coho salmon and alter habitat both upstream and downstream of the constriction (Furniss et al. 1991).*
- *Undersized or blocked culverts can cause water ponding, rill-slope saturation, and road breaching (Chatwin et al. 1994).*
- *A 50-year culvert design does not guarantee that a culvert will not fail. Stream crossing design should account for the possibility of culvert failure from both overflow and plugging (Weaver and Hagans 1994).*
- *Crossings can be a source of sedimentation, especially if they fail or become plugged with debris causing debris torrents and significant cumulative impacts downstream (Furniss et al. 1991; Murphy 1995).*

Response: As with the previous responses, it should be noted that a definition is just that, a statement of the meaning of a word or group of words used elsewhere in the rules, it is not an enforceable standard. The appropriate rules regarding enforceable standards associated with watercourse crossing standards are found in 14 CCR 923.3 [943.3, 963.3]. This code section was evaluated on pages 41-42 of the draft document and will not be repeated here. See the response to the discussion regarding 14 CCR 923.3 [943.3, 963.3] regarding the topic of watercourse crossings.

It should be noted that 14 CCR 923.3 [943.3, 963.3] requires, “Drainage structures on watercourses that support fish shall allow for unrestricted passage of fish.” And “Permanent watercourse crossings and associated fills and approaches shall be constructed or maintained to prevent diversion of stream overflow down the road and to minimize fill erosion should the drainage structure become obstructed. ...”

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14 CCR 923.1(b) [943.1(b), 963.1(b)] states that, “New logging roads shall be planned in accordance with their classification and maintenance requirements.” Logging roads would include those crossings necessary in the system.

Furness (1991) recommends designing drainage structures to accommodate peak streamflow based on at least a 50-year-interval flood. Trying to design crossings that will never fail is likely doomed for failure. The use of the 50-year design criteria balances economic and resource protection. In addition, 14 CCR 923.3 requirements are there if the unforeseen happens.

Specific Concerns

895.1 Definitions

Prescribed Maintenance Period means the period during which erosion controls which are required and constructed as part of a timber operation must be maintained in a functional condition. The period shall not exceed three years.

Analysis

- *The definition limits maintenance for a maximum of three years. There is no accountability for road or landing failures after this period.*
- *Drainage structures, especially waterbars and culverts, need regular maintenance to properly function.*

Potential Biological Impacts

- *Roads that are not properly decommissioned can alter hillside drainage; intercepting, diverting, and concentrating surface and subsurface flow, and increasing the drainage network of watersheds (Hauge et al. 1979; Wemple et al. 1996). This can lead to changes in peak and base flows in streams.*
- *Improperly maintained roads may still fail, years after construction (Furniss et al. 1991).*

Response: While the regulations do not require accountability after the three year maintenance period, the three years was chosen because the chance of failure becomes much less likely. Roads that will be used continuously such as legacy and main haul routes will be maintained yearly because they will be under the use by a current THP.

Other sections of the FPRs require construction, reconstruction, and abandonment of roads and associated drainage structures to minimize maintenance requirements (discussed elsewhere in this document in greater detail). Temporary logging roads must be abandoned with self-maintaining erosion controls upon completion of timber operations. On seasonal logging roads, watercourse crossings must be removed and erosion controls installed before the beginning of each winter period during the period of timber operations and upon completion. Waterbars tend to stabilize over time if the road or skid trail is not in use. If in use, a permanent logging road is most likely used for other land management activities and/or other harvest plans. In the latter case, it would be subject to overlapping operational and prescribed maintenance periods. Most logging

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roads are on private property and not readily accessible to the general public after harvest operations have been completed.

See discussion in the response to 895.1 Definitions, Abandonment regarding the proper decommissioning of roads and requirements that reduce the potential for altering hillside drainage, intercepting, diverting, and concentrating surface and subsurface flow.

Specific Concerns

895.1 Definitions

Saturated Soil Conditions means 1) the wetness of the soil within a yarding area such that soil strength is exceeded and displacement from timber operations will occur. It is evidenced by soil moisture conditions that result in: a) reduced traction by equipment as indicated by spinning or churning of wheels or tracks in excess of normal performance, or b) inadequate traction without blading wet soil or, c) soil displacement in amounts that cause visible increase in turbidity of the downstream waters in a receiving Class I or II watercourse or lake. Soils frozen to a depth sufficient to support equipment weight are excluded. 2) soil moisture conditions on roads and landings, in excess of that which occurs from normal road watering or light rainfall that will result in the significant loss of surface material from the road and landings in amounts that cause visible increase in turbidity of the downstream waters in receiving Class I or II watercourse or lake.

Analysis

- *The term “visible increase in turbidity” of downstream waters is undefined. The qualitative assessment is difficult to make, particularly when streams are often already turbid from background sediment levels.*
- *Does not require anticipating saturated soil conditions. Indicators of saturated soil conditions include churning up soils, sliding (inadequate traction), soil displacement. By this point, significant damage may have already occurred.*

Potential Biological Impacts

- *Operation of equipment on wet soils (condition where moisture is higher than found during normal dust abatement treatments) can damage road surfaces, leading to increased erosion and sedimentation.*
- *Surface erosion from road systems deliver sediments to watercourses, diminishing pool quality and quantity, increasing turbidity, smothering coho salmon eggs and larvae, increasing gravel embeddedness, decreasing benthic invertebrate abundance, and disrupting social and feeding behavior (Cordone and Kelly 1961, Everest et al. 1987; Hicks et al. 1991; Kelsey et al. 1981; Lloyd et al. 1987; Megahan 1982)*

Response: Roads constructed as parts of plans are located, to the degree possible, where they will not have a significant impact on watercourses. Where significant impacts might occur, further review and mitigations are required. Existing and planned roads, if they are to be used during the winter months when saturated conditions are the most likely to occur, are required to be surfaced for wet weather hauling. In addition, RPFs are

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including a wet weather plan in the THP in response to the coho listing and the coho considerations document.

14 CCR 923.6 [943.6, 963.6] Conduct of Operations on Roads and Landings, includes reference to a indicator of saturated soil conditions and criteria for when operations may take place. The code section states (emphasis added):

“Routine use and maintenance of roads and landings shall not take place when, due to general wet conditions, equipment cannot operate under its own power. Operations may take place when roads and landings are generally firm and easily passable or during hard frozen conditions. Isolated wet spots on these roads or landings shall be rocked or otherwise treated to permit passage. However, operations and maintenance shall not occur when sediment discharged from landings or roads will reach watercourses or lakes in amounts deleterious to the quality and beneficial uses of water. This section shall not be construed to prohibit activities undertaken to protect the road or to reduce erosion.”

The “visible increase in turbidity” was added to the rules as a guide to the timber operator. It is best used in the early portion of storms and as the waters begin to recede. During these times an increase in turbidity can be seen and operations are to cease.

Specific Concerns

895.1 Definitions

Watercourse or Lake Transition Line means that line closest to the watercourse or lake where riparian vegetation is permanently established.

Analysis

- *Definition does not consider and compensate for potential future migration of the watercourse. This is particularly important in the valley bottoms with wide floodplains where streams are very sinuous.*
- *Definition does not incorporate low flow channels and remnant channels that may not be watered at the time the measurement is taken.*
- *Definition does not further define “riparian vegetation”; small willows in the middle of an otherwise barren floodplain could be used to delineate the watercourse and lake transition line.*

Potential Biological Impacts

- *Over time, stream channels can migrate within their floodplain or reoccupy older channels. Incorrect identification of the actual edge of the functioning stream system (including migratory path, low flow, and relict channels) may lead to inadequate riparian buffer protections or permit forest management activities within the channel migration zone that could negatively impact aquatic resources. These resources include off-channel rearing habitat, streambank stability, LWD, and shade-providing canopy.*

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- *Loss of riparian vegetation may destabilize streambanks, leading to a loss of cover along the edge of stream channels, increased fine sediment deposition, increased stream width, and reduced stream depth (Hicks et al. 1991).*

Response: The definition does not rely on the watercourse or lake being watered at the time the measurement is taken. The key phrase is “riparian vegetation” for establishing this line. Riparian vegetation is likely to be present over much of valley bottoms with wide floodplains where streams are very sinuous and in low flow or remnant channels where water may not be present. In addition, low flow or remnant channels would be likely to show evidence of being wet at some portion of the year, requiring some form of protection.

Wide valley bottoms with wide floodplains where streams are very sinuous and migration of the channel is common generally have a wide expanse of gravel, cobbles or other loose material and do not support mature trees over much of the floor of the valley due to the mobile nature of the substrate. The transition line here would be where the vegetation is established at the edge of this mobile material, and there would likely be little conifer within this floodplain. Where conifers grow within the floodplain, Watercourse and Lake Protection Zones (WLPZ) protections will assure retention of forest conditions. Should the stream migrate so will future WLPZs.

The transition line is used as the starting point for protection zones that move even further from the watercourse. Two hundred feet from the watercourse transition line of federal or state designated wild and scenic rivers is the special treatment area designated by the rules (14 CCR 895.1). 14 CCR 916.4(b)(3) [936.4(b)(3), 956.4(b)(3)] addresses the measurement of the WLPZ and the possibility of an absence of riparian vegetation:

“The width of the WLPZ shall be measured along the surface of the ground from the watercourse or lake transition line or in the absence of riparian vegetation from the top edge of the watercourse bank.”

14 CCR 916.4(b)(5) [936.4(b)(5), 956.4(b)(5)] allows for a wider zone under certain conditions, one of which is hydrologic considerations:

“If requested by either party, and after on-the-ground inspection, the RPF and the Director may increase or decrease the width of a proposed WLPZ. A decrease shall not exceed 25 percent of the width as determined by the procedure prescribed in Sections 14 CCR 916.4(c) [936.4(c), 956.4(c)], and 916.5 [936.5, 956.5]. Such changes in zone width shall be based on considerations of soil, slope, climatic factors, biologic, hydrologic, and geologic values listed in Section 14 CCR 916.4(b) [936.4(b), 956.4(b)], silvicultural methods, yarding systems, road location, and site preparation activities. In no case shall the width be adjusted to less than 50 feet for Class I and II waters. Where soil surfaced roads exist within the standard WLPZ, no in-lieu reduction of WLPZ width shall be approved.”

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14 CCR 916.4 (a), 936.4(a), 956.4(a) address this issue by requiring the RPF to identify and propose mitigation for floodprone areas and changeable channels. Elsewhere in the rules, the transition line is used to describe where remedial measures are required during harvest operations. 14 CCR 916.3 (a), (b) [936.3(a),(b), 956.3(a),(b)] state:

“The quality and beneficial uses of water shall not be unreasonably degraded by timber operations. During timber operations, the timber operator shall not place, discharge, or dispose of or deposit in such a manner as to permit to pass into the water of this state, any substances or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, or the quality and beneficial uses of water. All provisions of this article shall be applied in a manner which complies with this standard.

- (a) When there is reasonable expectation that slash, debris, soil, or other material resulting from timber operations, falling or associated activities, will be deposited in Class I and Class II waters below the watercourse or lake transition line or in watercourses which contain or conduct Class IV water, those harvest activities shall be deferred until equipment is available for its removal, or another procedure and schedule for completion of corrective work is approved by the director.
- (b) Accidental depositions of soil or other debris in lakes or below the watercourse or lake transition line in waters classed I, II, and IV shall be removed immediately after the deposition or as approved by the director.”

While “riparian vegetation” is not a specific definition in the FPRs, this type of vegetation is alluded to in the definition of “Riparian” in 14 CCR 895.1; “Riparian means the banks and other adjacent terrestrial environs of lakes, watercourses, estuaries, and wet areas, where transported surface and subsurface freshwaters provide soil moisture to support mesic vegetation.”

Off-channel rearing habitat would be classified as class I watercourses, due to the presence of fish, and would be provided the appropriate protections.

Specific Concerns

895.1 Definitions

Winter Period means the period between November 15 to April 1, except for purposes of installing drainage facilities and structures, waterbreaks and rolling dips in which case the period shall be October 15 to May 1.

Analysis

- *The definition of winter period is based on a calendar date, not normal rainfall patterns. The definition may be adequate in some areas, not adequate in others. Particularly in the Coastal District, significant precipitation often occurs earlier and continues later than the defined winter period. A potential exists that proper erosion control measures will not be in place, or will be removed too early.*

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- *Under the definition, stream crossing construction or other sediment-causing activities could occur in the spring before juveniles emerge from the gravel (as late as May or June in some areas).*
- *By defining a specific winter period, the rule ties certain practices to a specific time of year, rather than to environmental conditions, such as a significant rainfall event, which could occur at any time during the year*

Potential Biological Impacts

- *Operation of equipment on wet soils (condition where moisture is higher than found during normal dust abatement treatments) can damage road surfaces, leading to increased erosion and sedimentation.*
- *Mulching, reseeding, and slope protection can minimize surface erosion. Lack of such protective measures may lead to increased sedimentation in stream systems during wet weather.*
- *Surface erosion from road systems deliver sediments to watercourses, diminishing pool quality and quality, increasing turbidity, smothering salmonid eggs larvae, increasing gravel embeddedness, decreasing benthic invertebrate abundance, and disrupting social and feeding behavior (Cordone and Kelly 1961, Everest et al. 1987; Hicks et al. 1991; Kelsey et al. 1981; Lloyd et al. 1987; Megahan 1982).*
- *Fry emergence is inhibited by excessive fine sediments that can trap fry in gravel (Phillips et al. 1975).*

Response: The calendar dates used for the winter operating period have been derived from normal rainfall patterns. However, as with the WLPZ widths in the section above, the rules do allow for additional restrictions if there is a potential for significant environmental damage. In a mass mailing to all RPFs regarding “Coho Salmon Considerations for Timber Harvesting under the California Forest Practice Rules” on April 29, 1997, CDF recommended that RPFs include special measures within their plans:

“At any time of year, rain in significant amounts striking exposed soil can erode soil particles into watercourses unless drainage features are operative. This is true whether the exposed soil is in the WLPZ or outside but where the runoff can reach a watercourse. Because many sediment control measures should be triggered by significant rain, the THP should define it in enforceable terms. The definition should be based on:

- Preventing elevated runoff and sediment to watercourses, and
- The features (usually roads) of the THP most responsive, in terms of water runoff and erosion, to precipitation.

A possible definition of significant rain could be 0.5 in. rain in a 24 hour period as forecast by the US Weather Service.”

“The RPF should write a wet weather road use plan to guide the actions of the timber operator before, during and shortly after periods of precipitation. It should address road use that is capable of altering the surface including site preparation. The plan should consider the condition of the buffer between roads and watercourses within and appurtenant to the THP (width, slope, and post-harvest filtering capacity), the

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condition of the road (grade, soil type, surfacing, and level of use following completion of harvest), and the ability of the road as designed and operated to deliver sediment and elevate water discharge into coho habitat. At a minimum, the road use plan might discuss the following for maintaining water quality:

- weather, road surface, and drainage conditions that would result in suspension of road use. For example, this could occur when a certain amount of precipitation has been measured at a nearby weather station;
- stabilization techniques and specifications for road surfaces, drainage facilities that may be constructed, and drainage structures which may be installed. The circumstances which would cause the stabilization treatments to be applied should be described; and
- maintenance methods for drainage facilities and structures. The circumstances which would cause the maintenance practices to be applied should be described.”

14 CCR 914.6 [934.6, 954.6](a) and (b), Waterbreaks states; “All waterbreaks shall be installed no later than the beginning of the winter period of the current year of timber operations...” and “Waterbreaks shall be constructed concurrently with the construction of firebreaks and immediately upon conclusion of use of tractor roads, roads, layouts, and landings which do not have permanent and adequate drainage facilities, or drainage structures.” At any given time of the year, only the area currently being harvested should be in need of drainage structures if a significant rainfall event were to occur. Half an inch of rain during the summer when soils can accommodate the moisture would be different than the same half an inch of rain when the soils are already at field capacity [saturated]. (Half an inch in half an hour is different than half an inch in a day.)

Stream crossing construction, especially in a watercourse where salmon have spawned, would require a permit from DFG. The emergence of juveniles from the gravels would be considered.

14 CCR 915.1 [935.1, 955.1](b) states; “Heavy equipment shall not be used for site preparation under saturated soil conditions or when it cannot operate under its own power due to wet conditions.” This is regardless of the time of year.

14 CCR 923, 943, 963 (emphasis added) states “All logging roads and landings in the logging area shall be planned, located, constructed, reconstructed, used, and maintained in a manner which: is consistent with long-term enhancement and maintenance of the forest resource; best accommodates appropriate yarding systems, and economic feasibility; minimizes damage to soil resources and fish and wildlife habitat; and prevents degradation of the quality and beneficial uses of water.” This allows CDF the latitude to request wet weather road use plans if a road or roads within a plan area is in a position that use during unseasonable rainfall periods could result in harmful amounts of sediment reaching anadromous fish (freshwater shrimp, red-legged frog, southern torrent salamander, etc.,) bearing waters.

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Specific Concerns

898 Feasibility Alternatives

After considering the rules of the Board and any mitigation measures proposed in the plan, the RPF shall indicate whether the operation would have any significant adverse impact on the environment. On TPZ lands, the harvesting per se of trees shall not be presumed to have a significant adverse impact on the environment. If the RPF indicates that significant adverse impacts will occur, the RPF shall explain in the plan why any alternatives or additional mitigation measures that would significantly reduce the impact are not feasible.

Cumulative impacts shall be assessed based upon the methodology described in Board Technical Rule Addendum Number 2, Forest Practice Cumulative Impacts Assessment Process and shall be guided by standards of practicality and reasonableness. The RPF's and plan submitter's duties under this section shall be limited to closely related past, present and reasonably foreseeable probable future projects within the same ownership and to matters of public record. The Director shall supplement the information provided by the RPF and the plan submitter when necessary to insure that all relevant information is considered.

Analysis

- Assessment is done for project impacts only. No consideration is given to whether existing watershed conditions are significantly impacted or past cumulative impacts have occurred.*
- RPF makes the decision and justifies if additional measures are not feasible, based on his/her assessment of cumulative impacts. Public and agency input often over-ruled.*
- If watershed already has significant cumulative impacts due to past practices, storm events, or other factors, additional management (including but not limited to road building and clear cuts) can occur as long as the THP does not add additional significant cumulative impacts.*
- Mitigations can include fixing problems not directly related to the THP, for example providing mitigation for a failing road or landing from a past plan. Thus fixing a problem created by past management does not occur unless continued harvesting is permitted. Mitigations are not developed that address the existing condition of the watershed and past impacts.*

Potential Biological Impacts

Impacts of cumulative watershed effects on fisheries resources and aquatic communities include:

- Changes in peak discharge, discharge variance, low-flow discharge, and seasonal runoff distribution that can result in scour of redds, inaccessibility, changes in food resources and aquatic communities.*
- Changes in channel morphology, including changes in substrate and habitat complexity, that can impact spawning gravels and rearing habitat.*
- Changes in water temperature that can impact growth rates.*

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- *Changes in other water quality parameters, including sediment loading and forest chemicals that impact fish and aquatic communities.*
- *Changes in food resources from impacts to in-stream habitat and adjacent riparian disturbance. (Reid 1993, Menning et al. 1996, Berg et al. 1996, Peterson et al. 1992, Bisson et al. 1992).*

Response: See response to 895.1 Definitions - Past Projects, the current condition of the watershed is considered using the CEQA and its substantive criteria for the evaluation of a proposed project's environmental impact and Technical Rule Addendum #2. The condition of the watershed (using criteria such as Sediment Effects, Water Temperature Effect, Organic Debris Effects, Chemical Contamination Effects, Peak Flow Effects in general and Gravel, Pools Filling, Aggrading, Bank Cutting, Bank Mass Wasting, Dencutting, Scouring, Organic Debris, Stream-Side Vegetation, and Recent Floods in particular) requires extensive consideration to whether existing watershed conditions are significantly impacted and whether past cumulative impacts have occurred.

CDF is not bound by the decision and justification provided by the RPF regarding the assessment of cumulative impacts. 14 CCR 898.1, Review of Plan by Director, states (emphasis added):

- "(a) In reviewing plans, the Director shall apply all applicable rules promulgated by the Board.
- (b) In reviewing plans, the Director shall disapprove all plans which:
- (1) Do not incorporate feasible silvicultural systems, operating methods and procedures that will substantially lessen significant adverse impacts on the environment.
 - (2) Would not meet the requirements of individual rules which provide a range of feasible alternatives through which to carry out the intent of the Act.
 - (3) Meet the special conditions for disapproval set by the Board in 14 CCR 898.2.
- (c) If the Director, before the public comment period has ended, finds a plan cannot be approved without a change in the conduct of timber operations, the Director shall, consistent with the rules and procedures adopted by the Board, communicate with the preparer of the plan, explain any probable causes for disapproval and suggest possible mitigation measures. The preparer of the plan shall then have the opportunity to respond to the Director and provide appropriate mitigation measures prior to the end of the public comment period. Any significant changes (as described in 1036(b), except as covered in 1040, in the conduct of a timber operation made between the close of public comment and the date of the Director's decision will require returning the plan to the review team and reopening the public comment period for ten working days. Public members who participated in the review of the plan will be notified of the significant changes in the conduct of the timber operation and the reopening of the comment period.
- (d) If the Director disapproves a plan, the Director shall, consistent with the rules and procedures adopted by the board, provide to the preparer of the plan written reasons for disapproval.

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(e) If the Director finds no feasible, less-damaging alternatives that conform with the rules, the Director shall approve such plan unless approval threatens to cause immediate, significant, and long-term harm to the natural resources of the state. In the even of such a threat, the Director shall withhold decision on the plan and shall follow procedures developed by the Board pursuant to PRC 4555. ...”

Also, as stated in the response to General Concerns, if an agency has a recommendation that the review team chairperson did not include in the final draft of recommendations, there are measures that agency can take. The first action that can be taken is to file a non-concurrence. This is described in 14 CCR 1037.5(e). See response to General Concerns for the text of this rule section. A higher level of action that can be taken by the State Water Resources Control Board or the Director of DFG would be a Head of Agency Appeal, 14 CCR 1056.

See other responses regarding specific protective measures found in the rules for the protection of fisheries resources and aquatic communities. It should be noted that the changes listed under Potential Biological Impacts need not be negative. A mitigation which “fixes” a problem, whether directly related to the harvest plan or not, may result in improvement in the quality of the substrate, habitat complexity, water temperatures, sediment loading, and food resources.

Specific Concerns

912.5 Procedure for Estimating Surface Soil Erosion Hazard Rating [Coast]

A proposed plan shall show the estimated erosion hazard ratings of the plan area, by areas, down to 20 acres (8.1 ha) if such a breakdown will change the estimated erosion hazard of individual areas. The plan shall show high and extreme erosion hazard ratings, by areas, down to 10 acres if such a breakdown will change the erosion hazard of the individual areas. Specific erosion hazard areas not fitting the above minimum will be considered independently and protective measures commensurate with the problem applied. These measures are covered in Chapter 4, Subchapter 4 of Title 14 CCR.

To estimate the erosion hazard rating of any plan or portion thereof, the RPF or supervised designee shall follow the procedures and requirements contained in Board Technical Rule Addendum #1, dtd. February 1, 1990. Approximate weights for the factors in the Estimated Surface Soil Erosion Hazard, Form I, in the Addendum, shall be calculated and the factors shall be summed to five the rating. A copy of the calculations from Form I shall be attached to the Timber Harvesting Plan.

Analysis

- *The methodology is simplistic and subjective but if used conservatively may serve as a tool for estimating erosion hazards. Ranges for various categories are broad and subject to interpretation by the RPF.*
- *Unstable slopes are not addressed by this methodology.*

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- *The methodology does not account for alteration of drainage area due to the type of harvest operation conducted.*
- *The methodology allows dead vegetation (slash, stumps, duff) to be counted toward the protective vegetative cover. Dead vegetation can disrupt overland flow but may not prevent sediment delivery associated with rilling or gullying (Marron et al, 1995).*

Potential biological impacts

- *Surface erosion and mass wasting deliver sediments to watercourses that can result in gravel embeddedness, pool filling aggradation, bank cutting, bank mass wasting, and temperature changes (Hagans et al. 1986).*
- *Chronic inputs of fine sediments can reduce intergravel flow in spawning gravels and entomb alevins, and may reduce interstitial spaces in cobble that juvenile salmonids use as winter cover (Chabmerlin et al. 1991).*
- *Yarder trails and skid trails can alter drainage patterns and enhance gully formation (Marrion et al. 1995).*
- *Increases in turbidity and suspended sediment can interfere with normal feeding by salmonids and cause gill damage (Hicks et al. 1991).*

Response: This rule provides the direction for determining the erosion hazard ratings which are required to be included in the plan. The rule refers to Board Technical Rule Addendum #1. While some level of subjectivity is present in the rating system, the Technical Rule Addendum contains very specific direction for determining soil texture, detachability and depth to restrictive layer or bedrock. Surface coarse fragments including rocks or surface stones, slope factor, and vegetative cover are factors that can be measured or estimated with little difficulty and do not need expansive explanation. The rainfall intensity value is derived from maps provided in the Technical Rule Addendum, maps taken from Technical Paper No. 28, U.S. Weather Bureau, or can be derived from more localized information if available.

Although the Erosion Hazard Rating (EHR) methodology can be described as simplistic, and results are subjective, all the major factors causing and resisting surface erosion have been considered and the rating can be expected to perform as well as other similar systems used for the same purpose.

The EHR rating is designed to indicate potential hazards of both sheet erosion, and rill or gully erosion from more concentrated flows on roads and skid trails.

“Dead vegetation” serves to both break up raindrop impact and retard surface flow. This prevents the initiation of surface erosion, maintains high infiltration rates to minimize or prevent surface runoff by preventing surface soil sealing, and greatly reduces sediment transport capacity through reduced surface flow volume and velocity. Such surface cover is widely recognized as the most important factor in preventing surface erosion.

During the initial review of the plan, the math on the EHR is checked and obvious inconsistencies questioned. For many counties in California, the Soil Conservation Service has prepared Soil Surveys which often contain ranges of values for several of the

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factors (detachability, permeability and depth to restrictive layer) for the soil types shown on the maps which are also found in the documents. This allows for an office comparison of the figures calculated by the RPF and likely values for the soil types in the plan area. If a plan is determined to need a PHI, the EHR is generally evaluated in the field.

The rating is used in the plan, as per various FPRs, to guide the spacing of waterbars, limit tractor operations on certain slopes, etc. The rating is not the final word and is not intended to address mass wasting. It is used for general considerations over the bulk of the plan area, on the stable slopes. For example, 14 CCR 914.6 [934.6, 954.6] Waterbreaks states in subsection (c) "The appropriate waterbreak spacing shall be based upon the erosion hazard rating and road or trails gradient." But qualifies that in section f) with "Where waterbreaks cannot effectively disperse surface runoff, including where waterbreaks on roads and skid trail cause surface run-off to be concentrated on downslopes, roads or skid trails, other erosion controls shall be installed as needed to comply with Title 14 CCR 914 [934,954]." 14 CCR 914.2 [934.2, 954.2](i), Tractor Operations [All Districts], states "Where waterbreaks cannot effectively disperse surface runoff, other erosion controls shall be installed as needed."

Unstable areas are addressed in 14 CCR 914.2 [934.2, 954.2] Tractor Operations [All Districts], subsection (d); "Heavy equipment shall not operate on unstable areas. If such areas are unavoidable the RPF shall develop specific measures to minimize the effect of operations on slope instability. These measures shall be explained and justified in the plan and must meet the requirements of 14 CCR 914 [934, 954]."

Specific Concerns

912.9, 932.9, 952.9 Cumulative Impacts Assessment Checklist [All Districts]

STATE OF CALIFORNIA BOARD OF FORESTRY CUMULATIVE IMPACTS ASSESSMENT

- (1) *Do the assessment area(s) of resources that may be affected by the proposed project contain any past, present or reasonably foreseeable probable future projects? Yes ___ No ___ If the answer is yes, identify the project(s) and affected resource subject(s).*
- (2) *Are there any continuing, significant adverse impacts from past land use activities that may add to the impacts of the proposed project? Yes ___ No ___ If the answer is yes, identify the activities and affected resource subject(s).*
- (3) *Will the proposed project, as presented, in combination with past, present, and reasonably foreseeable probable future projects identified in items (1) and (2) above, have a reasonable potential to cause or add to significant cumulative impacts in any of the following resource subjects?*

Analysis

- *Cumulative impacts assessment as described in the FPRs has good intent and addresses most of the issues of concern using a flexible approach. However the*

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analysis and results are open to interpretation by the RPF or supervised designee, and lack repeatable objective, quantitative approaches.

- *Consistent, accurate and quantitative information is not always provided to track habitat parameters through time. This information includes (but is not limited to) aerial photographs, fish habitat and channel condition data, fish density, location and extent of unstable areas and landslides.*
- *The assessment does not discuss appropriate landscape scales for assessment of cumulative watershed effects (CWE's). Planning watersheds may be appropriate by larger spatial scales should also be considered.*
- *The assessment does not incorporate the appropriate time scales for assessment of CWEs. Impacts from past practices may linger longer than 10 years.*
- *Mitigations for CWEs do not depend on the degree of past impacts, and often perpetuate the CWE problem by only mitigating for the site-specific impacts associated with the THP.*
- *Mitigations for CWEs are not necessarily based upon alleviating the impact from the CWE. Best Management Practices, off-site mitigation, and similar mitigations may not be the appropriate mitigation for the particular CWE.*
- *CWEs and resource degradation are often due to accumulation of small impacts from disturbances that often accumulate over long temporal and large spatial scales. This mismatch between the scale of management and the scale of impacts make assessment and management of CWEs difficult.*
- *Impacts to a watershed due to small increments of change are particularly difficult to measure.*
- *In many cases, by the time CWEs are apparent the damage is irreversible or recovery will take a long time.*
- *CWEs can result from changes in dominant watershed processes.*
- *CWEs do not take into account the condition of current fish habitat in watersheds relative to what the habitat potential is for listed salmonids.*

Potential Biological Impacts

CWEs associated with forest practices and natural processes affect geomorphic products and processes in watersheds. Changes in geomorphic inputs (wood, water, sediment, removal of shade) alter stream channels in measurable ways. In turn, these changes can have impacts on the biological communities inhabiting them, including but not limited to:

- *Changes in peak flows and timing of discharge that affect fish habitat.*
- *Higher sediment loading arising from erosion and mass wasting that cause pool filling or gravel siltation.*
- *Reductions in large organic debris recruited to channels that can result in fewer pools and unstable stream beds,*
- *Changes in stream temperatures, nutrient levels, and turbidity.*
- *Changes to subsurface flow and pressure, possibly leading to increased instability and mass wasting. (Reid 1993; Menning et al. 1996; Berg et al. 1996; Peterson et al. 1992; Bisson et al. 1992; Washington Forest Practices Board 1997, Montgomery et al. 1995).*

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Response: There have been many methods developed to assess cumulative impacts. None of these methods is perfect. A strictly empirical approach cannot succeed because too many land-use activities can combine in too many ways and affect too many potential resources and values. A simple example would be: the effect of sediment from a road on a ridge is much different than if the road were in the stream bottom. The amount of disturbed surface cannot be used as an adequate measure of effect. The checklist format used in THPs relies on the user's expertise, experience and professional judgment, so results are not necessarily reproducible. (Reid, 1991) This is why the rules give CDF, WQ, DFG and DMG the opportunity to review the completed checklist and supporting information. The checklist has significant advantages over other quantitative cumulative analysis methods. It is flexible, requiring assessment of more than one type of impact from more than one type of mechanism. For example, the checklist considers not just the relationship between equipment use and sediment or peak flow changes on streams, like many models, but also stream cover and water temperature relationships, equipment's effects on compaction, effect of harvest on snags and so on. It also allows evaluation of accumulating impacts and recognizes changes in harvesting. Note that logging prior to the FPRs used practices not permitted today and the land is left with the legacy of these practices.

RPFs use a large volume of information in making their determinations. This information includes aerial photographs, soils maps, soil erosion hazard rating, wildlife surveys, and the scientific literature. This has been combined with years of experience and repeated examination of the THP and other areas to assess operational results.

Although the rules require a list of past projects for a period of ten years, the analysis of existing conditions reveals the effects of impacts without regard to the time of creation. Contrary to expressed concerns about production of cumulative impacts by the accumulation of small impacts, which are presumably not addressed by site specific mitigations, watersheds where cumulative impacts are clearly expressed, such as Redwood Creek, have experienced large increases in erosion from clearly identifiable sources caused by pre-rule practices that are no longer permitted.

In many cases, the THP has been submitted by a property owner who has no control over any property other than that where the THP has been filed. In these cases, mitigation of site-specific impacts associated with the THP or the plan area in general is all that can be accomplished. In addition to mitigation of direct THP impacts, potential cumulative impacts are addressed by the use of off-setting mitigation of existing problem sites both on and off the THP area. For large industrial timberland owners there are generally road maintenance plans, agreements with DFG or local habitat restoration groups, habitat conservation plan(s) or other things in place that address reduction of cumulative impacts either directly or indirectly on a watershed or larger basis.

Current in-stream conditions are considered as the basis for determining potential cumulative impacts of proposed operations on beneficial uses.

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Specific Concerns

913.1, 933.1, 953.1 Regeneration Methods Used in Evenaged Management [All Districts; except variances in (a)(4)(A) and (d)(3) Shelterwood Removal Step]

The following types of regeneration methods are designed to replace a harvestable stand with well spaced growing trees of commercial species. Evenaged management systems shall be applied with the limitations described by this rule:

(a) Timber stands harvested under an evenaged regeneration method shall meet the following standards:

- (1) Where a regeneration step harvest of evenaged management will occur on stands younger than 50 years of age for Class I lands, 60 years of age for Class II and III lands, or 80 years of age for Class IV and V lands, or equivalent age of trees, based on height as determined according to the appropriate site class, the RPF preparing the THP or SYP must demonstrate how the proposed harvest will achieve MSP pursuant to Section 913.11(a) or (b) provided, however, that the Director may grant an exemption from this section based on hardship.
- (2) The regeneration harvest of evenaged management shall be limited to 20 acres for tractor yarding. Aerial or cable yarding may be 30 acres. Tractor yarding may be increased to 30 acres where the EHR is low and the slopes are <30%. The RPF may propose increasing these acreage limits to a maximum of 40 acres, and the Director may agree where measures contained in the THP provide substantial evidence that the increased acreage limit does any one of the following:
 - (A) by using additional on-site mitigation measures, reduces the overall detrimental effects of erosion thereby providing better protection of soil, water, fish and/or wildlife resources; or
 - (B) provides for the inclusion of "long corners"; or
 - (C) create a more natural logging unit by taking maximum advantage of the topography; or
 - (D) will increase long-term sustained yield; or
 - (E) provide feasible off-site mitigation measures that can be incorporated in the plan to restore or enhance previously impacted resource areas or other environmental enhancements that will result in demonstrable net environmental benefits within the planning watershed. These measures may include, but are not limited to watercourse restoration, soil stabilization, road surface stabilization, road outsloping, road abandonment, road reconstruction, enhancement of wildlife habitats and vegetation management. To qualify for an exemption the plan submitter is not required to demonstrate that other feasible options are not available.
- (1) Evenaged regeneration units within an ownership shall be separated by a logical logging unit that is at least as large as the area being harvested or 20 acres, whichever is less, and shall be separated by at least 300 ft. in all directions.
- (2) Within ownership boundaries, no logical logging unit contiguous to an evenaged management unit may be harvested using an evenaged regeneration method unless the following are met:

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(A) [Coast] The prior evenaged regeneration unit has an approved report of stocking, and the dominant and codominant trees average at least five years of age or average at least five ft. tall and three years of age from the time of establishment on the site, either by the planting or by natural regeneration. If these standards are to be met with trees that were present at the time of the harvest, there shall be an interval of not less than five years following the completion of operations before adjacent evenaged management may occur.

(A) [Northern and Southern] The prior evenaged regeneration unit has an approved report of stocking, and the dominant and codominant trees average at least five feet tall, or at least five years of age from the time of establishment on the site, either by the planting or by natural regeneration. If these standards are to be met with trees that were present at the time of the harvest, there shall be an interval of not less than five years following the completion of operations before adjacent evenaged management may occur.

- (3) Except for the clearcut method, all trees to be harvested or all trees to be retained shall be marked by, or under the supervision of, an RPF prior to felling operations. A sample area shall be marked prior to a preharvest inspection. The sample area shall include at least 10% of the harvest area up to a maximum of 20 acres per stand type, and must be representative of the range of conditions present in the area. The marking requirement may be waived by the Director if the trees to be harvested are easily distinguished from the trees to be retained, when explained and justified by the RPF in the plan.*
- (4) Special consideration for aesthetic enjoyment shall be given to selection of silvicultural treatments and timber operations within 200 feet of the edge of the traveled surface of any permanent road maintained by the County, or the State.*
- (5) Special consideration for aesthetic enjoyment and protection of adjacent stand vigor shall be given to the selection of silvicultural methods and timber operations within 200 feet of adjacent non-federal lands not zoned TPZ.*

Analysis

- Allows clearcutting up to 40 acres, but does not require an analysis of the mass wasting potential within a unit before determining the appropriate unit size or before determining if clearcutting is an appropriate harvesting method.*
- The actual criteria used to allow increased clearcut harvest acreage is poorly defined.*
- Mitigation for increased acreage is not necessarily based upon alleviating the impact from increased unit size. Off-site mitigation may not be appropriate and do not necessarily provide and equivalent level of protection.*
- Restoring previously impacted resources as mitigation for increased unit size only perpetuates an impacted watershed condition, rather than actually improving the condition. Under this rule, current impacts can be mitigated by fixing past mistakes, a scenario which does not encourage proper management up front.*
- The rule allows regeneration units to be close both physically (300 ft) and temporally (5 years).*

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Potential biological Impacts

- *Landslides can originate on clearcut slopes when the root strength that is maintaining soil stability is lost after trees are cut. Additionally, loss of protective vegetative cover can increase erosion and decrease soil stability, Swanston et al. (1980) found that the size and location of planned clearcuts, and subsequent treatments, greatly influence the occurrence of mass movements.*
- *Clearcutting can increase the probability of mass wasting events. Chamberlin et al (1991) reported that Ice (1985) found clearcutting increased mass soil movement from 2 to 4 times in Oregon and Washington, Howes (1987) recorded an increase of up to 6.6 times in the Coast Mountains of British Columbia, and Rood (1984) found mass wasting increased 31 times in the Queen Charlotte Islands.*
- *The cumulative impact of numerous regeneration harvests in close proximity to each other and within a relatively short amount of time may lead to changes in geomorphic inputs such as wood water, and sediment. These changes can impact anadromous salmonids and their habitat through changes in peak flows and timing of discharge, higher sediment loads causing pool filling and gravel imbeddedness, reductions in large organic debris resulting in channel simplification and unstable stream beds, changes in water quality, and changes to subsurface flow and pore pressure, possibly leading to increased slope instability (Reid 1993; Menning et al. 1996; Berg et al. 1996; Peterson et al. 1992; Bisson et al. 1992; Washington Forest Practices Board 1997, Montgomery et al. 1995).*

Response: This rule does not stand alone. Unstable areas for the entire plan area are required to be mapped and appropriate measures established for any operations that may be proposed on or near these areas included in the plan. Silvicultural systems are chosen considering the achievement of maximum sustained production of high quality timber products as the major consideration. Field conditions (unstable areas for example) can and do necessitate altering silviculture practices.

Mitigation for increased acreage, the impact from the harvest unit size, and off-site mitigation are considered under the cumulative impacts analysis as well as under this rule section. The plan must be considered as a whole.

Regeneration units may be close to each other both spatially and temporally. Regarding the five year spacing, Chamberlin et al. (1991) states: "Harvested areas contain wetter soils than unlogged areas during periods of evapotranspiration and hence higher groundwater levels and more potential late-summer runoff. The effect lasts 3-5 years until new root systems occupy the soil." (The effect of late-summer runoff could a beneficial factor for fish bearing watercourses during the summer months.)

Any plans with unstable areas where operations such as clear cutting are proposed will get a review and most likely a field evaluation by a DMG Certified Engineering Geologist.

Specific Concerns

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914.2, 934.2, 954.2 Tractor Operations [All Districts]

The following standards are applicable to tractor operations:

(a) Tractor operations shall be conducted in a manner which complies with 14 CCR 914 [934, 954].

(b) Tractor, or other heavy equipment which is equipped with a blade, shall not operate on skid roads or slopes that are so steep as to require the use of the blade for braking.

(c) Tractor roads shall be limited in number and width to the minimum necessary for removal of logs. When less damage to the resources specified in 14 CCR 914 [934, 954] will result, existing tractor roads shall be used instead of constructing new tractor roads.

(d) Heavy equipment shall not operate on unstable areas. If such areas are unavoidable, the RPF shall develop specific measures to minimize the effect of operations on slope instability. These measures shall be explained and justified in the plan and must meet the requirements of 14 CCR 914 [934, 954].

(e) Slash and debris from timber operations shall not be bunched adjacent to residual trees required for silvicultural or wildlife purposes, or placed in locations where they could be discharged into a Class I or II watercourse, or lake.

(f) [Coast only] Tractor operations shall be subject to the following limitations:

(1) Heavy equipment shall be prohibited where any of the following conditions are present:

(i) Slopes steeper than 65%.

(ii) Slopes steeper than 50% where the erosion hazard rating is high or extreme.

(iii) Slopes over 50% which lead without flattening to sufficiently dissipate water flow and trap sediment before it reaches a watercourse or lake.

(2) On slopes between 50 percent and 65 percent where the erosion hazard rating is moderate, and all slope percentages are for average slope steepness based on sample areas that are 20 acres, or less if proposed by the RPF or required by the Director, heavy equipment shall be limited to:

(i) Existing tractor roads that do not require reconstruction, or

(ii) New tractor roads at a location that has been shown on the THP map, flagged by an RPF or supervised designee prior to the pre-harvest inspection or, when a pre-harvest inspection is not required, prior to the start of timber operations, and approved by the Director.

(3) The RPF may propose exceptions to the limitations on tractor operations described above, if the proposed exception will comply with 14CCR 914 [934, 954], and if the THP both clearly explains the proposed exception and justifies why application of the standard rule is either not feasible, or would not comply with 14CCR 914 [934, 954]. The location of tractor roads to be used under such exceptions shall be flagged prior to the pre-harvest inspection or, when a pre-harvest inspection is not required, prior to the start of timber operations.

(f) [Northern and Southern only] Tractor operations shall be subject to the following limitations:

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(1) Heavy equipment shall be prohibited where any of the following conditions are present:

(i) Slopes steeper than 65%.

(ii) Slopes steeper than 50% where the erosion hazard rating is high or extreme.

(iii) Slopes over 50% which lead without flattening to sufficiently dissipate water flow and trap sediment before it reaches a watercourse or lake.

(2) On slopes between 50 percent and 65 percent where the erosion hazard rating is moderate, and all slope percentages are for average slope steepness based on sample areas that are 20 acres, or less if proposed by the RPF or required by the Director, heavy equipment shall be limited to:

(i) Existing tractor roads that do not require reconstruction, or

(ii) New tractor roads that have been flagged by an RPF or supervised designee prior to use.

(3) The RPF may propose exceptions to the limitations on tractor operations described above, if the proposed exception will comply with 14CCR 934 [954], and if the THP both clearly explains the proposed exception and justifies why application of the standard rule is either not feasible, or would not comply with 14CCR 934 [954]. The location of tractor roads to be used under such exceptions shall be flagged prior to the pre-harvest inspection or, when a pre-harvest inspection is not required, prior to the start of timber operations.

(g) Where tractor roads are constructed, timber operators shall use tractor roads only, both for skidding logs to landings and on return trips.

(h) Timber operators shall exercise due diligence so that desirable residual trees and seedlings will not be damaged or destroyed in tractor operations.

(i) Where waterbreaks cannot effectively disperse surface runoff, other erosion controls shall be installed as needed.

(j) [Southern only] Except where terracing will disturb less than 50 percent of the soil surface, mechanical site preparation shall not be conducted on any of the following:

(1) Any slopes over 40%.

(2) Slopes over 30% which lead without flattening to a Class I or Class II watercourse or to a lake.

(3) Areas having average slopes over 30%, where the erosion hazard rating is high or extreme. The area sampled for the average shall not exceed 20 acres.

(k) [Southern only] The Director may approve exceptions to (j)(1), (j)(2) and (j)(3) above when damage to soil and water quality caused by the use of heavy equipment will not exceed that caused by other site preparation methods if explained and justified in the THP.

Analysis

- The rule limits the use of heavy equipment on steep slopes, but allows for exceptions. The justification required for exceptions of this rule is not further defined. In practice, off-site mitigation can be used to mitigate for the impacts of heavy equipment on steep slopes.
- An analysis of the mass wasting potential of an area is not required to determine the appropriateness of heavy equipment uses on that area.

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Potential Biological Impacts

- *The construction of tractor roads across steep and unstable slopes can exacerbate mass wasting.*
- *Potential for increased surface erosion and channelized runoff from tractor roads (Spence et al. 1996).*
- *Ground-based vehicles can compact and scarify soils, reducing the infiltration capacity of soil pores, and increasing the potential for slumps, landslides and surface erosion (Everest et al. 1987, as cited in Spence et al. 1996).*

Response: The exception criteria is clearly stated. First, it must meet 14 CCR 914 intent (i.e.) prevent unreasonable damage to fish and wildlife habitat, reproduction and riparian vegetation, prevent degradation of the quality and beneficial uses of water, and maintain site productivity by minimizing soil loss; and second, justify why standard rule is not feasible or would not comply with 14 CCR 914.

It is true that off-site mitigation may be mitigated for impacts of heavy equipment on steep slopes, but this is only after all on-site and in-kind mitigations have been applied.

Justifications for individual exceptions are all site specific. Each justification is evaluated by CDF and other members of the review team. Exceptions to the use of heavy equipment on steep slopes have to fit the nature of the slope to be impacted.

Unstable areas are each unique, there are different soil types, different relationships to watercourses and sizes that range from a few square feet to acres. A plan which shows either the crossing of a large unstable area or the crossing of many small ones will usually trigger a field review by the one of the Certified Engineering Geologists with the DMG, as part of the preharvest inspection.

The rule minimizes the use of tractor roads across steep and unstable slopes. The proposal for such roads is thoroughly evaluated by CDF during the preharvest inspection. If reasonable alternatives exist for alternative placement of the road which would avoid the unstable area, these would be recommended and generally made part of the plan by the RPF.

Tractor roads are required to have erosion control structures constructed after operations are completed or prior to the winter operating period. Surface erosion and channelization of runoff from tractor roads is minimized with the inclusion of these structures. Where the tractor roads are already in place from previous harvesting, especially harvesting prior to the advent of the current FPRs, there may be little or no erosion control present prior to the submission of the THPs. A current plan requires the installation of the erosion control structures on these roads regardless of whether they had them prior to the proposed operation.

Specific Concern

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Article 6 Water Course and Lake Protection

916.2, 936.2, 956.2 Protection of the Beneficial Uses of Water.2, 936.2, 956.2
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Protection of the Beneficial Uses of Water.2, 936.2, 956.2 Protection of the Beneficial
Uses of Water [All Districts]

(a) The measures used to protect the beneficial uses of water for each watercourse and lake shall be determined by the following:

(1) The quality and beneficial uses of water as specified by the applicable water quality control plan.

(2) The restorable uses of water for fisheries as identified by the Department of Fish and Game.

(3) The biological needs of the fish and wildlife species provided by the riparian habitat.

(4) Sensitive near stream conditions as specified in 14 CCR 916.4(a), [936.4(a), 956.4(a)].

(b) The State's waters are grouped into four classes based on key beneficial uses. These classifications shall be used to determine the appropriate protection measures to be applied to the State's waters during the conduct of timber operations. The basis for classification (characteristics and key beneficial uses) and the range of protective measures applicable to each class are contained in Sections 916, 916.4(c), 916.5 [936, 936.4(c), 936.5; 956, 956.4(c), 956.5].

(c) When the protective measures contained in 14 CCR 916.5 [936.5, 956.5] are not adequate to provide protection to beneficial uses, feasible protective measures shall be developed by the RPF or proposed by the director under the provisions of 14 CCR 916.6 [936.6, 956.6], Alternative Watercourse and Lake Protection, and incorporated in the THP when approved by the Director.

Analysis

- The term "biological needs" is not further defined. The rule does not specify whether this means maintaining the habitat in a properly functioning condition.
- The classification of the watercourse classes is not precise and may lead to misclassification of stream types, in turn leading to inadequate protections to meet the biological needs of aquatic species.

Potential Biological Impacts

- A misunderstanding of the biological needs of aquatic species and how riparian vegetation provided for these needs can lead to inadequate riparian buffers. Riparian buffers provide shading, streambank stabilization, sediment metering, LWD

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contributions, organic litter inputs, and nutrient flux and composition (FEMAT 1993; O'Laughlin and Belt 1994; Cerderholm 1994, as cited in Spence et al. 1996).

Response: It is unclear what the Service defines as “properly functioning condition”. 14 CCR 916.4(b) is used to determine the biological and habitat needs of fish species. Technical Rule Addendum #2 also provides a useful list of factors to consider for all wildlife species under the heading of “Biological Resources:”

C. BIOLOGICAL RESOURCES: Biological assessment areas will vary with the species being evaluated and its habitat. Factors to consider in the evaluation of cumulative biological impacts include:

1. Any known rare, threatened, or endangered species or species of special concern (as described in the FPRs) that may be directly or indirectly affected by project activities.

Significant cumulative effects on listed species may be expected from the results of activities over time which combine to have a substantial effect on the species or on the habitat of the species.

2. Any significant, known wildlife or fisheries resource concerns within the immediate project area and the biological assessment area (e.g. loss of oaks creating forage problems for a local deer herd, species requiring special elements, sensitive species, and significant natural areas).

Significant cumulative effects may be expected where there is a substantial reduction in required habitat or the project will result in substantial interference with the movement of resident or migratory species.

The significance of cumulative impacts on non-listed species viability should be determined relative to the benefits to other non-listed species. For example, the manipulation of habitat results in conditions which discourage the presence of some species while encouraging the presence of others.

3. The aquatic and near-water habitat conditions on the THP and immediate surrounding area. Habitat conditions of major concern are: pools and riffles, large woody material in the stream, near-water vegetation.

Much of the information needed to evaluate these factors is described in the preceding Watershed Resources section. A general discussion of their importance is given below:

a. Pools and Riffles: Pools and riffles affect overall habitat quality and fish community structure. Streams with little structural complexity offer poor habitat for fish communities as a whole, even though the channel may be stable. Structural complexity is often lower in streams with low gradients, and filling of pools can reduce stream productivity.

b. Large Woody Material: Large woody debris in the stream plays an important role in creating and maintaining habitat through the formation of pools. These pools comprise important feeding locations that provide maximum exposure to drifting food organisms in relatively quiet water. Removal of woody debris can reduce frequency and quality of pools.

c. Near-Water Vegetation: Near-water vegetation provides many habitat benefits, including: shade, nutrients, vertical diversity, migration corridors,

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nesting, roosting, and escape. Recruitment of large woody material is also an important element in maintaining habitat quality.

4. The biological habitat condition of the THP and immediate surrounding area. Significant factors to consider are:

- . Snags/den trees
- . Downed, large woody debris
- . Multistory canopy
- . Road density
- . Hardwood cover
- . Late seral (mature) forest characteristics.
- . Late seral habitat continuity

The following general guidelines may be used when evaluating biological habitat. The factors described are general and may not be appropriate for all situations. No actual measurement is intended. The THP preparer must also be alert to the need to consider factors which are not listed below. Each set of ground conditions are unique and the analysis conducted must reflect those conditions.

a. Snags/Den/Nest Trees: Snags, den trees, nest trees and their recruitment are required elements in the overall habitat needs of more than 160 wildlife species. Many of these species play a vital role in maintaining the overall health of timberlands. Snags of greatest value are >16" DBH and 20 ft. in height. The degree of snag recruitment over time should be considered. Den trees are partially live trees with elements of decay which provide wildlife habitat. Nest trees have importance to birds classified as a sensitive species.

b. Downed large, woody debris: Large downed logs (particularly conifers) in the upland and near-water environment in all stages of decomposition provide an important habitat for many wildlife species. Large woody debris of greatest value consists of downed logs >16" diameter at the large end and >20 feet in length.

c. Multistory canopy: Upland multistoried canopies have a marked influence on the diversity and density of wildlife species utilizing the area. More productive timberland is generally of greater value and timber site capability should be considered as a factor in an assessment. The amount of upland multistoried canopy may be evaluated by estimating the percent of the stand composed of two or more tree layers on an average per acre basis.

Near-water multistoried canopies in riparian zones that include conifer and hardwood tree species provide an important element of structural diversity to the habitat requirements of wildlife. Near-water multistoried canopy may be evaluated by estimating the percentage of ground covered by one or more vegetative canopy strata, with more emphasis placed on shrub species along class III and IV streams (14 CCR 916.5, 936.5, or 956.5).

d. Road Density: Frequently traveled permanent and secondary roads have a significant influence on wildlife use of otherwise suitable habitat. Large declines in deer and bear use of areas adjacent to open roads are frequently noted. Road density influence on large mammal habitat may be evaluated by estimating the miles of open permanent and temporary roads, on a per-section basis, that receive some level of maintenance and are open to the public. This

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assessment should also account for the effects of vegetation screening and the relative importance of an area to wildlife on a seasonal basis (e.g. winter range).

e. **Hardwood Cover:** Hardwoods provide an important element of habitat diversity in the coniferous forest and are utilized as a source of food and/or cover by a large proportion of the state's bird and mammal species. Productivity of deer and other species has been directly related to mast crops. Hardwood cover can be estimated using the basal area per acre provided by hardwoods of all species.

f. **Late Seral (Mature) Forest Characteristics:** Determination of the presence or absence of mature and over-mature forest stands and their structural characteristics provides a basis from which to begin an assessment of the influence of management on associated wildlife. These characteristics include large trees as part of a multilayered canopy and the presence of large numbers of snags and downed logs that contribute to an increased level of stand decadence. Late seral stage forest amount may be evaluated by estimating the percentage of the land base within the project and the biological assessment area occupied by areas conforming to the following definitions:

Forests not previously harvested should be at least 80 acres in size to maintain the effects of edge. This acreage is variable based on the degree of similarity in surrounding areas. The area should include a multi-layered canopy, two or more tree species with several large coniferous trees per acre (smaller subdominant trees may be either conifers or hardwoods), large conifer snags, and an abundance of large woody debris.

Previously harvested forests are in many possible stages of succession and may include remnant patches of late seral stage forest which generally conform to the definition of unharvested forests but do not meet the acreage criteria.

g. **Late Seral Habitat Continuity:** Projects containing areas meeting the definitions for late seral stage characteristics must be evaluated for late seral habitat continuity. The fragmentation and resultant isolation of late seral habitat types is one of the most significant factors influencing the sustainability of wildlife populations not adapted to edge environments.

This fragmentation may be evaluated by estimating the amount of the on-site project and the biological assessment area occupied by late seral stands greater than 80 acres in size (considering the mitigating influence of adjacent and similar habitat, if applicable) and less than one mile apart or connected by a corridor of similar habitat.

h. **Special Habitat Elements:** The loss of a key habitat element may have a profound effect on a species even though the habitat is otherwise suitable. Each species may have several key limiting factors to consider. For example, a special need for some large raptors is large decadent trees/snags with broken tops or other features. Deer may have habitat with adequate food and cover to support a healthy population size and composition but be dependent on a few critical meadows suitable for fawning success. These and other key elements may need special protection.

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Table 1 (14 CCR 916.5 [936.5, 956.5]) also provides the water class characteristics or key indicator beneficial uses, and is quoted in full later in this document. The classification of watercourses is a common point of evaluation on pre-harvest inspections.

Specific Concerns

916.3, 936.3, 956.3 General Limitations Near Watercourses, Lakes, Marshes, Meadows and Other Wet Areas [All Districts]

The quality and beneficial uses of water shall not be unreasonably degraded by timber operations. During timber operations, the timber operator shall not place, discharge, or dispose of or deposit in such a manner as to permit to pass into the water of this state, any substances or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, or the quality and beneficial uses of water. All provisions of this article shall be applied in a manner which complies with this standard.

(a) When there is reasonable expectation that slash, debris, soil, or other material resulting from timber operations, falling or associated activities, will be deposited in Class I and Class II waters below the watercourse or lake transition line or in watercourses which contain or conduct Class IV water, those harvest activities shall be deferred until equipment is available for its removal, or another procedure and schedule for completion of corrective work is approved by the director.

(b) Accidental depositions of soil or other debris in lakes or below the watercourse or lake transition line in waters classed I, II, and IV shall be removed immediately after the deposition or as approved by the director.

(c) The timber operator shall not construct or reconstruct roads, construct or use tractor roads or landings in Class I, II, III or IV watercourses, in the WLPZ, marshes, wet meadows, and other wet areas unless when explained and justified in the THP by the RPF, and approved by the Director, except as follows:

(1) At prepared tractor road crossings as described in 914.8(b) [934.8(b), 954.8(b)].

(2) Crossings of Class III watercourses which are dry at the time of timber operations.

(3) At existing road crossings.

(4) At new tractor and road crossings approved as part of the Fish and Game Code process (F&GC 1600 et seq.).

Use of existing roads is addressed in 916.4(a) [936.4(a), 956.4(a)].

(d) Vegetation, other than commercial species, bordering and covering meadows and wet areas shall be retained and protected during timber operations unless explained and justified in the THP and approved by the director. Soil within the meadows and wet areas shall be protected to the maximum extent possible.

(e) Trees cut within the WLPZ shall be felled away from the watercourse by pulling or other mechanical methods if necessary, in order to protect the residual vegetation in the WLPZ. Exceptions may be proposed in the THP and used when approved by the director.

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(f) Where less than 50% canopy exists in the WLPZs of Class I and II waters before timber operations, only sanitation salvage which protects the values described in 14 CCR 916.4(b) [936.4(b), 956.4(b)] shall be allowed.

(g) Recruitment of large woody debris for instream habitat shall be provided by retaining at least two living conifers per acre at least 16 in. diameter breast high and 50 ft. tall within 50 ft. of all Class I and II watercourses.

Analysis

- *The rules allow trees to be removed from wet areas. These wet areas may be susceptible to mass wasting. The rules do not provide for retaining trees that will provide root strength to stabilize these wet areas.*
- *Felling across stream channels may damage vegetation and destabilize streambanks. The rules require trees to be felled away from watercourses, but allow exemptions. The justification for felling across watercourses is not described.*
- *The number of trees retained after harvesting to provide for large woody debris recruitment is inadequate to provide properly functioning aquatic habitat. Depending on site specific conditions, the diameter and size of the trees required to be retained after harvesting may also be inadequate.*
- *The rules do not require the recruitment trees to be marked. There is no restriction on removing those trees the next entry and retaining two other trees that meet the size requirement.*

Potential Biological Impacts

- *Loss of vegetation can increase splash erosion and decrease slope stability (Swanson et al. 1980; Marcus et al. 1990). Compaction of decomposing root structures can reduce the infiltration capacity of soils, increasing the chance of slumping, landslides, and surface erosion (Everest et al. 1987).*
- *Loss of riparian vegetation may destabilize streambanks, leading to a loss of cover along the edge of stream channels, increased fine sediment deposition, increased stream width, and reduced stream depth (Hicks et al. 1991).*
- *Removing trees from the riparian area adjacent to watercourses have the potential to change the distribution, size, and abundance of LWD in streams (Hicks et al. 1991; Ralph et al. 1994) and to simplify stream channels (Bisson et al. 1992). LWD regulates sediment and flow routing, influences stream channel bedform and bank stability, and provides hydraulic refugia and cover within stream systems (Bilby 1984; Gregory et al. 1987; Hogan 1987; Keller and Swanson 1979; Keller et al. 1995; Lisle 1983; Nakamura and Swanson 1993; Sendell and Beschta 1991).*

Response: Wet areas are defined in 14 CCR 895.1 as “those natural areas except cutover timberland which are moist on the surface throughout most of the year and support aquatic vegetation, grasses and forbes as their principal vegetative cover.” These are generally found in low spots in the topography, not on steep slopes. However, the rules do address unstable areas in 14 CCR 914.2 [934.2, 954.2] Tractor Operations [All Districts], subsection (d). “Heavy equipment shall not operate on unstable areas. If such areas are unavoidable the RPF shall develop specific measures to minimize the

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effect of operations on slope instability. These measures shall be explained and justified in the plan and must meet the requirements of 14 CCR 914 [934, 954].”

The criteria for the exception of falling across the channel is found in 14 CCR 916.1 i.e. (1) must provide equal protection provided by the standard rule e.g. stream bank stability and (2) must provide for protection of the beneficial uses of water to the standards of 14 CCR 916.3 and 916.4(b). Like unstable areas described in a previous section, the conditions that may lead to the proposal to fall a tree across a watercourse will vary widely. Each situation will be unique, there are different types of watercourses (this could include domestic water supply ditches as well as natural streams), presence or absence of water, configuration of watercourse banks, soil types, intention to leave a section of the tree in place in or above the watercourse for large woody debris (LWD), safety considerations, potential for a naturally falling tree to create an adverse impact (uprooting and exposing large root wad with soil attached to the channel), etc. Exceptions to felling away from have to fit the nature of the conditions encountered.

Definitely two trees per acre is inadequate. However, auditing of the implementation of the FPRs on THPs for large woody debris by the CDF through sampling done by the CDF field audit inspectors and CDF harvest inspectors resulted in the following observations.

Large Woody Debris – The average number of potential conifer trees over 16 inches within 50 feet of a class I watercourse per acre.

Survey Type	Number of trees over 16 inches	Number of observations
Audit Sampling	33	3
Field Insp. Sampling	25	27

Field inspectors found also that recent LWD recruitment had occurred in 17 of the 27 streams inspected. In only four of these cases had any salvage logging of this material occurred. (Anthony 1997)

In addition, CDF is requiring five to ten large conifers be left per acre within 50 feet of the watercourse in watersheds containing coho and other anadromous fish. This is a result of CDF’s “Coho Considerations” document and the recognition of the importance of LWD in the species’ life cycle.

It is true that the rules do not require the recruitment trees to be marked. Any future entry will require a THP and the trees within the WLPZs would again be evaluated for recruitment. Harvesting a tree counted for recruitment now and retaining other trees that meet the size standards could be beneficial.

Specific Concerns

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916.4, 936.4, 956.4 Watercourse and Lake Protection [All Districts]

(a) *The RPF or supervised designee shall conduct a field examination of all lakes and watercourses and shall map all lakes and watercourses which contain or conduct Class I, II, III or IV waters. As part of this field examination, the RPF or supervised designee shall evaluate areas near watercourses and lakes for sensitive conditions including, but not limited to, use of existing roads within the standard WLPZ width, unstable and erodible watercourse banks, debris jam potential, flow capacity and changeable channels, overflow channels, and flood prone areas. The RPF shall consider these conditions when proposing WLPZ widths and protection measures. The THP shall identify such conditions where they may interact with proposed timber operations to significantly and adversely affect the beneficial uses of water, and shall describe measures to protect the beneficial uses of water.*

(b) *The standard width of the WLPZ and/or the associated basic protection measures shall be determined from Table I (14 CCR 916.5), [936.5, 956.5] or Section 14 CCR 916.4(c) [956.4(c), 956.4(c)], and shall be stated in the THP. A combination of the rules, the THP, and mitigation measures shall provide protection for the following:*

- (a) *Water temperature control.*
- (b) *Streambed and flow modification by large woody debris.*
- (c) *Filtration of organic and inorganic material.*
- (d) *Upslope stability.*
- (e) *Bank and channel stabilization.*
- (f) *Vegetation structure diversity for fish and wildlife habitat, possibly including but not limited to:*

- (1) *Vertical diversity*
- (2) *Migration corridor*
- (3) *Nesting, roosting, and escape*
- (4) *Food abundance*
- (5) *Microclimate modification*
- (6) *Snags*
- (7) *Surface cover*

(1) *Measures and the appropriate zone widths for the protection of the State's waters which have been taken from Table I (14 CCR 916.5), [936.5, 956.5] or developed under Section 916.4(c) [936.4(c), 956.4(c)] shall be stated in the THP.*

(2) *All timber operations shall conform to the marking, flagging and other identification of protective measures specified in CCR 916.4 [936.4, 956.4] and 916.5 [936.5, 956.5] and the THP. Conformance shall be determined based on the evaluation of no less than a 200 foot lineal segment of each watercourse or lake.*

(3) *The width of the WLPZ shall be measured along the surface of the ground from the watercourse or lake transition line or in the absence of riparian vegetation from the top edge of the watercourse bank.*

(4) *Slopes shall be measured in percent for the proposed WLPZ. If topography within the proposed WLPZ is variable, segments of the proposed WLPZ should be segregated by slope class as indicated in Table I 14 CCR 916.5 [936.5, 956.5].*

(5) *If requested by either party, and after on-the-ground inspection, the RPF and the Director may increase or decrease the width of a proposed WLPZ. A decrease shall not exceed 25 percent of the width as determined by the procedure prescribed in Sections 14 CCR 916.4(c) [936.4(c), 956.4(c)], and 916.5 [936.5, 956.5]. Such changes in zone width shall be based on considerations of soil, slope, climatic factors, biologic,*

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hydrologic, and geologic values listed in Section 14 CCR 916.4(b) [936.4(b), 956.4(b)], silvicultural methods, yarding systems, road location, and site preparation activities. In no case shall the width be adjusted to less than 50 feet for Class I and II waters. Where soil surfaced roads exist within the standard WLPZ, no in-lieu reduction of WLPZ width shall be approved.

(6) Within the WLPZ, at least 75% surface cover and undisturbed area shall be retained to act as a filter strip for raindrop energy dissipation, and for wildlife habitat. This percentage may be adjusted to meet site specific conditions when proposed by the RPF and approved by the Director or where broadcast burning is conducted under the terms of a project type burning permit and in compliance with 14 CCR 915.2(b) [935.2(b), 955.2(b)].

(c) The protection and WLPZ widths for Class III and Class IV waters shall prevent the degradation of the downstream beneficial use of water and shall be determined on a site-specific basis.

(1) Where operations occur adjacent to Class III watercourses, the RPF shall designate in the THP an equipment limitation zone (ELZ) of at least 25 feet where sideslope steepness is less than 30% and at least 50 feet where sideslope steepness is 30% or greater unless explained and justified otherwise in the THP and approved by the director. Class III watercourses within logging areas where the EHR is Low and the slopes are less than 30% shall not require an ELZ unless proposed by the RPF or required by the Director. The RPF shall describe the limitations on the use of heavy equipment in the THP. Where appropriate to protect the beneficial uses of water the RPF shall describe additional protection measures which may include surface cover retention, vegetation protection and timber falling limitations. The location of the areas of heavy equipment use in any ELZ shall be clearly described in the plan, or flagged or marked on the ground before the preharvest inspection. When necessary to protect the beneficial use of water, the RPF shall designate and the Director may require a WLPZ for Class III and Class IV waters or an ELZ for Class IV waters.

(2) The width of the WLPZ for Class III and IV waters shall be determined from on-site inspection. Minimum protective measures required when Class III and Class IV protection zones are necessary are contained in Table I 14 CCR 916.5 [936.5, 956.5].

(3) Soil deposited during timber operations in a Class III water course other than at a temporary crossing shall be removed and debris deposited during timber operations shall be removed or stabilized before the conclusion of timber operations, or before October 15. Temporary crossings shall be removed before the winter period, or as approved by the Director.

(4) When approved by the Director on an individual plan basis as provided in Section 14 CCR 916.4(c)(1) [936.4(c)(1), 956.4(c)(1)] Class IV waters shall be exempted from required protection when such protection is inconsistent with the management objectives of the owner of the manmade watercourse.

(d) Heavy equipment shall not be used in timber falling, yarding, or site preparation within the WLPZ unless such use is explained and justified in the THP and approved by the Director.

(e) Flagging for heavy equipment use within the WLPZ adjacent to Class I waters and for all tractor road watercourse crossings of all watercourses must be completed before the preharvest inspection if one is conducted or start of operations, whichever comes

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first. *Flagging for heavy equipment use within the WLPZ adjacent to Class II, III and IV waters may be done at the option of the RPF or as required by the Director on a site-specific basis.*

(f) Subsection (d) does not apply to (1)-(4) below. Subsection (e) does not apply to (2)-(4) below.

(1) At prepared tractor road crossings as described in 914.8(b) [934.6(b), 954.8(b)].

(2) Crossings of Class III watercourses which are dry at the time of timber operations.

(3) At existing road crossings.

(4) At new tractor and road crossings approved as part of the Fish and Game Code Process (F&GC 1600 et seq.).

Analysis

- The use of the watercourse or lake transition line or top of bank as the point to begin measuring the WLPZ does not factor in side channels, flood plain, or potential channel migration. The protective buffering value of the WLPZ may be lost if the channel migrates further than the width of the WLPZ.*
- The rule requires retaining 75% undisturbed surface cover, this allows a full 25% left bare, adjusted through agreement between the RPF and the Director. This level of disturbance is too high. The rule does not describe the criteria that are used to determine whether the percent undisturbed area should be increased or decreased.*
- The term “where appropriate” in reference to additional protection for Class III ELZs is not further explained.*
- WLPZ buffers are not required for Class III. This limits the level of protection that may be provided to Class III watercourses, and by association, salmonid habitat downstream.*
- Defining an ELZ does not necessarily minimize the impact from heavy equipment. The rule does not encourage minimizing the amount of heavy equipment used within the ELZ.*
- The rules prohibit heavy equipment use within WLPZs, but exemptions to heavy equipment use within the WLPZ are common and easily obtained.*

Potential Biological Impacts

- The watercourse and lake transition line may not encompass the total floodplain and potential migratory path of the channel. Floodplain functions, side channels, and backwaters can be impacted. Backwaters and side-channels are important rearing habitat for many salmonid juveniles (Sedell and Luchessa 1982, as cited in Spence et al. 1996).*
- The loss of protective surface cover can increase splash erosion and decrease slope stability (Swanston et al. 1980; Marcus et al. 1990).*
- Heavy equipment use can cause extensive soil disturbance and compaction. This may increase splash erosion and channelized runoff (Spence et al. 1996).*
- Surface erosion that delivers sediment to streams can diminish pool quality and quantity, increase turbidity, smother coho salmon eggs and larvae, cause gravel embeddedness, decrease benthic invertebrate abundance, and disrupt social and*

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feeding behavior (Cordone and Kelly 1961, Everest et al. 1987; Hicks et al. 1991; Kelsey et al. 1981; Lloyd et al. 1987; Megahan 1982).

Response: The RPF is required in 14 CCR 916.4(a) to conduct a field examination of all lakes and watercourses and evaluate areas near the watercourses for sensitive conditions including, but not limited to, use of existing roads within the standard WLPZ width, unstable and erodible watercourse banks, debris jam potential, flow capacity and changeable channels, overflow channels and flood prone areas. This information is used in proposing WLPZ widths and protection measures. The plan must identify any conditions which may react with timber operations to significantly and adversely affect fish and their habitat.

The rule requires “at least 75%” undisturbed surface cover be retained. There is no target of 25% to be disturbed. As heavy equipment is generally excluded from WLPZs, except at designated crossings, and harvest levels are limited, it is unlikely that 25% of the ground would be disturbed in the WLPZ. The criteria to determine whether the percent of undisturbed area should be increased or decreased would depend on local factors such as what resource is being protected, soil type, mitigation (e.g, mulching), size of the WLPZ (total of less than one acre or total of many acres). CDF has further addressed this issue by requiring, when the conditions warrant, that exposed mineral soil areas within the WLPZ greater than 100 square feet be covered with mulch or slash prior to significant rainfall. Similar erosion control is required to bare soil on banks, regardless of its area, when the bare area is contiguous with the active channel and is the result of timber operations.

Additional protection for class III watercourses would likewise depend on many local factors, for protection of specific beneficial uses of water. These would be site-specific and explained in the plan or in the agency’s record of the review of the plan. Additional protection of class III watercourses could include WLPZ buffers, if necessary, for the protection of salmonid habitat downstream.

Equipment limitation zones (ELZ) as generally interpreted by CDF, limit the use of heavy equipment to designated watercourse crossings. The general use of the term “Equipment Exclusion Zone” has been used less frequently recently because, if there are designated watercourse crossings, it is not the appropriate term – the crossings are areas where equipment is not excluded.

The most common exemption to the exclusion of heavy equipment use in a WLPZ is for the use of an existing facility (road, skid trail, landing) in the zone. In steep and rugged terrain, the alternative of moving a road, skid trail, or landing enough that it would be outside of the WLPZ could involve the movement of massive amounts of soil on steep slopes. Where stable facilities are in place and are not causing significant erosion or other problems, it is the most reasonable course of action to use these facilities rather than construct new ones with the potential for higher sediment production.

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Backwaters would probably be classified as wet areas by the rules and be afforded protection. If a backwater is providing rearing habitat for salmonid juveniles it would be a class I watercourse and be provided a WLPZ.

Specific Concerns

916.5, 936.5, 956.5 Procedure for Determining Watercourse and Lake Protection Zone (WLPZ) Widths and Protective Measures [All Districts]

The following procedure for determining WLPZ widths and protective measures shall be followed:

(a) The following information shall be determined from field investigation:

(1) The location of all lakes and watercourses including man made watercourses.

(2) The existing and restorable beneficial uses of the waters to be protected as identified in subsection (1) above.

(3) The side slope classes for the individual class of waters to be protected (e.g. < 30%, 30-50%, >50%), where side slope is measured from the watercourse or lake transition line to a point 100 feet upslope from the watercourse or lake transition line, or, in the absence of riparian vegetation, from the top of the watercourse bank where slope configurations are variable, a weighted average method shall be used to determine sideslope percent.

(b) The beneficial uses noted from the field investigations in subsection (a) shall be compared to the characteristics or key beneficial uses listed in Row 1 of Table I 14 CCR 916.5 [936.5, 956.5] to determine the water classes (e.g. I, II, III, IV, Row 2).

(c) The standard protection zone width differentiated by slope classes determined in Subsection (a) are shown in Rows 4-7, Table I 14 CCR 916.5 [936.5, 956.5]. These widths may be modified as stated in 14 CCR 916.4(b)(5) [936.4(b)(5), 956.4(b)(5)].

(d) The alphabetical letter designations A through I in Rows 4-7, Table 1 14 CCR 916.5 [936.5, 956.5], and described in subsection (e) to Table I indicate the standard protective measures to be applied to the classes of water as determined in subsection (b) above.

(e) The letter designations shown in the "Protective Measures and Widths" column in Table I correspond to the following:

"A" WLPZ shall be clearly identified on the ground by the RPF who prepared the plan, or supervised designee, with paint, flagging, or other suitable means prior to the preharvest inspection.

"B" WLPZ shall be clearly identified on the ground by an RPF, or supervised designee, with paint, flagging, or other suitable means, prior to the start of timber operations. In planning watersheds determined to contain coho salmon, chinook

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salmon, or steelhead, on the ground identification of the WLPZ must be completed prior to the preharvest inspection.

"C" In site-specific cases, the RPF may provide in the plan, or the director may require, that the WLPZ be clearly identified on the ground with flagging or by other suitable means prior to the start of timber operations.

"D" To ensure retention of shade canopy filter strip properties of the WLPZ and the maintenance of a multi-storied stand for protection of values described in 14 CCR 916.4(b) [936.4(b), 956.4(b)], a base mark below the cut line of residual or harvest trees within the zone shall be done in advance of the preharvest inspection by the RPF, or supervised designee. Except in planning watersheds determined to contain coho salmon, chinook salmon, or steelhead, sample marking is satisfactory in those cases where the Director determines it is adequate for the plan evaluation. When sample marking has been used, all marking shall be done in advance of falling operations within the WLPZ.

"E" To ensure retention of shade canopy filter strip properties and the maintenance of wildlife values described in 14 CCR 916.4(b) [936.4(b), 956.4(b)], a base mark shall be placed below the cut line of the residual or harvest trees within the zone and shall be done in advance of timber falling operations by an RPF, or supervised designee. In planning watersheds determined to contain coho salmon, chinook salmon, or steelhead, tree marking must be completed prior to the preharvest inspection. Sample marking is satisfactory in those cases where the Director determines it is adequate for the plan evaluation. When sample marking has been used, all marking shall be done in advance of falling operations.

"F" Residual or harvest tree marking within the WLPZ may be stipulated in the THP by the RPF or required by the Director in site-specific cases to ensure retention of filter strip properties or to maintain soil stability of the zone. The RPF shall state in the THP if marking was used in these zones.

"G" To protect water temperature, filter strip properties, upslope stability, and fish and wildlife values, at least 50% of the overstory and 50% of the understory canopy covering the ground and adjacent waters shall be left in a well distributed multi-storied stand composed of a diversity of species similar to that found before the start of operations. The residual overstory canopy shall be composed of at least 25% of the existing overstory conifers. Species composition may be adjusted consistent with the above standard to meet on-site conditions when agreed to in the THP by the RPF and the Director.

"H" At least 50% of the understory vegetation present before timber operations shall be left living and well distributed within the WLPZ to maintain soil stability. This percentage may be adjusted to meet on-site conditions when agreed to in the THP by the RPF and the Director. Unless required by the Director, this shall not be construed to prohibit broadcast burning with a project type burning permit for site preparation.

"I" To protect water temperature, filter strip properties, upslope stability, and fish and wildlife values, at least 50% of the total canopy covering the ground shall be left in a well distributed multi-storied stand configuration composed of a diversity of species similar to that found before the start of operations. The residual overstory canopy shall be composed of at least 25% of the existing overstory conifers. Due to variability in

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Class II watercourses these percentages and species composition may be adjusted to meet on-site conditions when agreed to by the RPF and the Director in the THP.

Analysis

- *In watersheds where shade is the limiting factor for stream temperature, the canopy retention standards (50% overstory and 50% understory are insufficient to maintain optimum water temperatures required for salmonids.*
- *The rule only requires retaining 25% of overstory conifers. Conifers provide better LWD than hardwoods.*
- *The rule does not define “total canopy”. This could be interpreted as a percentage of the existing canopy structure, which may be much less than the stand’s attainable canopy.*
- *The rule requires the post-harvest stand structure to be similar to that found before harvest; this ignores the fact that the pre-harvest stand size distribution may not be desirable in terms of providing the riparian values necessary to maintain property functioning aquatic habitat.*
- *The rule can be altered site specifically. There is no criteria or analysis factors provided to describe the conditions under which alternative prescriptions would be acceptable.*
- *The rule allows broadcast burning in Class III watercourses.*
- *The rule does not place any limits on taking overstory trees in Class III WLPZ.*

Potential Biological Impacts

- *Measurements of shade in old-growth forests reported canopy densities from 75% in northern California (Erman et al. 1977) to between 80 and 90% in western Washington (cited in Beschta et al. 1987). Removal of riparian canopy can increase maximum stream temperatures and increase diel (sic) fluctuations (Beschta et al 1987, Beschta et al. 1995).*
- *Woody debris produced by hardwood vegetation tends to be more mobile, smaller, and shorter-lived than conifer debris (Spence et al. 1996).*
- *Fire reduced root strength and ground cover in burned areas. This can accelerate various erosional processes including splash erosion, sheeting, and mass wasting (McNabb and Swanson 1990; cited in Agee 1993).*
- *Removal of overstory trees can weaken root systems within Class III swales. In shallow materials, root systems increase the shear strength of unstable overburden (Chatwin et al. 1994).*

Response: RPFs have been addressing this issue for quite sometime. The average canopy retention has been measured at over 80% before CDFs Coho Consideration Document was released. In watersheds where shade is the limiting factor for stream temperature, CDF can and does require greater retention standards. In the Coho Considerations document, CDF re-emphasized the 75-85% canopy retention to protect coho. Note the wording in the rules (emphasis added), “ ... at least 50% of the overstory and 50% of the understory canopy covering the ground and adjacent waters ...” The same is true for the conifer retention standards, “ ... at least 25% of the existing overstory conifers.” The rule does not speak to “stand structure” as described in the Analysis above

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but states that the diversity of species will be similar to that found before the start of operations.

Temperature is less of an issue with coho on the coast because of the coastal influence. The issue with coho appears to be light, i.e. the darker the better. Therefore, the consideration of leaving low overhanging canopy appears to benefit coho over steelhead.

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The rules allow for this consideration, and plans in the coho area are taking this into account and including mitigation when it is appropriate.

Regarding broadcast burning in class III watercourse areas (as well as in class I and II WLPZ) 14 CCR 917.3(d), 937.3(c) and 957.3(c), Prescribed burning of Slash, state:

“Use of the broadcast burning prescription in the Watercourse and Lake Protection Zone for class I, and II waters, is prohibited. Where necessary to protect downstream beneficial uses, the director may prohibit burning prescription in Class III watercourses.”

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Specific Concerns

TABLE I

Procedures for Determining Watercourse and Lake Protection Zone Widths and Protective Measures ¹								
Water Class Characteristics or Key Indicator Beneficial Use	1) Domestic supplies, including springs, on site and/or within 100 feet downstream of the operations area and/or		1) Fish always or seasonally present offsite within 1000 feet downstream and/or		No aquatic life present, watercourse showing evidence of being capable of sediment transport to Class I and II waters under normal high water flow conditions after completion of timber operations.		Man-made watercourses, usually downstream, established domestic, agricultural, hydroelectric supply or other beneficial use.	
	2) Fish always or seasonally present onsite, includes habitat to sustain fish migration and spawning.		2) Aquatic habitat for nonfish aquatic species.					
			3) Excludes Class III waters that are tributary to Class I waters.					
Water Class	Class I		Class II		Class III		Class IV	
Slope Class (%)	Width Feet	Protection Measure	Width Feet	Protection Measure	Width Feet	Protection Measure	Width Feet	Protection Measure
					[see 916.4(c)] [see 936.4(c)] [see 956.4(c)]		[see 916.4(c)] [see 936.4(c)] [see 956.4(c)]	
<30	75	BDG	50	BEI	See CFH		See CFI	
30-50	100	BDG	75	BEI	See CFH		See CFI	
>50	150 ²	ADG	100 ³	BEI	See CFH		See CFI	
1 - See Section 916.5(e) for letter designations application to this table. 2 - Subtract 50 feet width for cable yarding operations. 3 - Subtract 25 feet width for cable yarding operations.								

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Analysis

- *The methodology used to insure correct designation based on the above criteria is not included in the rule. Incorrect designations may occur depending on the time of year for the survey, historic records and the potential for blockages to be removed that result in the repopulation of upstream habitats by anadromous fish. Incorrect designations may lead to inadequate protection of anadromous salmonid habitat.*
- *For the most part, the buffers for all stream classes are not wide enough to provide the riparian values necessary to achieve and maintain properly functioning condition.*
- *The protective measures prescribed for each watercourse class may not provide adequate shade, structure, and woody debris to maintain properly functioning aquatic habitat.*
- *The rule allows the buffer to be decreased for cable yarding operations but does not differentiate between partial and full suspension.*

Potential Biological Impacts

- *Riparian buffers provide shading, streambank stabilization, sediment metering, LWD contributions, organic letter inputs, and nutrient flux and composition (FEMAT 1993; O'Laughlin and Belt 1994; Cederholm 1994, as cited in Spence et al. 1996).*
- *The ability of riparian areas to provide for these essential habitat requirements decreases in proportion to increasing distance from the stream bank. Within this riparian area, forest management activities within, adjacent to, or above streams containing salmonid habitat may cause changes in stream temperatures, increase sediment levels, alter species composition and abundance of macroinvertebrates, destabilize streambanks and streamside areas, reduce in-stream structural complexity, reduce LWD recruitment, and alter peak and base flows.*

Response: It is possible that watercourses could be incorrectly classified. To minimize this potential CDF has printed a guide to watercourse classification (CDF, 83), issued policy on the classification of class II watercourses (1997), and finally, watercourse classification is a common issue on pre-harvest evaluations.

Unless there is substantial evidence from actual field measurements that the buffer widths are not providing adequate protection, California's buffers provide adequate protection for salmonids and maintain a habitat that protects their life cycle process. Since the coho, listing buffers are, on the average, larger than the rule minimums. In addition, the Coho Considerations document requests that RPFs consider the impact that silviculture activities outside the buffer have on the buffer and limit activities so that the full benefits to the fish are maintained and that habitat is maintained in a fully functioning condition.

The potential for blockages to be removed that result in the re-population of upstream habitats by anadromous fish, is addressed in several code sections. Two are 14 CCR 916.2 [936.2, 956.2] and 14 CCR 916.5 [936.5,956.5].

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916.2, 936.2, 956.2 Protection of the Beneficial Uses of Water [ALL Districts]

(a) The measures used to protect the beneficial uses of water for each watercourse and lake shall be determined by the following:

(1) The quality and beneficial uses of water as specified by the applicable water quality control plan.

(2) The restorable uses of water for fisheries as identified by the Department of Fish and Game.

(3) The biological needs of the fish and wildlife species provided by the riparian habitat. ...(emphasis added)

916.5, 936.5, 956.5 Procedure for Determining Watercourse and Lake Protection Zone (WLPZ) Widths and Protective Measures [All Districts]

The following procedure for determining WLPZ widths and protective measures shall be followed:

(a) The following information shall be determined from field investigation:

(1) The location of all lakes and watercourses including man made watercourses.

(2) The existing and restorable beneficial uses of the waters to be protected as identified in subsection (1) above. ...(Emphasis added)

It is true that the rules do not differentiate between partial and full suspension on WLPZ reductions. When this becomes an issue it is discussed in both the review team meeting and the pre-harvest inspection and mitigation measures applied when necessary to prevent a violation of 14 CCR 916.3 and other related code sections. In addition, areas of 100 square feet or more would have to be mulched or otherwise treated to prevent erosion.

Specific Concerns

923.1, 943.1, 963.1 Planning for Roads and Landings [All Districts]

The following standards for logging roads and landings shall be adhered to:

(a) All logging roads shall be located and classified on the THP map as permanent, seasonal, or temporary. Road failures on existing roads which will be reconstructed shall also be located on the THP map. In addition to the requirements of 14 CCR 1034(x), the probable location of those landings which require substantial excavation or which exceed one quarter acre in size, shall be shown on the THP map.

(b) New logging roads shall be planned in accordance with their classification and maintenance requirements.

(c) Logging roads and landings shall be planned and located, when feasible, to avoid unstable areas. The Director shall approve an exception if those areas are unavoidable, and site-specific measures to minimize slope instability due to construction are described and justified in the THP.

(d) Where roads and landings will be located across 100 feet or more of lineal distance on any slopes over 65% or on slopes over 50% which are within 100 ft. of the boundary of a WLPZ, measures to minimize movement of soil and the discharge of concentrated surface runoff shall be incorporated in the THP. The Director may waive inclusion of

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such measures where the RPF can show that slope depressions, drainage ways, and other natural retention and detention features are sufficient to control overland transport of eroded material. The Director may require end-hauling of material from areas within 100 ft. of the boundary of a WLPZ to a stable location if end hauling is feasible and is necessary to protect water quality. The Director shall require maintenance provisions in the THP for drainage structures and facilities provided that such maintenance is feasible and necessary to keep roadbeds and fills stable.

(e) New logging roads shall not exceed a grade of 15% except that pitches of up to 20% shall be allowed not to exceed 500 continuous feet (152.4m). These percentages and distances may be exceeded only where it can be explained and justified in the THP that there is no other feasible access for harvesting of timber or where in the Northern or Southern Districts use of a gradient in excess of 20% will serve to reduce soil disturbance.

(f) Roads and landings shall be planned so that an adequate number of drainage facilities and structures are installed to minimize erosion on roadbeds, landing surfaces, sidecast and fills.

(g) Unless exceptions are explained and justified in the THP, general planning requirements for roads shall include:

(1) Logging roads shall be planned to a single-lane width compatible with the largest type of equipment used in the harvesting operation with turnouts at reasonable intervals.

(2) Roads shall be planned to achieve as close a balance between cut volume and fill volume as is feasible.

(3) When roads must be planned so that they are insloped and ditched on the uphill side, drainage shall be provided by use of an adequate number of ditch drains.

(h) Road construction shall be planned to stay out of Watercourse and Lake Protection Zones. When it is a better alternative for protection of water quality or other forest resources, or when such roads are the only feasible access to timber, exceptions may be explained and justified in the THP and shall be agreed to by the Director if they meet the requirements of this subsection.

(i) [Coast] The location of all logging roads to be constructed shall be flagged or otherwise identified on the ground before submission of a THP or major amendment. Exceptions may be explained and justified in the THP and agreed to by the Director if flagging is unnecessary as a substantial aid to examining: (1) compatibility between road location and yarding and silvicultural systems, or (2) possible significant adverse effects of road location on water quality, soil productivity, wildlife habitat, or other special features of the area.

(i) [Northern, Southern] All logging roads to be constructed shall be flagged or otherwise identified on the ground before submission of a THP or, substantial deviation, except for temporary roads less than 600 ft. in length that would meet the requirements for a minor deviation (see 14 CCR 1036, 1039, 1040) if they were submitted as such. Exceptions may be explained and justified in the THP and agreed to by the Director if flagging or other identification is unnecessary as a substantial aid to examining: (1) compatibility between road location and yarding and silvicultural systems or (2) possible significant adverse effects of road location on water quality, soil productivity, wildlife habitat, or other special features of the area.

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(j) If logging roads will be used from the period of October 15 to May 1, hauling shall not occur when saturated soil conditions exist on the road.

Analysis

- *The rule does not encourage landowners to minimize the density of roading in watersheds, limit the total amount of roads within watersheds, or develop a long-term transportation plan. The rule does encourage or require alternatives to building new roads, such as longer yarding capacity.*
- *There is no mechanism for identification of unstable areas.*
- *There is no true limitation or prohibition on locating roads and landings on unstable areas, including 0-order swales or headwalls where water convergence occurs. The rule does not limit or prohibit placing roads and landings on inner gorges and steep slopes or anywhere that concentrates water or delivers sediment to channels that network with stream courses.*
- *There is no assessment of the sediment input and delivery from roads – no way to learn from past experience. There is no limitation on new road location and construction where sediment-related degradation has already occurred in watercourses. There is no accountability for roads that deliver sediment to watercourses or that block fish passage.*
- *There is no restriction of limitation to hauling on roads where there is any risk of pumping fines that have the potential to deliver to watercourses.*

Potential Biological Impacts

- *Roads can affect salmonid habitat by increasing sediment loads, altering channel morphology and destabilizing streambanks, modifying the hydrological drainage network, creating barriers to movement, and increasing the potential for chemical contamination (Furniss et al. 1991).*
- *Construction of a road network can greatly accelerate erosion rates within a watershed (Beschta 1978; Best et al. 1995; Gardner 1979; Hagens and Weaver 1987; Haupt 1959; Kelsey et al. 1981; Reid and Dunne 1984; Swanston and Swanson 1976).*
- *Cederholm et al. (1981) reported that the percentage of fine sediments in spawning gravels increased above natural levels when more than 2.5% of a basin area was covered by roads.*
- *Roads and other areas of intentional surface disturbance continually erode fine sediment, providing a large source of sediment to streams (Swanston 1991). In steeper terrain, road construction may trigger landslide processes that deliver large amounts of sediment directly into streams (Furniss et al. 1991).*
- *Road networks can affect hillside drainage; intercepting, diverting, and concentrating surface and subsurface flow, and increasing the drainage network of watersheds (Hauge et al. 1979; Wemple et al. 1996).*

Response: 14 CCR 923 [943, 963] Logging Roads and Landings [All Districts] states (emphasis added):

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“All logging roads and landings in the logging area shall be planned, located, constructed, reconstructed, used, and maintained in a manner which: is consistent with long-term enhancement and maintenance of the forest resource; best accommodates appropriate yarding systems, and economic feasibility; minimizes damage to soil resources and fish and wildlife habitat; and prevents degradation of the quality and beneficial uses of water. The provision of this article shall be applied in a manner which complies with this standard.

Factors that shall be considered when selecting feasible alternatives (see 14 CCR 897 and 898) shall included, but are not limited to, the following:

- (a) Use of existing roads whenever feasible.
- (b) Use of systematic road layout patterns to minimize total mileage.
- (c) Planned to fit topography to minimize disturbance to the natural features of the site.
- (d) Avoidance of routes near the bottoms of steep and narrow canyons, through marshes and wet meadows, on unstable areas, and near watercourses or near existing nesting sites of threatened or endangered bird species.
- (e) Minimization of the number of watercourse crossings.
- (f) Location of roads on natural benches, flatter slopes and areas of stable soils to minimize effects on watercourses.
- (g) Use of logging systems which will reduce excavation or placement of fills on unstable areas.”

Unstable areas are defined in code section 14 CCR 895.1:

“Unstable Areas are characterized by slide areas or unstable soils or by some or all of the following: hummocky topography consisting of rolling bumpy ground, frequent benches, and depressions; short irregular surface drainages begin and end on the slope; tension cracks and head wall scarps indicating slumping are visible; slopes are irregular and may be slightly concave in upper half and convex in lower half as a result of previous slope failure; there may be evidence of impaired ground water movement resulting in local zones of saturation within the soil mass which is indicated at the surface by sag ponds with standing water, springs, or patches of wet ground. Some or all of the following may be present: hydrophilic (wet site) vegetation prevalent; leaning, jackstrawed or split trees are common; pistol-butted trees with excessive sweep may occur in areas of hummocky topography (note: leaning and pistol butted trees should be used as indicators of slope failure only in the presence of other indicators).”

While roads are not prohibited on unstable areas, in inner gorges, steep slopes, or where water concentrates or delivers sediment to channels that network with stream courses, roads for such areas must be justified and site specific measures are included to minimize slope instability due to the construction activities. The CDF evaluates such conditions during the preharvest inspection and requests a geologist (DMG) also be present at that field meeting.

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The rules restrict hauling on roads when there is the potential to deliver sediment to the watercourses:

“923.1, 943.1, 963.1 Planning for Roads and Landings [All Districts]

The following standards for logging roads and landings shall be adhered to: ...

(i) If logging roads will be used from the period of October 15 to May 1, hauling shall not occur when saturated soil conditions exist on the road.”

(“Saturated Soil Conditions means 1) the wetness of the soil within a yarding area such that soil strength is exceeded and displacement from timber operations will occur. It is evidenced by soil moisture conditions that result in: a) reduced traction by equipment as indicated by spinning or churning of wheels or tracks in excess of normal performance, or b) inadequate traction without blading wet soil or, c) soil displacement in amounts that cause visible increase in turbidity of the downstream waters in a receiving Class I or II watercourse or lake. Soils frozen to a depth sufficient to support equipment weight are excluded. 2) soil moisture conditions on roads and landings, in excess of that which occurs from normal road watering or light rainfall that will result in the significant loss of surface material from the road and landings in amounts that cause visible increase in turbidity of the downstream waters in receiving Class I or II watercourse or lake.”)

In addition, CDF is requiring the RPF to address the issue in each plan. The RPF must have a plan for stopping operations under site specific conditions and amount of rainfall, or must eliminate hauling in wet conditions from these near stream areas.

Specific Concerns

923.2, 943.2, 963.2 Road Construction [All Districts]

Logging roads shall be constructed or reconstructed in accordance with the following requirements or as proposed by the RPF, justified in the THP, and found by the Director to be in conformance with the requirements of this Article.

(a) Logging roads shall be constructed in accordance with the approved THP. If a change in designation of road classification is subsequently made, the change shall be reported in accordance with 14 CCR 1039 or 1040, as appropriate.

(b) Where a road section which is greater than 100 feet in length crosses slopes greater than 65%, placement of fill is prohibited and placement of sidecast shall be minimized to the degree feasible. The director may approve an exception where site specific measures to minimize slope instability, soil erosion, and discharge of concentrated surface runoff are described and justified in the THP.

(c) On slopes greater than 50%, where the length of road section is greater than 100 ft., and the road is more than 15 ft. wide (as measured from the base of the cut slope to the outside of the berm or shoulder of the road) and the fill is more than 4 ft. in vertical height at the road shoulder for the entire 100 feet the road shall be constructed on a bench that is excavated at the proposed toe of the compacted fill and the fill shall be compacted. The Director may approve exception to this requirement where on a site-

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specific basis if the RPF has described and justified an alternative practice that will provide equal protection to water quality and prevention of soil erosion.

(d) [Coast] Fills, including through fills across watercourses shall be constructed in a manner to minimize erosion of fill slopes using techniques such as insloping through-fill approaches, waterbars, berms, rock armoring of fill slopes, or other suitable methods.

(d) [Northern, Southern] Roads shall be constructed so no break in grade, other than that needed to drain the fill, shall occur on through fill; breaks in grade shall be above or below the through fill, as appropriate. Where conditions do not allow the grade to break as required, through fills must be adequately protected by additional drainage structures or facilities.

(e) Through fills shall be constructed in approximately one foot lifts.

(f) On slopes greater than 35 percent, the organic layer of the soil shall be substantially disturbed or removed prior to fill placement. The RPF may propose an exception in the THP and the Director may approve the exception where it is justified that the fill will be stabilized.

(g) Excess material from road construction and reconstruction shall be deposited and stabilized in a manner or in areas where downstream beneficial uses of water will not be adversely affected.

(h) Drainage structures and facilities shall be of sufficient size, number and location to carry runoff water off of roadbeds, landings and fill slopes. Drainage structures or facilities shall be installed so as to minimize erosion, to ensure proper functioning, and to maintain or restore the natural drainage pattern. Permanent watercourse crossings and associated fills and approaches shall be constructed where feasible to prevent diversion of stream overflow down the road and to minimize fill erosion should the drainage structure become plugged.

(i) Where there is evidence that soil and other debris is likely to significantly reduce culvert capacity below design flow, oversize culverts, trash racks, or similar devices shall be installed in a manner that minimizes culvert blockage.

(j) Waste organic material, such as uprooted stumps, cull logs, accumulations of limbs and branches, and unmerchantable trees, shall not be buried in road fills. Wood debris or cull logs and chunks may be placed and stabilized at the toe of fills to restrain excavated soil from moving downslope.

(k) Logging roads shall be constructed without overhanging banks.

(l) Any tree over 12 in. (30.5 cm) d.b.h. with more than 25% of the root surface exposed by road construction, shall be felled concurrently with the timber operations.

(m) Sidecast or fill material extending more than 20 ft. (6.1 m) in slope distance from the outside edge of the roadbed which has access to a watercourse or lake which is protected by a WLPZ shall be seeded, planted, mulched, removed, or treated as specified in the THP, to adequately reduce soil erosion.

(n) All culverts at watercourse crossings in which water is flowing at the time of installation shall be installed with their necessary protective structures concurrently with the fill, construction and reconstruction of logging roads. Other permanent drainage structures shall be installed no later than October 15. For construction and reconstruction of roads after October 15, drainage structures shall be installed concurrently with the activity.

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(o) *Drainage structures and drainage facilities on logging roads shall not discharge on erodible fill or other erodible material unless suitable energy dissipators are used. Energy dissipators suitable for use with waterbreaks are described in 14 CCR 914.6(f) [934.6(f), 954.6(f)].*

(p) *Where roads do not have permanent and adequate drainage, the specifications of Section 914.6 [934.6, 954.6] shall be followed.*

(q) *Drainage facilities shall be in place and functional by October 15. An exception is that waterbreaks do not need to be constructed on roads in use after October 15 provided that all such waterbreaks are installed prior to the start of rain that generates overland flow.*

(r) *No road construction shall occur under saturated soil conditions, except that construction may occur on isolated wet spots arising from localized ground water such as springs, provided measures are taken to prevent material from significantly damaging water quality.*

(s) *Road construction not completed before October 15 shall be drained by outsloping, waterbreaks and/or cross-draining before the beginning of the winter period. If road construction does take place after October 15, roads shall be adequately drained concurrent with construction operations.*

(t) *Roads to be used for log hauling during the winter period shall be, where necessary, surfaced with rock in depth and quantity sufficient to maintain a stable road surface throughout the period of use. Exceptions may be proposed by the RPF, justified in the THP, and found by the Director to be in conformance with the requirements of this subsection.*

(u) *Slash and other debris from road construction shall not be bunched against residual trees which are required for silvicultural or wildlife purposes, nor shall it be placed in locations where it could be discharged into Class I or II watercourses.*

(v) *Road construction activities in the WLPZ, except for stream crossings or as specified in the THP, shall be prohibited.*

Analysis

- *The rules do not encourage adherence to state-of-the-science construction techniques for minimizing the impacts to aquatic resources, such as constructing roads that conform to topography, using full bench construction on steep slopes, and using vegetative or mechanical stabilization techniques to prevent cut and fill slope erosion from entering stream courses.*
- *There is not requirement against concentrating runoff.*
- *The rule for fill around drainage facilities is limited. The rule does not require minimizing fills used in water crossings, or require armoring and rolling dips to prevent diversion potential.*
- *The rules allow construction to occur on isolated wet areas. Such areas include springs and seeps that are potentially unstable or could be destabilized by construction activity.*
- *Road construction is permitted during critical times for fish populations. Critical times for fish populations can be considered any time after the first winter storms up to when juveniles emerge from the gravel.*

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Potential Biological Impacts

- *Roads can affect salmonid habitat by increasing sediment loads, altering channel morphology and destabilizing streambanks, modifying the hydrological drainage network, creating barriers to movement, and increasing the potential for chemical contamination (Furniss et al. 1991).*
- *Construction of a road network can greatly accelerate erosion rates within a watershed (Beschta 1978; Best et al. 1995; Gardner 1979; Hagans and Weaver 1987; Haupt 1959; Kelsey et al. 1981; Reid and Dunne 1984; Swanston and Swanson 1976).*
- *Cederholm et al. (1981) reported that the percentage of fine sediments in spawning gravels increased above natural levels when more than 2.5% of a basin area was covered by roads.*
- *Roads and other areas of intentional surface disturbance continually erode fine sediment, providing a large source of sediment to streams (Swanston 1991). In steeper terrain, road construction may trigger landslide processes that deliver large amounts of sediment directly into streams (Furniss et al. 1991).*
- *Road networks can affect hillside drainage; intercepting, diverting, and concentrating surface and subsurface flow, and increasing the drainage network of watersheds (Hauge et al. 1979; Wemple et al. 1996).*
- *In a study in Redwood Creek Basin, construction of logging roads greatly increased the rate of hillslope erosion. Most of the erosion involved stream crossings, especially stream diversions (Best et al. 1995).*

Response: The rules do encourage adherence to state-of-the-science construction techniques for minimizing the impacts to aquatic resources, such as constructing roads that conform to topography, using full bench construction on steep slopes, and using vegetative or mechanical stabilization techniques to prevent cut and fill slope erosion from entering stream courses.

14 CCR 923 [943, 963] Logging Roads and Landings [All Districts] states:

“All logging roads and landings in the logging area shall be planned, located, constructed, reconstructed, used, and maintained in a manner which: is consistent with long-term enhancement and maintenance of the forest resource; best accommodates appropriate yarding systems, and economic feasibility; minimizes damage to soil resources and fish and wildlife habitat; and prevents degradation of the quality and beneficial uses of water. The provision of this article shall be applied in a manner which complies with this standard.

Factors that shall be considered when selecting feasible alternatives (see 14 CCR 897 and 898) shall included, but are not limited to, the following:

- (a) Use of existing roads whenever feasible.
- (b) Use of systematic road layout patterns to minimize total mileage.
- (c) Planned to fit topography to minimize disturbance to the natural features of the site.

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- (d) Avoidance of routes near the bottoms of steep and narrow canyons, through marshes and wet meadows, on unstable areas, and near watercourses or near existing nesting sites of threatened or endangered bird species.
- (e) Minimization of the number of watercourse crossings.
- (f) Location of roads on natural benches, flatter slopes and areas of stable soils to minimize effects on watercourses.
- (g) Use of logging systems which will reduce excavation or placement of fills on unstable areas.(emphasis added)

14 CCR 923.1(d), 923.1(f), 923.1g(3) and 923.4 all address concentrating runoff.

14 CCR 923.3b and 923.3e address fills around drainage facilities.

It is almost impossible on the coast to predict where every isolated wet area is going to be. The construction of roads and landings in isolated wet areas is not encouraged. This rule is to cover those unexpected times that a wet area is encountered during the construction.

14 CCR 923.2(r) and (s) limits the effects of road construction during critical times for the fish.

Specific Concerns

923.3, 943.3, 963.3 Watercourse Crossings [All Districts]

Watercourse crossing drainage structures on logging roads shall be planned, constructed, and maintained or removed, according to the following standards. Exceptions may be provided through application of Fish and Game Code Sections 1601 and 1603 and shall be included in the THP.

(a) The location of all new permanent watercourse crossing drainage structures and temporary crossings located within the WLPZ shall be shown on the THP map. If the structure is a culvert intended for permanent use, the minimum diameter of the culvert shall be specified in the plan. Extra culverts beyond those shown in the THP map may be installed as necessary.

(b) The number of crossings shall be kept to a feasible minimum.

(c) Drainage structures on watercourses that support fish shall allow for unrestricted passage of fish.

(d) When watercourse crossings, other drainage structures, and associated fills are removed the following standards shall apply:

(1) Fills shall be excavated to form a channel which is as close as feasible to the natural watercourse grade and orientation and is wider than the natural channel.

(2) The excavated material and any resulting cut bank shall be sloped back from the channel and stabilized to prevent slumping and to minimize soil erosion. Where needed, this material shall be stabilized by seeding, mulching, rock armoring, or other suitable treatment.

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(e) Permanent watercourse crossings and associated fills and approaches shall be constructed or maintained to prevent diversion of stream overflow down the road and to minimize fill erosion should the drainage structure become obstructed. The RPF may propose an exception where explained in the THP and shown on the THP map and justified how the protection provided by the proposed practice is at least equal to the protection provided by the standard rule.

Analysis

- *There is no standardized methodology for ensuring that culverts will provide unrestricted passage of both juvenile and adult fish.*
- *There is not standardized methodology for determining culvert size necessary to meet or exceed the fifty-year flood level criterion.*
- *Stream crossings can change the channel bed, block sediment transport downstream, or alter the velocity of water. There is no requirement in the rules to avoid these situations.*
- *A 50-year flood flow design may not be adequate for roads with a long planned useful life. The rule does not require stream crossing designs to incorporate the anticipated road life and use or access the risk of flows exceeding flood design.*
- *The rule does not require permanent watercourse crossings and approaches to be designed to anticipate failure or plugging, by minimizing diversion potential and reducing fill.*

Potential Biological Impacts

- *Stream crossings can restrict channel geometry and prevent or interfere with migration of adult and juvenile salmonids (Furniss et al. 1991).*
- *Crossings can also be a source of sedimentation, especially if they fail or become plugged with debris causing debris torrents and significant cumulative impacts downstream (Furniss et al. 1991; Murphy 1995).*
- *Hagans and Weaver (1987) found that fluvial hillslope erosion associated with roads in the lower portions of Redwood Creek produced about as much sediment as landslide erosion between 1954 and 1980. Similar results are reported by Best et al. (1995), attributing most of the sediment to stream diversions at crossings.*
- *A fifty-year culvert design does not guarantee that a culvert will not fail. Stream crossing design should account for the possibility of culvert failure from both overflow and plugging (Weaver and Hagans 1994).*

Response: A portion of the rule states; “Drainage structures on watercourses that support fish shall allow for unrestricted passage of fish.” Much literature exists describing drainage structures that do and do not allow fish passage. For example, Furniss et al. (1991) has several diagrams and a listing of conditions. As the criteria vary by species of fish and conditions of the stream itself (gradient, seasonal flow, etc.), it is not practical to try and develop a standardized methodology for ensuring that culverts will provide unrestricted passage of both juvenile and adult fish. The rule is fully enforceable. If during the review, especially during the field inspection, CDF questions whether a structure will allow for unrestricted passage of fish, the RPF would be required to respond to that concern and if needed provide for unrestricted passage.

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Larger timberland owners may have a fisheries biologist on staff to do this, smaller ownerships can secure the services of a consulting biologist if detailed analysis is required.

Culvert design is a part of road engineering that has been practiced for decades. There are several “standard” methods for calculating culvert size necessary to meet or exceed the fifty-year flood level criterion. One commonly used method is called the “Rational Formula.”

The Fish and Game Code (code section 1603) covers the concern that stream crossings can change the channel bed, block sediment transport downstream, or alter the velocity of water. There is no requirement in the rules to avoid these situations. That code section states:

“It is unlawful for any person to substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake designated by the department, or use any material from the streambeds, without first notifying the department of such activity, except when the department has been notified pursuant Section 1601. The department within 30 days of receipt of such notice, or within the time determined by mutual written agreement, shall when an existing fish or wildlife resource may be substantially adversely affected by such activity, notify the person of the existence of such fish and wildlife resources together with a description thereof, and shall submit to the person its proposals as to measures necessary to protect fish and wildlife. Upon determination by the department of the necessity for onsite investigation or upon the request for an onsite investigation by the affected parties, the department shall notify the affected parties that it shall make an onsite investigation of the activity and shall make that investigation before it shall proposed any measure necessary to protect the fish and wildlife. ...

It is unlawful for any person to commence any activity affected by this section until the department has found it will not substantially adversely affect an existing fish or wildlife resource or until the department’s proposals, or the decisions of a panel of arbitrators, have been incorporated into such projects. ...”

The literature (Furniss et al. 1991) recommends the same drainage design as used in the Forest Practice Rules; “The following guidelines will help reduce adverse effects of roads on streams. ... Design drainage structures to accommodate peak streamflow based on at least a 50-year-interval flood...” In a natural system it is always possible that a culvert may fail. On the largest ownerships there are road maintenance plans, some of which include inspections of roads during or after major storms to pinpoint and correct problem areas before major damage occurs.

The rule does require permanent watercourse crossings and approaches to be designed to anticipate failure or plugging, by minimizing diversion potential and reducing fill. See section (e), permanent watercourse crossings and associated fills and approaches shall be constructed or maintained to prevent diversion of stream overflow

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down the road and to minimize fill erosion should the drainage structure become obstructed.

Specific Concerns

923.4, 943.4, 963.4 Road Maintenance. [All Districts]

Logging roads, landings, and associated drainage structures used in a timber operation shall be maintained in a manner which minimizes concentration of runoff, soil erosion, and slope instability and which prevents degradation of the quality and beneficial uses of water during timber operations and throughout the prescribed maintenance period. In addition those roads which are used in connection with stocking activities shall be maintained throughout their use even if this is beyond the prescribed maintenance period.

(a) The prescribed maintenance period for erosion controls on permanent and seasonal roads and associated landings and drainage structures which are not abandoned in accordance with 14 CCR 923.8 [943.8, 963.8] shall be at least one year. The Director may prescribe a maintenance period extending up to three years in accordance with 14 CCR 1050.

(b) Upon completion of timber operations, temporary roads and associated landings shall be abandoned in accordance with 14 CCR 923.8 [943.8, 963.8].

(c) Waterbreaks shall be maintained as specified in 14 CCR 914.6 [934.6, 954.6].

(d) Unless partially blocked to create a temporary water source, watercourse crossing facilities and drainage structures, where feasible, shall be kept open to the unrestricted passage of water. Where needed, trash racks or similar devices shall be installed at culvert inlets in a manner which minimizes culvert blockage. Temporary blockages shall be removed by November 15.

(e) Before the beginning of the winter period, all roadside berms shall be removed from logging roads or breached, except where needed to facilitate erosion control.

(f) Drainage structures, if not adequate to carry water from the fifty-year flood level, shall be removed in accordance with 14 CCR 923.3(d) [943.3(d), 963.3(d)] by the first day of the winter period, before the flow of water exceeds their capacity if operations are conducted during the winter period, or by the end of timber operations whichever occurs first. Properly functioning drainage structures on roads that existed before timber operations need not be removed. An RPF may utilize an alternative practice, such as breaching of fill, if the practice is approved by the Director as providing greater or equal protection to water quality as removal of the drainage structure.

(g) Temporary roads shall be blocked or otherwise closed to normal vehicular traffic before the winter period.

(h) During timber operations, road running surfaces in the logging area shall be treated as necessary to prevent excessive loss of road surface materials by, but not limited to, rocking, watering, chemically treating, asphaltting or oiling.

(i) Soil stabilization treatments on road or landing cuts, fills, or sidecast shall be installed or renewed, when such treatment could minimize surface erosion which threatens the beneficial uses of water.

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(j) Drainage ditches shall be maintained to allow free flow of water and minimize soil erosion.

(k) Action shall be taken to prevent failures of cut, fill, or sidecast slopes from discharging materials into watercourses or lakes in quantities deleterious to the quality or beneficial uses of water.

(l) Each drainage structure and any appurtenant trash rack shall be maintained and repaired as needed to prevent blockage and to provide adequate carrying capacity. Where not present, new trash racks shall be installed if there is evidence that woody debris is likely to significantly reduce flow through a drainage structure.

(m) Inlet and outlet structures, additional drainage structures (including ditch drains), and other features to provide adequate capacity and to minimize erosion of road and landing fill and sidecast to minimize soil erosion and to minimize slope instability shall be repaired, replaced, or installed wherever such maintenance is needed to protect the quality and beneficial uses of water.

(n) Permanent watercourse crossings and associated approaches shall be maintained to prevent diversion of stream overflow down the road should the drainage structure become plugged. Corrective action shall be taken before the completion of timber operations or the drainage structure shall be removed in accordance with 14 CCR Section 923.3(d) [943.3(d), 963.3(d)].

(o) Except for emergencies and maintenance needed to protect water quality, use of heavy equipment for maintenance is prohibited during wet weather where roads or landings are within a WLPZ.

(p) The Director may approve an exception to a requirement set forth in subsections (b) through (o) above when such exceptions are explained and justified in the THP and the exception would provide for the protection of the beneficial uses of water or control erosion to a standard at least equal to that which would result from the application of the standard rule.

Analysis

- *Roads and landings are only maintained for a period of 1-3 years, rather than a perpetual annual maintenance program or decommissioning. There is no accountability for road or landing failures after this period.*
- *There is no accountability for legacy roads, which are potentially major sources of sediment.*
- *Drainage structures, especially waterbars, and trash racks need regular annual maintenance to properly function, prevent blockage, and provide adequate carrying capacity. Trash racks placed immediately over culvert inlets can plug up with debris.*
- *This rule has no requirement for water drafting to minimize impacts to aquatic resources.*
- *Blockages are allowed to create temporary water sources. The rules require blockages to be removed by November 15, but this may permit blocking movement of juvenile salmonids during the summer or early migratory adults that move into stream systems after the first significant rain event.*

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- *Removal of water crossing and closure of temporary and seasonal roads are based upon calendar dates, not actual rainfall amounts. Drainage structure installation and removal can occur during critical times for salmonids.*
- *The rules provide little guidance as to how to maintain roads, landings, and crossings in a manner that does not deliver sediments to streams. For example, there are no restrictions on sidecasting bladed material onto fill. The rules require that crossings must be maintained to prevent diversion of stream flow, but do not provide guidance as to how this is best accomplished. Waterbars are not sufficient to prevent diversion.*
- *Prescriptive maintenance does not require soil stabilization to be sufficient to prevent gully formation or overland surface erosion delivering fine sediments to stream.*

Potential Biological Impacts

- *Roads can affect salmonid habitat by increasing sediment loads, altering channel morphology and destabilizing streambanks, modifying the hydrological drainage network, creating barriers to movement, and increasing the potential for chemical contamination (Furniss et al. 1991).*
- *Construction of a road network can greatly accelerate erosion rates within a watershed (Beschta 1978; Best et al. 1995; Gardner 1979; Hagans and Weaver 1987; Haupt 1959; Kelsey et al. 1981; Reid and Dunne 1984; Swanston and Swanson 1976).*
- *In a study of gully erosion in the lower Redwood Creek Basin, most of the gully-derived sediment projection could have been prevented by excavating or dishing-out skid-trail stream crossings, installing properly sized culverts on roads crossing channels of perennial, intermittent, or ephemeral streams, and maintaining road and drainage structures, especially during and immediately following storms (Weaver et al. 1995). Nearly 70% of the eroded material in this study was attributed to newly formed gullies.*
- *Improperly maintained roads may still fail, years after construction (Furniss et al. 1991).*

Response: The accountability for road and landing failures is made during the cumulative impact evaluation of subsequent THPs. If the failure is a large one and causing a problem, there are other state laws that can come into play to get correction and compliance such as the Porter Cologne Water Quality Act and the Fish and Game Code.

Existing roads (legacy roads) if they are within the plan area and to be used for timber operations may require reconstruction to reduce existing sedimentation and the potential for future sedimentation, much like new road construction. 14 CCR 923.2 [943.2, 963.2] states:

“Logging roads shall be constructed or reconstructed in accordance with the following requirements or as proposed by the RPF, justified in the THP, and found by the Director to be in conformance with the requirements of this Article.

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(h) Drainage structures and facilities shall be of sufficient size, number and location to carry runoff water off of roadbeds, landings and fill slopes. Drainage structures or facilities shall be installed so as to minimize erosion, to ensure proper functioning, and to maintain or restore the natural drainage pattern. Permanent watercourse crossings and associated fills and approaches shall be constructed where feasible to prevent diversion of stream overflow down the road and to minimize fill erosion should the drainage structure become plugged.

(o) Drainage structures and drainage facilities on logging roads shall not discharge on erodible fill or other erodible material unless suitable energy dissipators are used. Energy dissipators suitable for use with waterbreaks are described in 14 CCR 914.6(f) [934.6(f), 954.6(f)].

(p) Where roads do not have permanent and adequate drainage, the specifications of Section 914.6 [934.6, 954.6] shall be followed. ...

(t) Roads to be used for log hauling during the winter period shall be, where necessary, surfaced with rock in depth and quantity sufficient to maintain a stable road surface throughout the period of use. Exceptions may be proposed by the RPF, justified in the THP, and found by the Director to be in conformance with the requirements of this subsection.”

The rule above states; “Where needed, trash racks or similar devices shall be installed at culvert inlets in a manner which minimizes culvert blockage.” It is recognized that a structure directly over a culvert opening would be more likely to plug the culvert. Trash racks are generally placed at some distance from the culvert inlet.

Drainage structures, particularly waterbars, do not need extended maintenance to function properly. Following harvest operations, the logging roads are generally not heavily traveled. These roads are generally on private ownerships and not open to the general public. If there is logging traffic following a specific operation, it would be associated with another harvest plan with associated road maintenance requirements. Waterbars tend to stabilize over time if not in use.

In a mass mailing to all RPFs regarding “Coho Salmon Considerations for Timber Harvesting under the California Forest Practice Rules” on April 29, 1997, CDF discussed drafting and recommended that RPFs include special measures within their plans:

“Drafting stream water for dust abatement and other uses may temporarily dewater salmon redds (nests) causing mortality and/or reduce available habitat for juvenile coho during critical summer low flow periods. Activities associated with the proposed timber harvest that acquire water from Class I watercourses should be addressed by the RPF in the THP. Possible measures include:

- Modifying the rate of drafting or diversion or even ceasing if necessary, to assure no visible drop in water surface of the water-body downstream of the intake/diversion point; or

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- Conferring with the NMFS or DFG as to the timing that activities might cause problems.

All water intakes should be properly screened to prevent harming small fish. Placing in-takes in off-channel basins that are not inhabited by fishes can ameliorate drafting impacts.”

The Fish and Game Code (Code Section 1603) requires that the DFG be involved, if watercourses are to be blocked, to create a temporary water source. It also addresses removal of watercourse crossings that might impact fish. That code section states:

“It is unlawful for any person to substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake designated by the department, or use any material from the streambeds, without first notifying the department of such activity, except when the department has been notified pursuant Section 1601. The department within 30 days of receipt of such notice, or within the time determined by mutual written agreement, shall when an existing fish or wildlife resource may be substantially adversely affected by such activity, notify the person of the existence of such fish and wildlife resources together with a description thereof, and shall submit to the person its proposals as to measures necessary to protect fish and wildlife. Upon determination by the department of the necessity for onsite investigation or upon the request for an onsite investigation by the affected parties, the department shall notify the affected parties that it shall make onsite investigation of the activity and shall make such investigation before it shall proposed any measure necessary to protect the fish and wildlife. ...

It is unlawful for any person to commence any activity affected by this section until the department has found it will not substantially adversely affect an existing fish or wildlife resource or until the department’s proposals, or the decisions of a panel of arbitrators, have been incorporated into such projects. ...”

Guidance as to how to maintain roads, landings, and crossings in a manner that does not deliver sediments to streams can be found in numerous scientific and practical publications.

The rule requires that logging roads, landings, and associated drainage structures used in a timber operation shall be maintained in a manner which minimizes concentration of runoff, soil erosion, and slope instability, and which prevents degradation of the quality and beneficial uses of water during timber operations and throughout the prescribed maintenance period.

Specific Concerns

923.5, 943.5, 963.5 Landing Construction. [All Districts]

Landings shall be constructed according to the following standards:

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(a) On slopes greater than 65%, no fill shall be placed and sidecast shall be minimized to the degree feasible. The director may approve an exception if, site specific measures to minimize slope instability, soil erosion, and discharge of concentrated surface runoff are described and justified in the THP.

(b) On slopes greater than 50%, fills greater than 4 ft. in vertical height at the outside shoulder of the landing shall be: 1) constructed on a bench that is excavated at the proposed toe of the fill and is wide enough to compact the first lift, and 2) compacted in approximately 1 ft. lift from the toe to the finished grade. The RPF or supervised designee shall flag the location of this bench or the RPF shall provide a description of the bench location (narrative or drawing) in the THP for fills meeting the above criteria, where the length of landing section is greater than 100 feet. The RPF may propose an exception in the THP and the Director may approve the exception where it is justified that the landing will be stabilized.

(c) Waste organic material, such as uprooted stumps cull logs, accumulations of limbs and branches, or unmerchantable trees, shall not be buried in landing fills. Wood debris or cull logs and chunks may be placed and stabilized at the toe of landing fills to restrain excavated soil from moving downslope.

(d) Constructed landings shall be the minimum in width, size, and number consistent with the yarding and loading system to be used. Landings shall be no larger than one-half acre (.202 ha) unless explained and justified in the THP.

(e) No landing construction shall occur under saturated soil condition.

(f) The following specifications shall be met upon completion of timber operations for the year or prior to October 15, whichever occurs first:

(1) Overhanging or unstable concentrations of slash, woody debris and soil along the downslope edge or face of the landings shall be removed or stabilized when they are located on slopes over 65% or on slopes over 50% within 100 ft. of a WLPZ.

(2) Any obstructed ditches and culverts shall be cleaned.

(3) Landings shall be sloped or ditched to prevent water from accumulating on the landings. Discharge points shall be located and designed to reduce erosion.

(4) Sidecast or fill material extending more than 20 feet in slope distance from the outside edge of the landing and which has access to a watercourse or lake shall be seeded, planted, mulched, removed or treated as specified in the THP to adequately reduce soil erosion.

(5) Sidecast or fill material extending across a watercourse shall be removed in accordance with standards for watercourse crossing removal set forth in 14 CCR 923.3 (d).

(g) On slopes greater than 35%, the organic layer of the soil shall substantially removed prior to fill placement.

(h) When landings are constructed after October 15 they shall be adequately drained concurrent with construction operations and shall meet the requirements of (f)(1) through (f)(4) of this subsection upon completion of operations at that landing.

(i) The RPF may propose and the Director may approve waiver of requirements in (f)(1) through (f)(4) of this subsection if the Director finds they are not necessary to minimize erosion or prevent damage to downstream beneficial uses. The Director may also approve an exception to the October 15th date for treatment of slash and debris, including the practice of burning.

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Analysis

- *The rules require sidecast or fill material that has the potential to deliver sediment to watercourse be appropriately stabilized. The term, “stabilize,” is not defined and does not consider the purpose of the “Stabilization”. If surface erosion is the problem, using mulch, straw, or seeding may be appropriate. If mass movement is a potential problem, pull-back or excavation may be necessary.*
- *The rules do not prohibit construction of landings on steep, unstable slopes.*
- *The rule does not adequately describe standards for constructing landing on steep slopes. For example, the rule does not require full bench construction on steep slopes. Particularly for slopes over 65% that are constructed within 100 ft of a WLPZ.*

Potential biological Impacts

- *Roads, landing, and other areas of intentional surface disturbance continually erode fine sediments, providing a large source of sediment to streams (Swanston 1991). In steeper terrain, road and landing construction may trigger landslide processes that deliver large amounts of sediment directly into streams (Furniss et al. 1991).*
- *Roads and landing can affect salmonid habitat by increasing sediment loads, altering channel morphology and destabilizing streambanks, modifying the hydrological drainage network, creating barriers to movement, and increasing the potential for chemical contamination (Furniss et al. 1991).*

Response: Because of the number of variables associated with individual landings (slope, soil type, depth to bedrock, surrounding vegetation, drainage patterns in the area, etc.), a wide array of stabilization measures are possible. As stated in the concern, there could be a problem where surface erosion is the problem for which using mulch, straw, or seeding may be appropriate. The problem could be mass movement potential, and pull-back or excavation may be an appropriate solution.

The rules do not prohibit construction of landings on steep slopes but do not encourage the practice either. Any construction on unstable slopes would require considerable justification. Unstable areas are addressed in 14 CCR 914.2 [934.2, 954.2] Tractor Operations [All Districts], subsection (d); “Heavy equipment shall not operate on unstable areas. If such areas are unavoidable the RPF shall develop specific measures to minimize the effect of operations on slope instability. These measures shall be explained and justified in the plan and must meet the requirements of 14 CCR 914 [934, 954].” The construction of landings would require the use of heavy equipment.

Unstable areas are each unique, there are different soil types, different relationships to watercourses, and sizes that range from a few square feet to acres. A plan which shows landing construction on a large unstable area will usually trigger a field review by one of the Certified Engineering Geologists with the DMG, as part of the preharvest inspection.

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No one landing construction method would be appropriate for all situations or even a limited suite of situations. In the discussion above, it is suggested that only construction of a full bench landing on steep slopes should be used. While a full bench landing would eliminate the use of a fill slope, it may not always be the alternative that would have the least impact. This form of construction would require cutting further into the hill to obtain the surface area needed for the landing. By doing this, more of the support for the hill above the landing must be removed. The benefits of the elimination of the fill slope must be balanced against the potential that the larger cut into the slope may cause instability above the landing. A situation, where a new landing is proposed on slopes over 65% within 100 feet of a WLPZ, is one that would raise questions during first review of a plan and more than likely result in a preharvest inspection being required. It is also likely that CDF would request a geological review of the proposed landing during that preharvest inspection and DFG would take an interest in that aspect of the plan. New construction of landings under these conditions is not common. Slopes over 65% are required to be cable yarded, with landings located in ridgetop areas, generally on gentler ground and well away from class I and II watercourses. Helicopter use is also becoming more common in these steep slope areas.

Specific Concerns

923.6, 943.6, 963.6 Conduct of Operations on Roads and Landings [All Districts]

Routine use and maintenance of roads and landings shall not take place when, due to general wet conditions, equipment cannot operate under its own power. Operations may take place when roads and landings are generally firm and easily passable or during hard frozen conditions. Isolated wet spots on these roads or landings shall be rocked or otherwise treated to permit passage. However, operations and maintenance shall not occur when sediment discharged from landings or roads will reach watercourses or lakes in amounts deleterious to the quality and beneficial uses of water. This section shall not be construed to prohibit activities undertaken to protect the road or to reduce erosion.

Analysis

- *Hauling on roads, even rocked roads, in wet conditions (road moisture is high than found during normal watering treatments) will pump fines and increase the amount of sediment capable of entering into streams.*

Potential Biological Impacts

- *Roads can affect salmonid habitat by increasing sediment loads, altering channel morphology and destabilizing streambanks, modifying the hydrological drainage network, creating barriers to movement, and increasing the potential for chemical contamination (Furniss et al. 1991).*
- *Roads and other areas of intentional surface disturbance continually erode fine sediment, providing a large source of sediment to streams (Swanston 1991).*

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- *Roads and related ditch networks are often connected to streams, providing a direct conduit for the sediment and changes in hydrology (Wemple et al. 1996, Furniss et al. 1991).*
- *Production of fine sediment delivered to watercourses increases with road use, particularly on wet roads (Reid et al. 1981, Reid and Dunne 1984).*

Response: The rule states: “Operations may take place when roads and landings are generally firm and easily passable or during hard frozen conditions.” The rules do not encourage hauling when wet conditions are present. In the definitions, the potential for sediment to reach watercourses is recognized:

“Saturated Soil Conditions mean 1) the wetness of the soil within a yarding area such that soil strength is exceeded and displacement from timber operations will occur. It is evidenced by soil moisture conditions that result in: a) reduced traction by equipment as indicated by spinning or churning of wheels or tracks in excess of normal performance, b) inadequate traction without blading wet soil, or c) soil displacement in amounts that cause visible increase in turbidity of the downstream waters in a receiving Class I or II watercourse or lake. Soils frozen to a depth sufficient to support equipment weight are excluded. 2) soil moisture conditions on roads and landings, in excess of that which occurs from normal road watering or light rainfall that will result in the significant loss of surface material from the road and landings in amounts that cause visible increase in turbidity of the downstream waters in receiving Class I or II watercourse or lake.”

This definition is used in other rules:

“923.1, 943.1, 963.1 Planning for Roads and Landings [All Districts]

The following standards for logging roads and landings shall be adhered to: ...

(i) If logging roads will be used from the period of October 15 to May 1, hauling shall not occur when saturated soil conditions exist on the road.”

14 CCR 915.1 [935.1, 955.1](b) states: “Heavy equipment shall not be used for site preparation under saturated soil conditions or when it cannot operate under its own power due to wet conditions.” This is regardless of the time of year.

Specific Concerns

923.8, 943.8, 963.8 Planned Abandonment of Roads, Watercourse Crossings, and Landings [All Districts]

Abandonment of roads, watercourse crossings and landings shall be planned and conducted in a manner which provides for permanent maintenance-free drainage, minimizes concentration of runoff, soil erosion and slope instability, prevents unnecessary damage to soil resources, promotes regeneration, and protects the quality and beneficial uses of water. General abandonment procedures shall be applied in a manner which satisfies this standard and include the following:

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(a) Blockage of roads so that standard production four wheel-drive highway vehicles cannot pass the point of closure at the time of abandonment.

(b) Stabilization of exposed soil on cuts, fills, or sidecast where deleterious quantities of eroded surface soils may be transported in a watercourse.

(c) Grading or shaping of road and landing surfaces to provide dispersal of water flow.

(d) Pulling or shaping of fills or sidecast where necessary to prevent discharge of materials into watercourses due to failure of cuts, fills, or sidecast.

(e) Removal of watercourse crossings, other drainage structures, and associated fills in accordance with 14 CCR 923.3(d). Where it is not feasible to remove drainage structures and associated fills, the fill shall be excavated to provide an overflow channel which will minimize erosion of fill and prevent diversion of overflow along the road should the drainage structure become plugged.

The Director may approve an exception to a requirement set forth in (b) through (e) above when such exceptions are explained and justified in the THP and the exception would provide for the protection of the beneficial uses of water or control erosion to a standard at least equal to that which would result from the application of the standard rule.

Analysis

- Failures occurring on abandoned roads, watercourse crossings, and landings often occur years or decades after abandonment.*
- The rule does not require occasional monitoring and/or maintenance of abandoned roads to assure that the stabilization measures and drainage structures withstand significant storm events. There is no requirement to fix stability and drainage problems should the abandoned road fail.*
- The rule does not encourage analysis of the watershed's road network to identify unneeded roads. The rule also does not encourage abandonment of roads near or within WLPZs and on unstable slopes. Roads near or within WLPZs have the greatest potential to deliver fine sediments based on proximity to stream courses (WFPB 1997).*
- There is no requirement that the process of abandoning roads re-establish natural drainage patterns on hillslopes and at streams. Inside ditches and culverts can reroute hillslope drainage, restrict or confine stream flow, and present slope stability hazards.*
- The rule does not define conditions where watercourse crossings cannot be removed. By only excavating fill to provide an overflow channel, the crossing is set up for failure and potential debris torrents.*

Potential Biological Impacts

- Roads can affect salmonid habitat by increasing sediment loads, altering channel morphology and destabilizing streambanks, modifying the hydrological drainage network, creating barriers to movement, and increasing the potential for chemical contamination (Furniss et al. 1991).*
- Improperly maintained roads may still fail, years after construction (Furniss et al. 1991).*

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Response: It is true that failures may occur on abandoned roads, watercourse crossings and landings at some later date. How often is debatable. However, the incidence of such failures is expected to be less than if these structures were not abandoned according to the rules. As stated in the rule, cut and fill slopes are to be stabilized, water is to be dispersed, watercourse crossings are to be removed or provided an overflow channel, and regeneration is to be promoted. As time passes vegetation, from grasses to trees, will become established in the abandoned roads, watercourse crossings and landings providing stabilization similar to that in the surrounding naturally occurring landscape. What was once a bare surface will be bound with the root systems of the vegetation that becomes established through planting or naturally after the structure is no longer exposed to vehicle traffic.

While the FPRs do not require monitoring or maintenance of abandoned roads after the prescribed maintenance period for the harvest plan has ended, the state does have other avenues to “fix stability and drainage problems should the abandoned road fail.” There are Water Quality and Fish and Game Codes that require remedial actions be taken if the beneficial uses of water are being adversely impacted, such as clean-up and abatement orders. But as indicated above, it would be expected that a road would be unlikely to fail after the measures in the abandonment rule had been undertaken than if the road were to be left untreated. This issue needs to be monitored to determine if more measures need to be taken.

There are other code sections that encourage analysis of the watershed’s road network to identify unneeded roads. Code section 14 CCR 913.1(a)(2)(E) [923.1(a)(2)(E), 953.1(a)(2)(E)] for example states the Director may agree to measures that:

“provide feasible off-site mitigation measures that can be incorporated in the plan to restore or enhance previously impacted resource areas or other environmental enhancements that will result in demonstrable net environmental benefits within the planning watershed. These measures may include, but are not limited to, watercourse restoration, soil stabilization, road surface stabilization, road outcropping, road abandonment, road reconstruction, enhancement of wildlife habitats and vegetation management. To qualify for an exemption the plan submitter is not required to demonstrate that other feasible options are not available.”

In Technical Rule Addendum #2, road density is one of the factors to be considered in the biological resources section of the cumulative impacts assessment. Growing space loss (due to roads, landings, permanent skid trails) is to be considered in the soil productivity section.

Natural drainage patterns would have been protected to the extent possible during the initial construction of the road. Section (e) requires the removal of watercourse crossings except in unusual cases where this is not feasible. Inside ditches would be removed under (c) – grading and shaping of road surface to provide dispersal of water flow. To

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retain inside ditches would be contrary to the instruction at the beginning of this rule which states that abandonment will provide for permanent maintenance-free drainage.

A condition where a watercourse crossing could not be removed would be an unusual circumstance. Provision (e) allows for such a condition to be considered. Perhaps an area with an existing crossing is providing support for unstable ground further upslope, and the removal of the crossing would result in future impacts from the upslope area sliding into the watercourse, impacts that would be greater than any impacts likely to result from the retention of the existing crossing.

Furniss et al. (1991) recommends closing and reclaiming unneeded roads, "They should be put into shape to be stable and drain properly without maintenance." Furniss et al. (1991) also states; "When a road is abandoned, most future erosion can be prevented if roads are backfilled, stream crossings are removed, stream channels are reconstructed to stable configurations, and the bare surfaces are revegetated." 14 CCR 923.8 [943.8,953.8] above requires these measures.

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