pit development, and helicopter landing construction.

Middle Quinault River and Cook Creek watersheds are designated as a "Key Watersheds". Treatment activities would be allowed to occur within these watersheds subject to their respective watershed analyses (NWFP, pages B18-20).

A watershed analysis for the Stevens Creek Watershed has not been completed to date. Any activities within this watershed would be required to stay out of Riparian Reserves until watershed analysis has been completed (NWFP, page B20). Ten acres of the Project Area are located within the Stevens Creek watershed. These acres represent approximately 0.34 mile of unclassified road to access two potential helicopter landings as well as approximately 7 acres of stand treatment outside of Riparian Reserves.

Two acres of project area are within the East Fork Humptulips River watershed and consists of one existing closed road (about 0.53 mile) that would be reopened to access a potential helicopter landing.

Approximately 80% of the Project Area is located within the 6th Field West Fork Humptulips watershed. As described in the Forest Plan and the East/West Fork Humptulips Watershed Analysis there is a need for forest stands that have elements characteristic of late-successional and old-growth habitats, such as structural diversity with horizontal and vertical variation in forms and spatial arrangement of live and dead plant material; a range of tree sizes, including large trees with large and complex crowns; and a diverse understory light environment that promotes growth and coverage of herbaceous plants on the forest floor.

Access and Travel Management: The Olympic National Forest developed an Access and Travel Management (ATM) Plan in 2003. The objective of the planning process was to involve the public and develop a framework for managing the Forest's present road system in a safe and environmentally sound manner. The ATM Plan provides a starting point for managing the Forest's road system and guides future analyses and decisions for the Olympic National Forest roads. The ATM Plan will be used to inform road management decisions as projects are developed across the forest. A review of the ATM Plan and additional field inspection by road engineers has been conducted to determine appropriate road management activities within the Planning Area.

Olympic National Forest Strategic Plan: The Olympic National Forest Strategic Plan (USDA 2004b) is a tool to help prioritize limited resources to accomplish work in the areas with the greatest resource need and where possible, satisfy multiple resource management objectives, based on aquatic, wildlife, and vegetation considerations. Fire prevention needs were also to be considered as opportunities allowed. The Strategic Plan provides priority ratings by resource area and 6th field watershed as shown in Table 1-2.

Table 1-2: Forest Strategic Plan ratings for Planning Area 6th field watersheds

	West Fork Humptulips River	Middle Quinault River	Cook Creek
Overall Priority	High	Moderate	Moderate
Aquatic Restoration	High	Moderate	Moderate
Wildlife Restoration	High	Moderate	High
Vegetation Priority Ranking			
LSR, 0-80 yrs (acres)	10,151	656	2,601
AMA, 1-120 yrs (acres)	384	1,157	2,537
Pre-Commercial Thin (acres)	4,184	875	1,301
Economic Rating	High	Moderate	Moderate

These priority ratings for each resource area were developed based on the following criteria:

Aquatic – The priority for the aquatics resource area was based on three primary issues: maintaining or improving fish habitat, assisting in the recovery of listed threatened and endangered fish species, and maintaining water quality for municipal water supplies.

Wildlife – The priority for the wildlife ranking was based on the primary issues of improving late-successional terrestrial wildlife species habitat and improving elk forage. Watersheds where the Olympic National Forest could have the greatest positive impact on listed threatened and endangered wildlife species, most notably the northern spotted owl and marbled murrelet, and forage availability were identified.

Vegetation Management – Commercial thinning opportunities were evaluated by identifying all managed forest stands currently between the age of 41 to 60 and 61 to 80 years of age in designated Late-Successional Reserves (LSR) or within Adaptive Management Areas (AMA). The potential for economically viable commercial thinning sales was also evaluated.

Scoping

"Scoping" (40 CFR 1501.7) is a process designed to determine the potential issues associated with a Proposed Action and to identify those issues and concerns that may be significant to the decision. Issues identified through the scoping process are used to develop and refine alternative management actions. This section of the assessment discusses Public Involvement - the review process by interested parties from the general public, recognized Tribes, other Federal and State agencies, and further analysis by the Interdisciplinary Team.

The West Fork Humptulips Thinning Project Proposal was listed in the Schedule of Proposed Actions (SOPA) on January 2007 and all subsequent SOPAs. Formal scoping was initiated with a letter sent to recognized tribes on January 12, 2007 and *The Daily World* published an article about the West Fork Humptulips Project Proposal on February 5, 2007. On February 12, 2007, formal scoping was initiated with the general public as the agency sent letters to all the individuals on the district's NEPA mailing list (approximately 85 individuals) announcing the availability of the Proposed Action and the opportunity to respond on the proposal.

Eight responses to scoping efforts were received and have been incorporated and considered as part of this West Fork Humptulips Project EA.

Issues

All relevant issues were reviewed and categorized by the interdisciplinary team and Responsible Official. The Forest Service separated potential issues into three groups: Key Issues; Other Issues; and Issues Raised, But Dropped From Further Analysis. Further explanation of these issues and consequences is included in Chapter 3 of this document.

KEY ISSUES

Key Issues are used to formulate alternatives or drive alternatives themes, affect the design of the alternatives, prescribe mitigation measures, or describe important and variable Environmental Consequences. The following issue was identified as being "Key" to the analysis of this project:

1. **Effects to aquatic conditions from road construction activities:** Opening (reconstruction) unclassified roads and construction of temporary roads may negatively impact aquatic conditions by increasing sedimentation. Soils on the Olympic National Forest tend to be porous in nature and have relatively high infiltration rates. Important factors found to directly contribute sediment into stream waters are stream crossings by roads and road construction activities in proximity to streams. Key effects from implementing the Proposed Action to the environment may be evaluated by the following criteria:

   - Miles and acres of new temporary road construction and reconstruction of unclassified abandoned roads.
   - Miles and acres of new temporary road construction and reconstruction of unclassified abandoned roads in Riparian Reserves.
   - Number of stream crossings directly affected by road construction/reconstruction activities associated with unclassified and temporary roads.

OTHER ISSUES

Other Issues as used in this environmental analysis are those that have been determined to be relevant, are used to disclose consequences, may affect design or prescribe mitigation measures, or whose disclosure of environmental effects are required by law or policy. Further explanation of these issues and consequences is included in Chapter 3 – Environmental Consequences, of this document. The following ***"Other"*** issues were identified as being relevant to the analysis of this project:

2. **Physical Resources:**

   Soils and Site Productivity. Density management (thinning) treatments and other connected actions may affect soils and site productivity through detrimental soil disturbance and effects on coarse woody material.

   Hydrology. Density management (thinning) treatments and other connected actions may affect hydrologic conditions, including channel morphology, large woody material, sediment delivery, water yield (flow), and stream temperature.

   Water Quality. Density management (thinning) treatments and other connected actions may affect hydrologic conditions, and water quality regarding 303(d) listed waterbodies.

   Northwest Forest Plan Aquatic Conservation Strategy. Density management (thinning) treatments and other connected actions may affect attainment of Northwest Forest Plan (NWFP) Aquatic Conservation Strategies and Objectives.

   Fire/Fuels. Density management (thinning) treatments and other connected actions may affect fuel loading and fire hazard conditions.

   Air Quality. Density management (thinning) treatments and activity fuels treatments may affect air quality.

3. Biological Resources

Botanical species and/or habitat. Density management (thinning) treatments and other connected actions may affect botanical species and habitat, including Proposed, Threatened, Endangered, or Sensitive species.

Invasive non-native plants. Density management (thinning) treatments and other connected actions may affect spread of non-native (invasive) plant species.

Wildlife Proposed, Threatened, Endangered, or Sensitive species, and/or Critical Habitat. Density management (thinning) treatments and other connected actions may affect terrestrial wildlife species of concern, including Proposed, Threatened, Endangered, or Sensitive species and/or Critical Habitat.

Wildlife Other Rare, or Uncommon species and/or Habitat; management indicator species, and neo-tropical birds. Density management (thinning) treatments and other connected actions may affect terrestrial wildlife species of concern, including other rare or uncommon species and/or habitat; management indicator species, and neotropical birds.

Snags and Coarse Woody Material. Density management (thinning) treatments and other connected actions may affect existing and future levels of snags and coarse woody material within watersheds.

Aquatic Species and Habitats. Density management (thinning) treatments and other connected actions may affect aquatic species and habitats, including Threatened, Endangered, or Sensitive species and/or Essential Fish Habitat.

4. Human/Social Resources

South Quinault Ridge and Moonlight Dome Inventoried Roadless Areas. Density management (thinning) treatments and other connected actions may affect the character and experience within the Inventoried Roadless Areas.

Colonel Bob Wilderness Area. Density management (thinning) treatments and other connected actions may affect the character and experience within the Wilderness area.

Neilton Municipal Watershed. Density management (thinning) treatments and other connected actions may affect water quality and availability to the residents of Neilton.

West Fork Humptulips River potential for inclusion in the Wild and Scenic Rivers System. Density management (thinning) treatments and other connected actions may affect the future possibility for inclusion into the Wild and Scenic Rivers System.

Lower Pete's Trail #858.1. Density management (thinning) treatments and other connected actions may affect the recreational experience for users of the Lower Pete's Trail.

Visuals. Density management (thinning) treatments and other connected actions may affect the viewing character of the landscape as seen from the Quinault Highway (HWY 101).

Recreation/Human Safety. Density management (thinning) treatments and other connected actions may affect safety to the public along well-used travelways.

Neilton Electronics Site. Density management (thinning) treatments and other connected actions may affect the electronic site and its operations.

Economics. Density management (thinning) treatments and other connected actions may affect the economic feasibility of implementing such treatment activities.

ISSUES RAISED BUT DROPPED FROM FURTHER ANALYSIS

The interdisciplinary team (IDT), with Responsible Official involvement and approval, has identified the following issues as raised but dropped from further analysis associated with the Proposed Action. Issues raised but dropped from further analysis were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence.

The size and controversy of this project may require documentation under an Environmental Impact Statement (EIS). The Responsible Official determined that the activities proposed in this project did not warrant a need to compile an EIS. The Forest has considerable experience with the types of activities included in the Proposed Action and project effects were expected to be low in intensity. The proposed activity acres total only about 3% of the affected 6th field watersheds. Additionally an informal survey of other completed Environmental Assessments in the region showed that the size and scale of this project are consistent with other EAs.

Quantitative and landscape level analyses should be conducted. The appropriate level of analysis is determined by the Responsible Official such that a reasoned and informed decision may be made. Where quantitative estimates are not practical, have high degree of error, or do not provide useful points of reference, qualitative analyses may be more practical. The scale and level of analysis is appropriate and relative to each resource studied and its respective area of influence.

Concern for efficacy of thinning stands greater than 50 years of age. Extensive research has been conducted to quantify the increases in tree growth resulting from thinning, generally in stands younger than 50 years of age, with fewer studies done in older stands. This has led to some concern about whether stands over 50 years of age can be expected to respond similarly to thinning treatments. Studies of the potential growth response to thinning in 110-year-old Douglas-fir stands found no short-term increase in diameter growth of residual trees 6 years following treatment (Yerkes, 1960), however increased diameter growth was observed with longer observation periods of 11 years (Williamson, 1966) and 19 years (Williamson, 1982), and positive growth response was reported by Worthington (1966) 30 years after thinning in a 60-year-old Douglas-fir stand. Even in much older trees (158 to 650 years old) diameter growth responses were observed after a lag of 5 to 25 years following density reduction (Latham and Tappeiner, 2002).

These results suggest that while older trees may not respond as rapidly as younger trees or stands they do exhibit a growth response to reductions in stand density. In stands on the Olympic Peninsula, similar in age to those included in this project, one recent study

found significant increases in the diameter growth of individual trees within 5 years of a variable density thinning treatment (Roberts and Harrington, 2008).

Thinning these 36-72 year-old stands addresses the stated purpose and need and stand management objectives for LSR, AMA, and RR lands. There is no requirement to optimize tree growth at the stand scale within these lands. A commercial thinning treatment is a silvicultural opportunity in these candidate stands.

CHAPTER 2 – ALTERNATIVES

Introduction

This chapter describes the process used to develop alternatives. It also describes alternatives considered in detail and a summary of project design criteria, measures to mitigate environmental effects, and monitoring applicable to the Action Alternatives. Alternatives considered but not analyzed in detail are also discussed. It concludes with a summary and comparison of the alternatives considered in detail.

Forest Service policy requires that all projects undertaken on National Forest System land must comply with their respective land and resource management plan as amended. For the Olympic National Forest, this includes the *Olympic National Forest Land and Resource Management Plan* (LRMP), as amended by the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (Northwest Forest Plan) and *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (S&Gs).

Process Used to Develop Alternatives

The Purpose and Need and Key Issue identified during scoping were used to develop the Proposed Action and range of action alternatives considered in this EA. This range is intended to: a) provide clear choices for the decision-maker, b) respond to the scoping comments, c) respond to management direction, and d) respond to the Purpose and Need for action.

Through a pre-NEPA planning process, initial development of the Proposed Action and identification of final stands to be included in Proposed Action primarily utilized Geographic Information System (GIS) systems, linked to analytical spreadsheets. The process began with all stands within the Planning Area between the ages of 36 to 72 years being tracked in GIS. This was estimated to be approximately 8,000 acres of stands meeting the age criteria. In an effort to be fully transparent and inclusive with the public the project's scoping effort started in February 2007 included all of these potential stands as part of the project.

The next steps in the process included field verification and additional GIS analysis review which identified stands for removal from consideration based on location and other conditions that would exclude them from meeting the stated objectives of this project. For example, stands were removed because they were: not considered suitable because stand conditions (stocking levels) did not favor density management treatment; located on unstable soils or slopes with a high hazard rating for potential to fail; interlaced with so many Riparian Reserves that treatment activities were not considered feasible; located where sensitive plant populations were so high as to not consider treatment operationally feasible; located within northern spotted owl nest core areas (0.7 mile radius); and/or access to the stand was not considered feasible due to distance from established roads or extraordinary road construction would be required.

Subsequent to the process steps and filters above, approximately 5,211 acres (gross) were identified as available for variable density thinning treatment. By incorporating Project Design Criteria for all action alternatives that are discussed later in this chapter, approximately 4,101 acres (net) were identified as stands where commercial thinning treatments would be

applied. This reduction from 5,211 acres reflects the removal of stand acres for skip areas and includes riparian no-cut buffers, potential nest tree buffers, and sensitive plant buffers.

For the purpose of this document and subsequent analysis, the West Fork Humptulips Project Area totals approximately 4,183 acres and includes the area within units planned for commercial thinning treatment. This total also includes an additional 82 acres for opening of existing unclassified roads, constructing new temporary roads, constructing helicopter landings, and potential quarry pit development that occur outside treatment units. As such, the Project Area reflects what would be the actual area of activities under the Proposed Action.

Through scoping (both internal and public), issues were identified and various strategies were identified to consider alternative ways of managing the West Fork Humptulips Project candidate stands and:

1. Meet the Purpose and Need for the project.
2. Consider a reasonable range of alternatives that addresses the Key Issue.
3. Meet Standards/Guidelines of the Olympic National Forest Land and Resource Management Plan as amended by the NW Forest Plan.

Alternatives Considered But Eliminated From Further Analysis

NEPA requires that Federal agencies explore all reasonable alternatives and briefly discuss the reasons for eliminating any alternatives that were explored but not developed in detail (40 CFR 1502.14 (a)). The following alternatives or actions within alternatives have been eliminated from detailed study for the reasons stated and/or because they did not meet the Purpose and Need for this project.

The need to analyze for thinning all units in the project area that are under 80 years old and lack late-successional habitat characteristics. Initial consideration was given to all stands in the Planning Area that were eligible for thinning based on stand age as presented to the public. Following additional preliminary analysis by the interdisciplinary team using Geographic Information Systems (GIS maps), Stand Exam information, and field data some candidate stands were removed from consideration based on resource considerations and established standards and guidelines. Stands were removed because they were: not considered suitable (stand conditions did not favor density management treatment), located within active owl centers, located on unstable soils or slopes, interlaced with so many Riparian Reserves such that treatment was not considered feasible, sensitive plant populations were so high as to make treatment not feasible, and/or access to the stand was not considered feasible. As a result of the preliminary analysis process, the Responsible Official determined that it would be inappropriate to develop an “all inclusive” alternative.

The need to analyze only those units that would individually generate a positive net value. Given the condition of the timber market, there was a question whether an alternative should be developed that would only include those treatment units that would potentially realize a positive economic return. The Responsible Official determined that it would be inappropriate to segregate only the economically “positive” treatment units. The purpose and need for action is to restore late-successional habitat, not realize the greatest monetary return. The only constraint is that any action alternative should be economically viable to ensure enough funds are generated to facilitate necessary actions.

As stated later in this chapter under Alternatives Considered in Detail, Assumptions Regarding

Treatment Application (Implementation): "… The combinations of treatment units would be variable, with many factors affecting this variability." Economics would be one of those factors that may influence "packaging" of various treatment activities into a prospective timber sale.

Use of collaborative stewardship in addition to traditional timber sales to balance the benefits and drawbacks of both options: This environmental analysis does not preclude the use of either collaborative stewardships or traditional timber sales to implement proposed activities that would address the Purpose and Need for action. Under the NEPA, this assessment addresses potential environmental consequences associated with proposed activities. How these activities are actually implemented is an administrative action.

The need to analyze for a Noncommercial Restoration Alternative. Consideration was given to implement stand density reduction treatments through non-commercial means. Such non-commercial activities would include girdling standing trees and/or falling trees to be left throughout many acres of relatively young, dense stands across the landscape. To realize a desired growth response from the remaining live trees and enhance the development of late-successional habitat, extra-ordinary large amounts of relatively small diameter dead standing and down material would be generated and left on site. Such conditions would not necessarily be beneficial for resources such as wildlife travel, future understory stand development, and levels of hazardous fuel loads. In addition, this type of alternative would not have the capacity to generate funds necessary to accomplish this work and other watershed restoration projects. Such non-commercial activities would not meet the intent of the Purpose and Need of this project.

The need to analyze for an alternative that does not treat within Riparian Reserves. As depicted in the NWFP Land Allocation Map in Appendix A, areas considered Riparian Reserves within the Planning Area are a major land allocation that overlay other land allocations. There are approximately 2,194 acres of Riparian Reserve Areas located within stands proposed for treatment. Of those Riparian Reserves, approximately 1,205 acres would be planned for treatment leaving approximately 989 acres located within no-cut buffers where no treatment would be proposed. An alternative that would not treat within Riparian Reserves in this portion of the Olympic National Forest would eliminate large portions of potential treatment units. Such reductions would not meet the Purpose and Need for this project as stands within Riparian Reserves need treatment to meet Forest Plan desired conditions and objectives.

Alternatives Considered in Detail

Four alternatives (including a No-Action Alternative) are analyzed in detail. The No-Action Alternative provides a basic description of conditions (both current and ongoing) for which all Action Alternatives are compared. All of the action alternatives would treat the same number of acres with differences in method of harvest, and miles and type of roads needed.

Alternative A, the Proposed Action, would use vegetation treatments to accelerate the development of late-successional characteristics in second-growth stands within the Quinault South Late Successional Reserve, Olympic Adaptive Management Area, as well as Riparian Reserve Areas. Criteria used to identify stands available for treatment include: stands currently between 36-72 years old where relative density (RD) is 45-100% plus; avoid areas with slopes greater than 80 percent; avoid areas with high mass wasting hazards; and use existing Forest System roads and unclassified abandoned roads where possible in order to

minimize watershed impacts, as well as potential construction costs. Alternative A would be designed to meet the Forest-Wide Standards and Guidelines and represent the maximum extent of all treatments proposed within the stated sideboards. Additionally consideration would be given for the opportunity to improve the condition of existing roads and better decommission unclassified, abandoned roads as part of the project.

Alternative B is similar to and is based on the Proposed Action. Alternative B differs from the Proposed Action with modifications that address the Key Issue of effects from road construction activities on aquatic resources. Modification of the Proposed Action shows a reduction in the number of unclassified and temporary roads used to access treatment units. The roads removed from consideration are located within the Riparian Reserve land classification that contains one or more of the following criteria: proximity to fish-bearing streams, number and/or size of stream crossings and juxtaposition to aquatic habitats, within areas considered having a moderate instability hazard (high hazard areas were avoided in the Proposed Action), and/or within Riparian Reserves that would contain specific wildlife habitat attributes that are unique to the Planning Area.

Alternative C is also similar to and is based on the Proposed Action. Alternative C differs from the Proposed Action with modification that addresses the Key Issue by eliminating almost all of the unclassified roads from consideration and eliminates all construction of new temporary roads. Though unclassified, there is one road that accesses one treatment unit that is currently open and used by the public. Due to its current stable condition, this road remains under consideration for this alternative.

NO ACTION ALTERNATIVE

The No Action Alternative identifies and describes the current conditions of the physical, biological, social, and economic environments associated with the treatment units and associated activities. As required by NEPA, a No-Action alternative is included and analyzed as a basis for which the Action Alternatives may be compared. Under this scenario, No-Action would not authorize density management and other connected actions to obtain the Purpose and Need for the West Fork Humptulips Thinning Project.

The No-Action alternative should not be confused with a baseline, however. Whereas a baseline is essentially a description of the affected environment at a fixed point in time, the No-Action alternative assumes that other things would happen to the affected environment, particularly in a dynamic, changing ecosystem over time. How this ecosystem could change over time without the proposed management actions is discussed more fully in those sections of this EA that describe potential consequences.

Under this alternative, forest stands in the proposed project area would remain untreated. This alternative would also retain all roads, both authorized and unclassified abandoned roads in their current condition. No funds would be generated for additional restoration opportunities in the project area.

GOALS AND ASSUMPTIONS COMMON TO THE ACTION ALTERNATIVES

The Action Alternatives propose commercial thinning and other treatments on overstocked previously managed stands (plantations) on approximately 4,101 acres within the Late-Successional Reserve, Adaptive Management Area, and Riparian Reserve land allocations. Treatments under the Action Alternatives are designed to accelerate current managed stand conditions toward late-successional forest conditions. Treatments would focus on adding

diversity over the next 1-6 years to managed stands that are currently between 36 and 72 years of age.

Production of commercial commodity products is an element of the Purpose and Need for this project in respect to funding the Proposed Action as well as providing for the economic feasibility of implementing additional watershed restoration activities. Tree harvest is a by-product of this project in Late-Successional Reserve and Riparian Reserve. The need for tree removal on Late-Successional Reserve and Riparian Reserve lands is for fish and wildlife habitat enhancement, and where appropriate, commercial tree harvest would help facilitate these needs.

Assumptions Regarding Treatment Application (Implementation)

The Action Alternatives assume that treatments would be located and conducted as specified in design criteria and/or use of specific mitigation measures. On-the-ground conditions that trigger these criteria would be identified and validated at the time of, or concurrent with implementation (and prior to operation).

This project (and its analysis under the National Environmental Policy Act) would treat only stands previously managed within the Planning Area; would treat stands that are between 36 and 72 years of age (as of 2007); and would not analyze or make decisions on financing or packaging of implementation contracts.

When the current relative stand density is less than 35 percent (i.e., it is not overly dense), the stand would not be treated. Considerations for steep slopes, unstable areas, and sensitive soil types are provided in design criteria. If a stand has no reasonable potential for access, or helicopter yarding is cost prohibitive, it would not be treated.

Treatments could eventually occur on stands that are over 72 years at the time of implementation, having been considered and analyzed at this time (e.g., a stand that is 72 years in 2007 would be 77 years old in 2012). This proposal, its analysis and forthcoming decision would authorize treatments on stands that are 80 years old or younger within the Late-Successional Reserve land allocation.

Project Design Criteria Applicable to All Action Alternatives

This section discusses criteria related to the design of treatments and actions (i.e., Project Design Criteria), applicable to all Action Alternatives. These criteria are to be employed during on-the ground project designation/implementation and are designed to address overall objectives (attain the Purpose and Need) and resource objectives to manage consequences (obtain compliance with Standards and Guidelines). Other criteria that manage consequences during actual operations are termed “mitigation measures” and are discussed later in this Chapter.

1. Project Design Criteria (PDC) for Silvicultural Treatments

Thinning Objectives. The primary objective being proposed for the West Fork Humptulips Project would be to treat previously managed stands to reduce stand density and add structural and spatial complexity; maintain or increase crown and branch size and diameter growth of individual trees; introduce or continue to develop an understory of seedlings/saplings, shrubs,

and herbs; increase the number of snags and snag recruitment trees suitable for cavity nesters; and to contribute to coarse woody debris recruitment. Hardwoods would be retained and, in some areas, enhanced. Thinning generally would have an objective of reducing stand relative density (RD) to about 30 to 35 percent (Douglas-fir or western hemlock density), a mid-level of thinning between maximizing stand growth and yield (RD40) and maximizing individual tree growth (RD30). Fewer trees may be removed (an objective of at most 1/3 basal area removed) in areas where root rot or other factors increase the vulnerability the stand to windthrow.

Thinning Process. The silvicultural treatment prescribed would be variable density thinning where generally smaller diameter trees would be removed to create additional growing space for the remaining larger trees. The variable density thinning treatment would include areas of no thinning (skips), small gaps (openings), areas of heavy thinning (lower tree density), and a general thinning from below treatment which would cumulatively increase within stand heterogeneity and accomplish the stated thinning objectives.

Skips (no-cut areas). Skip areas would include no-cut riparian buffers; buffers for potential nest trees, legacy trees and snags; and buffers for other plant species. Other skip locations would include areas that are potentially unstable, headwalls, rock outcrops, and other areas that are steep, brushy or otherwise unsuitable for commercial thinning. Additional skips (0.5 or 0.75 acre, but with the opportunity to form skips of 1.0, 1.25, and 1.5 acres when skip areas adjoin one another) would be designed for thinning units as needed in areas that lack these features, providing for untreated areas amounting to at least 15% of thinned stands.

Gaps. Occasional blowdown and snapped tops would provide small to mid-sized gaps in the forest. To increase stand heterogeneity, the thinning treatment, including clearing around larger bigleaf maples, would provide gaps at the lower end of the range of gap sizes. Additional mid to upper size gaps (0.1-0.25 acre) would be designed for this treatment in areas protected from wind and away from roads and landings, amounting to approximately 5% of thinning units. All conifers larger than the minimum diameter limit except any cedar and white pine would be removed from gaps, while all hardwoods would be retained.

Heavy thinning. In stands with low wind throw potential, areas of heavy thinning would be prescribed, amounting to approximately 5% of the stand area. This prescription would be to maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity. Heavily thinned patches (0.5 or 0.75 acre, but with the opportunity to form patches of 1.0, 1.25, and 1.5 acres when heavy thinning areas adjoin one another) would be designed for thinning units. Heavily thinned patches would be thinned to 20-50 trees per acre, retaining hardwoods and minor conifer species as “ghost trees.” (USDA 1996, USDA 1996a, USDA 1996b)

For the majority of the treatment unit area, a general thinning from below prescription would utilize a contract specification that was developed on the Willamette National Forest and adapted for use on the Olympic National Forest. The contract specification utilizes a spacing guide so that the cut and leave-trees are selected on a purely mechanical basis, eliminating any judgment calls that could violate the intent of the National Forest Management Act. The technique results in variably spaced trees and a wider range of leave-tree diameters than a strict thinning from below prescription, but generally removes the smaller trees.

Thinning prescriptions would be based on species composition within treatment units and used to promote minor species. To achieve this goal all western redcedar and hardwood species would generally be retained (Refer to Cedar and hardwoods below). Approximately 100-180 trees per acre would remain in the post treatment stands, with in general a range of about 60-90% crown closure maintained in the post treatment stands.

Treatment Boundaries. Treatment unit boundaries would follow existing borders of the unthinned, dense, plantation conifer stand type and the adjacent larger tree component stand type. In addition, treatment unit boundaries would follow Riparian Reserve PDC as discussed later in this section.

Cut-tree diameter limits. Trees over 20 inches dbh would not be cut and removed as part of the thinning treatment in any treatment unit. If trees above these diameter limits are cut for safety or operational reasons, they must remain on site as coarse woody debris. Trees of this size may be converted to snags or coarse woody debris following the Coarse Woody Debris PDC as discussed later in this section.

All trees under 8 inches dbh would be kept in the stand as part of the thinning prescription.

Damaged trees. Leave trees would be selected irregardless of whether the tree has any damage. Trees with defects, potential cavity or nesting trees, and other similar features of structural diversity may be retained in the units. In this case, the term "damage" refers to breakage, double tops, crooks, heart rots, ants, etc., that cause loss of wood volume, but usually don't kill the tree. Similarly, trees with fading crowns or bleeding boles indicative of root disease that may kill some trees and create snags and coarse woody debris over time would not be discriminated against in this prescription.

Cedar and hardwoods. In general all western redcedar would be retained. All alders and other hardwoods are to be retained for mollusk and neo-tropical migrant bird habitat when located outside of existing skid trails, yarding corridors, landings, and road locations that would be used for this treatment. Vine maple would not be cut, except where necessary for yarding, in order to maintain existing species diversity. Bigleaf maples exceeding 12 inches dbh would receive a 20-foot clearing radius around them, from which all conifers except cedar and white pine would be removed.

2. Project Design Criteria for Marbled Murrelets (Large tree protection)

Marbled murrelet potential nest trees (PNT) and old-growth legacy trees (similar to PNTs but may or may not have larger diameter branches suitable as nesting platforms) will be buffered with 100-foot no-cut buffers in 12 units that had surveys for such trees (Units F4, F5, F6, F7, F10, F20, F21, G8, G9, G15, G49, and H8). This buffer will help to maintain microclimate conditions around these 63 trees (38 PNTs and 25 legacy trees). Yarding (skyline corridors) and skid roads from ground-based equipment, including tractors, skidders, and processors, will avoid entering the buffer around PNTs. They should also be avoided wherever possible around legacy trees. Five units (F9, F15, G23, G25, and G67) were also surveyed but did not have any PNTs, legacy trees, or legacy snags, and the remaining units (HU1–2, HU8, H137, E76A, G3–7, G16, G18–21, G26–33, G48, G51, G58–62, G64, G68–69, G81–82, G91–92, F11, F16–19, F22, F30, and F54) were not surveyed. Any PNTs and legacy trees within these unsurveyed stands would be retained because the proposed prescription excludes harvest of trees greater than 20 inches dbh but they would not be marked or buffered.

3. Project Design Criteria for Coarse Woody Debris (Snags and Large Wood)

To add elements of characteristic late-successional and old-growth habitat within the previously managed stands, one objective is to manage snags and large wood in order to provide a renewable supply of coarse woody debris well distributed across the landscape in a manner that meets the needs of species and provides for ecological functions.

Coarse woody debris (CWD), i.e. dead and down wood on the forest floor, fulfills a number of important ecological functions such as stabilizing surface soils, increasing organic content in soils over the long-term, providing habitat for the many organisms that depend on snags and down logs in various stages of decay, and ensuring adequate coarse woody debris recruitment to meet the ecological needs of aquatic systems over time.

Large snags over 20 inches diameter are particularly essential for forest function. In addition, at least 96 wildlife species in Oregon and Washington are associated with snags in forests, using snags for shelter, roosting, and hunting. Most species use snags greater than 14 inches diameter (Rose et al. 2001). Ridges, upper thirds of slopes, and riparian areas or lower third of slopes are very important for late-successional dependent species. Snags in various size classes also are important to the recruitment pathways of the down coarse materials important to soils. As with snags, down logs are important for wildlife and aquatic ecosystem function. In addition, large coarse woody debris is particularly important to maintaining and holding soils in place.

Snags and down large coarse wood would be retained to support forest function. Under the Action Alternatives, down logs are to be retained in accordance with Forest Plan Standards and Guidelines (LRMP pages IV-47 through 49).

All snags with a diameter at breast height (dbh) of 16 inches or greater and over 12 feet tall will be retained unless they pose a hazard to human safety. Forty-one legacy snags (snags greater than 30 inches dbh) have been located in 12 units (the same units as noted under Project Design Criteria #2). These snags will have a no-cut buffer around them of 1 ½ times their height. Where possible; place skips in locations that incorporate large, tall, legacy snags. Where logging safety is jeopardized, however, the snags could be felled, but must be left on-site as CWD.

CWD existing on the site prior to thinning exceeding 6 inches in diameter may be moved for access, but would not be removed from the site. Disturbance would be minimized. Temporary and unclassified roads used by this project, and skid trails would be blocked after logging to conserve CWD that might otherwise be removed for firewood. Big, old stumps would be kept intact and not uprooted wherever possible.

4. Project Design Criteria for Riparian Reserves

Riparian Reserve areas cross all land allocations. The East/West Fork Humptulips watershed analysis (Module D - Riparian Function Assessment) describes the determination of Riparian Reserve boundaries. Site Potential Tree heights were used to determine appropriate reserve distances and vary depending on Plant Association Groups (PAGs). Reference to these PAGs may be found in Module B of the watershed analysis – Vegetation Assessment.

Within Riparian Reserves, protective riparian vegetation no-cut areas (i.e., buffers that would not be commercially thinned) would be implemented to protect known sensitive areas such as all fish-bearing streams, perennial and intermittent non-fish bearing streams, potentially unstable areas, and seeps and wetlands. The purpose of these buffers would be to maintain

stream temperature, maintain slope stability (including headwalls), minimize soil erosion and sedimentation, and to protect riparian vegetation and other riparian dependent species.

For general planning, analysis, and display purposes; those stream-adjacent riparian areas not field verified on the ground and delineated on maps that are potentially unstable are displayed with a 75 foot buffer. Further delineation of these buffers would be completed at time of layout under the direction of fish and/or watershed specialists.

For all fish-bearing streams, riparian no-cut buffers for commercial thinning shall include:

- West Fork Humptulips River – No commercial thinning **within 200 feet** from the edge of the streambank.
- All other fish-bearing streams - At least **125 feet** from the edge of the streambank.

For all perennial and intermittent, non-fish-bearing streams (including ephemeral streams [channels that may or may not flow during storm events and have definite scour channel]), riparian no-cut buffers for commercial thinning shall include:

- At least 50 feet from the edge of the streambank.

The above buffers shall be expanded in size to include unstable and potentially unstable areas identified during sale layout. (Unstable areas that have already been identified on the ground through preliminary field reconnaissance have already been excluded from harvest):

- **At least 25 feet** upslope from the major slope break that identifies the headwall or other potentially unstable area. These areas would be determined, and shall be based on landform, signs of instability (refer to soils report), and hazard/risk of logging systems. Delineation of these buffers would be completed prior to implementation of treatments under the direction of watershed specialists and/or biologists.

- Inner gorge - At least **25 feet** back from the edge of the inner gorge slope break of the stream bank.

- All harvest units that are located on landforms (see soils report) with potential slope stability concerns would be reviewed by a watershed specialist at the layout stage and modified if necessary to exclude unstable terrain.

A no-cut buffer of 300 feet shall be delineated around any small lakes and natural ponds found during layout that are greater than one acre in size (one such site is known in unit G15). This buffer will provide protection for the terrestrial portion of habitat that is used by aquatic species, notably Northern red-legged frogs (*Rana aurora*) and Northwestern salamanders (*Ambystoma gracile*). Adult *Rana aurora* have been known to make extensive movements to breeding wetlands from summer habitats (Nussbaum et al., 1983; Hayes et al., 2001), and juveniles have been observed in riparian areas greater than 0.5 km from the nearest known breeding site (M. Hayes, personal observations). Terrestrial adult *Ambystoma gracile* tend to remain within 1 km of breeding sites while juveniles may be found farther from their natal wetlands (Jones et al. 2005).

Small lakes and ponds that are less than one acre in size will have a no-cut buffer of 100 feet. Small lakes and natural ponds are defined here as those areas supporting water 6–12 months a year, including during the growing season, and having a presence of “wetland” plants such as sedges, willows, and rushes. This includes wet areas, such as swales and seeps, with no

channel scour. For wet areas the no-cut buffer width may be waived or modified to allow use of ground based equipment upon review by an aquatic specialist and with appropriate mitigation (such as use of corduroy logs, slash placement, or geofabric).

5. Project Design Criteria for Application of Logging Systems

Logging system options for stands that provide opportunities for commercial extraction include: ground-based systems, skyline cable systems, and aerial (helicopter) systems. The primary concern involved with use of the various logging systems is the potential for detrimental effects to soils (and indirectly hydrologic systems and aquatic habitat). This concern elevates when equipment is considered for use on steeper slopes, sensitive soil types, or unstable areas. The maximum percent of area in detrimental soil conditions would be 20% for an activity area, including roads and landings (LRMP, page IV-51 through 54).

Conversely, there is an operational concern for economics between the various systems being considered, i.e., ground based systems are most economic from an operational cost viewpoint, skyline systems increase in operational costs, and aerial systems are the most costly. Road access and landing accessibility are also factors to consider.

Ground Based Systems - This refers to a group of logging methods that are considered ground-based, and may also include mechanized harvesting equipment. Typically, logs are harvested using mechanized heavy equipment to skid the logs to a landing area, where they would be loaded onto a truck. These ground-based systems are usually utilized on terrain where slopes are 30% or less. The initial criterion for ground based systems is directly related to distance from road access. Ground based systems require direct adjacent road access. If access for landings and product haul are not immediately available, ground based systems would not be utilized. Mitigation measures would require use of existing skid trails where possible and pre-designation of skid trails during operations.

Tractor - In this system, a cutter will fall, then limb and buck the tree in the bed where it landed when it was felled. Chokers are attached to the logs and a tractor equipped with a winch (while traveling on pre-designated skid trails) uses a “bull line” to pull the logs from their beds into the skid trail. When a group of logs is assembled into a turn, the chokers are gathered together, the leading ends of the logs are suspended above the ground behind the tractor by way of an integrated arch or similar apparatus, and the trailing end of the logs drag along the ground on the way back to the landing. At the landing, a front-end or a knuckle-boom loader is used to load logs decked at the landing onto log trucks.

Rubber-tired Skidder - This system is essentially the same as tractor logging in technique, although the skidding equipment has some operational and functional differences. While most tractors have steel tracks with cleats that run along a rigid rail and tend to churn up some soil when it turns, rubber-tired skidders are often articulated in their middle instead of a rigid frame, and they displace somewhat less topsoil than a tractor would when it turns. Both types of equipment can have advantages, depending on the situation.

Typically, tractors can work on somewhat steeper slopes, while skidders are faster and average skidding distances can be somewhat longer. By virtue of the fact that both tractors and skidders bear the weight of one end of the logs being skidded, the weight of the machine skidding logs is not evenly distributed, but is instead concentrated near the back of the machine. This configuration can create disproportionately higher ground

pressure on the soils being skidded upon than the machines rated or calculated pressure (in pounds per square inch) would indicate.

Harvester - Forwarder - A harvester and forwarder are two separate pieces of equipment. The harvester (while traveling on pre-designated harvester trails) reaches its boom out to cut the tree, and lays it on its side approximately perpendicular to the axis of the skid trail. Rollers on the cutting head then pull the tree through delimbing knives which drops the limbs in the harvester trail front of the harvester as they are severed. As each pre-determined length of log has been fed through the harvester head, logs are cut to length and allowed to fall into a stack of uniform length logs alongside the harvester trail. As the harvester travels through the stand, it rides on the layer of limbs that act as a cushion to help minimize soil compaction.

Later, a forwarder uses the same trails to pick up the logs, load them onto its bunk, and transport the logs to the landing, completely free of the ground instead of dragging them behind the machine. Because the logs are transported free of the ground, the weight is evenly distributed over all of its wheels, so the resultant ground pressure is less than with other ground based systems. This method not only minimizes soil compaction, but it virtually eliminates any exposure of subsoil so there is rarely any detrimental displacement or erosion. Because of the specialized equipment, there is a slightly higher cost, compared to tractor or rubber-tired skidder.

Skyline Systems - A skyline is a system that transports logs from stumps to landings using a wire rope cable that is suspended between a tower and a tail tree. This cable (or skyline) functions as an overhead track for a load-carrying carriage. Logs are lifted by cables or other devices attached to the carriage and pulled into a skyline corridor. The carriage is then pulled to the landing by a mainline powered by a yarder. The skyline provides vertical lift so that the logs have their leading end suspended above the ground during inhaul. In some cases, the entire log may be suspended above the ground. Skyline systems require direct adjacent road access. Landing access must be adjacent to stands to be treated. If existing trees and/or stumps needed for skyline logging anchors outside of harvest units are determined not to be suitable for use, the timber sale administrator will review options with the watershed and wildlife specialists prior to making an anchor decision.

If new stub spurs or temporary roads are needed for skyline systems such that trees must be felled that have nest characteristics suitable for marbled murrelets (trees at least 21 inches in diameter and that have at least one branch 4 inches in diameter that is 33 feet high (McShane et al. 2004) and can function as a platform, either by having a flat surface, some amount of moss or lichen, mistletoe, or other deformities) or spotted owls (trees at least 21 inches in diameter that have nesting structures such as large cavities, broken tops, hawk nests mistletoe infections, and other evidence of decadence), then the wildlife biologist will be consulted.

Helicopter Systems - This logging system utilizes medium or heavy-lift helicopters to transfer logs from where they are cut to a landing where they are loaded on trucks for haul to a mill. Helicopters are divided into three classes, depending on their lift capabilities. Helicopters have high operating costs and are usually utilized where there are concerns for ground disturbance or where road building is not desired.

This system (helicopter) can be utilized where there is no directly adjacent road access. There are limitations however on the flight distance and elevation change from the landing to the stand where material would be transported. Ideally, landings should be within a distance no

more than ¼ mile from the treated stand. There are also other factors to consider regarding helicopter systems and economic feasibility, including canopy cover, turn size, maintenance, and fuel storage landings.

Helicopters can be used to move material from treatment area sites to processing areas (i.e., landings). The use of helicopters allows for full suspension of trees or material from the treatment area, above the forest canopy, to the landing area and does not create excessive ground disturbance via skid trails or skyline corridors.

New log landings would be limited to approximately one (1) acre in size. This generally equates to a landing that is approximately 208 feet by 208 feet in size. Vegetation would be cut adjacent to landings to facilitate approach and departure flight paths, and safe operating procedures.

In areas designated for helicopter yarding; areas with slopes considered stable and less than 50%, and outside of Riparian Reserve no-cut buffers, would be planned to incorporate the use of a track-mounted, single-grip harvester for the purpose of "pre-bunching" logs. Pre-bunching means the mechanical falling, limbing, bucking, and bunching of trees to improve efficiency and economic removal of the helicopter aerial yarding process. The track-mounted machine would travel up and down (perpendicular to slope) appropriate portions of helicopter units to pre-bunch felled trees prior to removal by a helicopter, while "walking" on slash generated from its limbing operations. The machine would also travel parallel to the slope at the ends of the pre-bunching rows in order to move from row to row. If travel routes outside of units are needed for processors associated with helicopter systems, these routes would be approved prior to use by the Timber Sale Administrator and if the routes must traverse suitable habitat, then the wildlife biologist shall be informed as re-consultation with U.S. Fish & Wildlife Service will be necessary.

6. Project Design Criteria for Developing Roaded Access and Landings

Transportation system options are important for the safe and efficient removal of commercial timber products. The primary concern involved with use of the various roads is the potential for detrimental effects to soils (and indirectly hydrologic systems and aquatic habitat). This concern elevates when roads are considered for use on steeper slopes, sensitive soil types, or unstable areas. Conversely, there is an operational concern for economics between the various harvest systems being considered and associated transportation systems.

Development of roaded access for the project would consider existing classified roads, unclassified abandoned roads, and potential new temporary road construction. No new permanent system roads would be constructed with this project.

Roads proposed for use in the action alternatives include the following classifications (Refer to EA, Appendix C for further clarification):

- Existing Forest system roads currently open to motorized vehicle use (Maintenance Level (ML) 2 and above. These roads consist of a double or single lane, paved or graveled for passenger and high clearance vehicles;
- Existing Forest system roads currently closed to motorized vehicle use (ML 1). These roads consist of a single lane, graveled for high clearance vehicles;
- Existing unclassified abandoned roads (remnant of historic logging activities); and
- New temporary road construction.

Reconstruction of existing classified roads (either Open or Closed) - Reconstruction involves

restoring a Classified system road to its previous operational condition and/or upgrading the road to meet current standards. Road repairs could have one or more of the following work items: removing fallen trees, cleaning out culvert inlets, removing and disposing of small cut slope slides, falling danger trees, replacing minor amounts of road surfacing, replacing failed culverts at stream crossings, etc. Treatments could include grading, clearing, restoring lost road width, or stabilizing a cut or fill (embankment) slope that was lost due to storm damage by placing riprap materials (large boulders) against existing slopes, and installing additional ditch relief and other culverts.

The amount of work would vary according to stand locations, the existing conditions, and conditions existing at the time of the need for the road. Performing road repairs could also be accomplished by future commercial timber sale or stewardship contracts that would include requirements to perform minor road reconstruction work and applicable road maintenance work.

Culvert replacement would occur in stream channels and drains that relieve road ditches. Culverts have a lifespan and effectiveness that diminishes as rust and corrosion decrease the strength and integrity of the structure. Culverts past their operational lifespan in the project area would be replaced as necessary, and if adequate funding is available. Additional ditch relief culverts may be installed to divert road runoff away from stream channels and meet current water quality standards. This project provides the opportunity to upgrade culverts for additional resource protection.

Work would entail excavating the fill covering the current culvert and removing the culvert. Fills placed over the new pipe would be compacted and the road prism shaped to provide good drainage in and around the new culvert. Project design criteria and preventive mitigation measures would be used to minimize stream channel disturbance at the site.

Maintenance of existing classified roads (either Open or Closed) - This activity includes several related activities of a lesser scale and effect than road reconstruction which maintain drainage, cuts and fills, and surfacing of the road prism to accommodate light and commercial road traffic; while maintaining the integrity of the road facility and minimizing effects to natural resources adjacent to the road. Much of this work is done with a motor grader, dump trucks, and backhoes. Road maintenance includes travel way surface maintenance, drainage ditch maintenance, culvert cleaning, surface rock replacement, shaping of the roadway and ditches by blading, removal of slough materials, compacting, and other mechanized and hand work. Note that some items associated with routine road maintenance are sometimes included in contracts and identified as road reconstruction.

Road maintenance renders the road durable and useable or in a storage condition that minimizes effects on soil, water and other resources.

Road maintenance includes use of rock quarries and water sources, roadside brushing, grading, ditching, rocking of perennial stream crossings on native surface roads and other activities needed to maintain the road facility in good condition. Maintenance work is usually performed commensurate to the use of the road and the condition of the road.

Opening of existing unclassified roads - Under this project, some existing spur roads or skid roads will be utilized for logging access where possible. In this analysis, reconstruction of existing (Unclassified) roads is defined as use and improvement of an travel way (not a system road), for the purpose of transporting logs that is built, utilized, and decommissioned over the

course of the treatment/harvest operation. These unclassified roads would be improved to allow access and haul where a road has previously existed and there is an existing road template. The road profile still exists on most of these roads, but the road surface is now covered with trees and shrubs of varying sizes. Work is needed to bring these roads to a useable condition and ranges from light clearing and grubbing to minor excavation; removal of vegetation that has re-established in the road prism; drainage improvements; and additional surfacing.

Appropriate drainage for each road site would be installed to route road drainage away from stream channels, potentially unstable hillslopes, and sidecast. Following use, unclassified roads would be decommissioned.

Construction of new temporary roads and landings - Temporary roads are proposed where one-time access is needed as part of a timber sale, for access to harvest units. Due to short-term use that is limited to industrial purposes, construction requirements may be something less than required for permanent roads open to the public. They typically have a lower degree of planning and design, and lower initial development cost than permanent system roads. These roads cannot be compared to engineered roads (permanent system roads) as they are not designed for multiple uses.

In this analysis, a temporary road is defined as a created travel way for the purpose of transporting logs that is built, utilized, and decommissioned over the course of the treatment/harvest operation. These temporary roads would be constructed where no road previously existed and there is no existing road template. These roads would be built and removed by the operator as part of the Forest Service contract. In this situation, these temporary roads are important access to or an extension of a landing. Roads would be located and designed to minimize disruption to hydrologic flows by following the contour of the terrain, rolling grades where possible to minimize clearing limits (generally widths of 16 ft on level ground, 20 ft. for curves, and slightly more for steeper grades) and excavation to what is necessary for safe haul and prevent loss of overhead canopy cover. Temporary roads would be designed for appropriate drainage for each road site to route road drainage away from: potentially unstable hillslopes, sidecast, and channels. Following use, temporary roads would be decommissioned.

While a majority of the areas associated with the project have an existing network of roads and landings from previous harvests, there would be some additional areas created for log landings. These would primarily occur in areas where a change in logging systems (e.g., where skyline logging is now prescribed in areas previously tractor logged).

These additional landings are highly variable by the selected logging system. For example, helicopter systems typically require up to 1 acre landing areas, whereas a tractor system could utilize areas barely larger than a road-width, although tractor and skyline systems would typically require many more landings.

Temporary road (and landing) locations and stabilization measures are typically determined by the Forest Service Sale Administrator, with agreement by the purchaser. The Sale Administrator may request the advice of a watershed specialist in determining the most appropriate location and stabilization measures to be applied. Special stabilization measures would be required if needed for a temporary road would extend for more than one year (seasonal mitigation measures).

Temporary roads and landings would be managed in accordance with water quality Best Management Practices[2] (BMPs) (USDA 1988) R-23 and considered as part of the affected (detrimental) soil conditions under the Soil Quality Standards and Guidelines.

7. Project Design Criteria for Decommissioning Unclassified Roads, Temporary Roads and Landings

In order to prevent continued low level casual use and to minimize resource impacts, unclassified and temporary roads and landings would be decommissioned at the completion of their intended use. Effective decommissioning is generally achieved through a combination of the following measures:

- All culverts would be removed and stream bank profiles would be re-established;
- On roads across relatively flat slopes, any thru-cuts that generate berms would be back-bladed into the roadway;
- Road surfaces would be out-sloped or cross ditched at varying distances depending on road grade, and ripped as needed;
- Adjacent slash material generated from road construction would be scattered on top of the disturbed soils;
- The entrance of the temporary road would be permanently blocked/closed with a combination of ditching and native materials to effectively block motorized vehicle traffic. This may include visual screening by creating short spur-off roads to major landings so that most skid trails are not road adjacent; and
- Road surfaces could be revegetated with grass seed and/or tree seedlings.

8. Project Design Criteria for Activity-Generated Fuels Treatment

Proposed stand density management activities would create fuels that would increase both the risk of wildland fire ignition and potential fire intensities throughout the treatment areas. Activity fuels are all fuels created by or modified by the proposed activity. It would not be economical to treat all activity fuels from planned management activities. Project design should provide buffer zones that would reduce expected fire behavior and spread to a level that would lend itself to successful initial attack by firefighting resources. Buffer zones would be created along any roadway left open to public use after management activities are completed and along all boundaries with private lands, power line corridors, and Special Use Permit access roads. (LRMP, pages IV-59 through 60)

Buffer zone dimensions would be determined by site specific conditions. Buffer zones would be 50 to 200 foot wide strips along areas of concern and would incorporate one or more, or combination of several of the following activity methods: directional falling of trees to keep from adding to existing fuels; redistribution of slash by lopping and scattering or end hauling slash back into units or other locations; machine pile and burning of slash at cable, ground base, and helicopter landings where the slash can't be redistributed; or hand pile and burning of activity fuels left within the buffer zones outside of landing areas. The actual method selected to treat activity fuels will be site specific and determined after final layout and design of units.

[2] *General Water Quality Best Management Practices,* Pacific Northwest Region, November 1988.

Design fuel treatment activities to minimize disturbance to riparian vegetation (Refer to the Northwest Forest Plan standards and guidelines FM-1, 3, 4, and 5 on pp. C-35, 36). Fuel management activities would not occur within no-cut buffers adjacent to wetlands or riparian areas.

ALTERNATIVE A – PROPOSED ACTION

This alternative is the Proposed Action (Table 2-1 and maps in Appendix A). As developed, this alternative considers one way of addressing the Purpose and Need while meeting all Forest Standards and Guidelines; and Federal, State, and local laws, rules and regulations. The Proposed Action would implement Project Design Criteria as previously described, to be employed during on-the ground project designation/implementation. Existing roads and unclassified, abandoned roads would be used where possible. Consideration would be given to the opportunity to improve the condition of existing roads and better decommission unclassified roads as part of the project. This alternative describes the associated potential activities that may occur and would reflect the maximum potential effects in regard to the Key Issue.

Stand Density Treatment (Commercial Thinning) Activities: An estimated 57.4 million board feet of timber (mmbf) would be harvested from commercially thinning approximately 63 treatment units totaling about 4,101 acres. Harvest activities would use a combination of ground-based, skyline, and helicopter logging systems. (These figures are estimates based on observations made during field review.)

Tractor – 1,932 acres and 27.1 mmbf
Skyline – 1,645 acres and 23.0 mmbf
Helicopter – 524 acres and 7.3 mmbf

Riparian Reserve Treatment Activities: Subject to Project Design Criteria and included within the proposed stand density treatment, activities would occur within approximately 1,205 acres of land classified as Riparian Reserves. Harvest activities within Riparian Reserves would use a combination of ground-based, skyline, and helicopter logging systems associated with adjacent treatment activities.

Tractor – 388 acres
Skyline – 697 acres
Helicopter – 120 acres

Roading Activities: No permanent roads are proposed to be constructed. Existing roads would be brought up to specifications to facilitate product removal through normal road maintenance and reconstruction activities as well as additional temporary road construction. See Appendix D for summary tables of roads proposed for use.

Open Roads – Approximately 3.5 miles of paved roads and 57.3 miles of gravel-surfaced open roads would require normal road maintenance activities to facilitate product removal. Existing open roads would be brought up to safe use specifications through normal road maintenance activities such as: roadside brushing, road blading, culvert/ditch clean-out, and surface rock replacement. In addition, existing culverts that have reached the end of their lifespan and have a potential to fail, would be replaced. Also about 7.4 miles of open roads would be brought up to safe use specifications, including installing additional ditch relief culverts or other road drainage improvements, as needed, to meet current water quality standards. After project use they would be closed with traffic control barriers for resource protection, with other work completed as needed for long

term resource protection (other resource protection work is dependent on project funding and could include side cast pull back, culvert removal, and subsoiling compacted soil). The ultimate goal for these roads would be decommissioning, however the funding for this work is uncertain as timber sale contracts or KV funds are not viable options and a separate funding source would be needed.

Closed Roads – Approximately 4.3 miles of Forest System roads currently closed would be reopened and closed; and about 12.1 miles of Forest System roads currently closed would be reopened and closed after project use with traffic control barriers for resource protection, with other work completed as needed for long term resource protection (other resource protection work is dependent on project funding and could include side cast pull back, culvert removal, and subsoiling compacted soil). The ultimate goal for these roads would be decommissioning, however the funding for this work is uncertain as timber sale contracts or KV funds are not viable options and a separate funding source would be needed. In addition to normal road maintenance activities, these roads would require activities to reopen them such as removing barricades and re-installing culverts.

Unclassified Roads – Approximately 85 unclassified road segments totaling about 19.0 miles would be opened (about 4.0 miles in Riparian Reserves). These roads would be treated as temporary roads and decommissioned after harvest operations.

Temporary Roads – Approximately 28 temporary road segments totaling about 4.4 miles would be constructed (about 0.7 mile in Riparian Reserves). Temporary roads would be decommissioned following harvest operations.

Helicopter Landings – Approximately 20 helicopter landings totaling about 20 acres would be constructed. Helicopter landings would be decommissioned following harvest operations.

Rock Quarry Pit Development – Four existing rock quarries (Elk Creek Pit, Wineglass Pit, Joe Creek Pit, and Damper Pit) would require additional pit development to produce surface rock that would be used for unclassified road, temporary road, and landing construction.

Fuels Reduction Activities: Activity generated slash would be treated to reduce hazardous fuels conditions.

Following timber harvest, concentrations of logging slash adjacent to open, well traveled Forest System Roads and other ownership property boundaries (up to 100 feet from the road or boundary) would be piled by hand and may be burned.

Danger Trees: Fall trees considered hazardous to the public along open roads. No old or large residual trees within the treatment units would be cut, except for danger trees. If old or large trees are felled as danger trees, they will not be authorized for removal as part of this project.

Table 2-1: West Fork Humptulips Alterative A (Proposed Action) Summary

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Riparian Reserves	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities
E76	82	1,148 mbf	RR - 8 ac	Commercial Thin	Tractor - 82	Tractor – 1,148	
F4	283	3,962 mbf	RR - 99 ac	Commercial Thin	Skyline – 107 Heli - 176	Skyline – 1,498 Heli – 2,464	Reopen 4 Unclass Rd – 1.48 mi.

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Riparian Reserves	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities
F5	130	1,820 mbf	RR - 67 ac	Commercial Thin	Tractor – 25 Skyline – 55 Heli - 50	Tractor – 350 Skyline – 770 Heli – 700	Reopen 2 Unclass Rd – 0.63 mi.
F6	84	1,176 mbf	RR - 29 ac	Commercial Thin	Tractor – 21 Skyline – 58 Heli -5	Tractor – 294 Skyline – 812 Heli – 70	
F7	96	1,344 mbf	RR - 44 ac	Commercial Thin	Skyline – 70 Heli -26	Skyline – 980 Heli – 364	Reopen 3 Unclass Rd – 0.68 mi.
F9	75	1,050 mbf	RR - 43 ac	Commercial Thin	Skyline - 75	Skyline – 1,050	Constr 1 Temp Rd – 0.09 mi.
F10	125	1,750 mbf	RR - 51 ac	Commercial Thin	Skyline - 125	Skyline – 1,750	Reopen 5 Unclass Rd – 1.34 mi.
F11	42	588 mbf	RR - 29 ac	Commercial Thin	Skyline – 35 Heli - 7	Skyline – 490 Heli – 98	
F15	48	672 mbf	RR - 14 ac	Commercial Thin	Skyline – 45 Heli -3	Skyline – 630 Heli – 42	
F16	48	672 mbf	RR - 23 ac	Commercial Thin	Skyline – 39 Heli - 9	Skyline – 546 Heli -126	Constr 1 Temp Rd – 0.15 mi. Reopen 1 Unclass Rd – 0.81 mi.
F17	44	616 mbf	RR - 20 ac	Commercial Thin	Skyline – 36 Heli - 8	Skyline –504 Heli -112	Reopen 2 Unclass Rd – 0.57 mi.
F18	88	1,246 mbf	RR - 41 ac	Commercial Thin	Skyline – 63 Heli - 25	Skyline –882 Heli -350	Constr 1 Temp Rd – 0.11 mi. Reopen 2 Unclass Rd – 0.44 mi.
F19	75	1,050 mbf	RR - 25 ac	Commercial Thin	Skyline – 63 Heli - 12	Skyline –882 Heli -168	Constr 1 Temp Rd – 0.15 mi. Reopen 2 Unclass Rd – 0.27 mi.
F20	51	714 mbf	RR - 20 ac	Commercial Thin	Tractor – 4 Skyline – 47	Tractor – 56 Skyline – 658	Reopen 1 Unclass Rd – 0.28 mi.
F21	41	574 mbf	RR - 11 ac	Commercial Thin	Tractor – 2 Skyline – 39	Tractor – 28 Skyline – 546	Reopen 2 Unclass Rd – 0.38 mi.
F22	43	602 mbf	RR - 12 ac	Commercial Thin	Tractor – 6 Skyline – 35 Heli -2	Tractor – 84 Skyline – 490 Heli – 28	Reopen 2 Unclass Rd – 0.29 mi.
F30	24	336 mbf	RR – 7	Commercial Thin	Skyline – 24	Skyline – 336	Reopen 2 Unclass Rd – 0.20 mi.
F54	5	70 mbf	RR – 1	Commercial Thin	Tractor – 4 Heli -1	Tractor – 56 Heli – 14	
G3	46	644 mbf	RR - 17 ac	Commercial Thin	Tractor – 46	Tractor – 644	Constr 1 Temp Rd – 0.10 mi. Reopen 2 Unclass Rd – 0.50 mi.
G5	65	910 mbf	RR - 14 ac	Commercial Thin	Tractor – 28 Heli -37	Tractor – 392 Heli – 518	
G6	72	1,008 mbf	RR - 12 ac	Commercial Thin	Tractor – 43 Skyline – 29	Tractor – 602 Skyline – 406	Reopen 4 Unclass Rd – 0.70 mi.
G7	69	966 mbf	RR - 14 ac	Commercial Thin	Tractor - 69	Tractor – 966	Reopen 1 Unclass Rd – 0.48 mi.
G8	53	742 mbf	RR - 18 ac	Commercial Thin	Skyline - 53	Skyline – 742	Constr 1 Temp Rd – 0.11 mi. Reopen 1 Unclass Rd – 0.27 mi.
G9	91	1,274 mbf	RR - 38 ac	Commercial Thin	Tractor – 70 Heli -21	Tractor – 980 Heli – 294	Constr 2 Temp Rd – 0.3 mi. Reopen 1 Unclass Rd – 0.21 mi.
G12	45	630 mbf	RR - 8 ac	Commercial Thin	Tractor - 45	Tractor – 630	Reopen 1 Unclass Rd – 0.29 mi.
G15	130	1,820 mbf	RR - 28 ac	Commercial Thin	Tractor – 79 Skyline – 46 Heli - 5	Tractor – 1,106 Skyline – 644 Heli – 70	Constr 2 Temp Rd – 0.37 mi. Reopen 5 Unclass Rd – 0.60 mi.
G16	273	3,822 mbf	RR - 35 ac	Commercial Thin	Tractor - 273	Tractor – 3,822	Constr 10 Temp Rd – 1.17 mi. Reopen 3 Unclass Rd – 0.46 mi.
G18	110	1,540 mbf	RR - 6 ac	Commercial Thin	Tractor - 110	Tractor – 1,540	Constr 2 Temp Rd – 0.51 mi.
G19	70	980 mbf	RR - 28 ac	Commercial Thin	Tractor - 70	Tractor – 980	Reopen 2 Unclass Rd – 0.42 mi.
G20	129	1,806 mbf	RR - 41 ac	Commercial Thin	Tractor – 48 Skyline – 65 Heli - 16	Tractor – 672 Skyline – 910 Heli – 224	Reopen 2 Unclass Rd – 0.48 mi.
G21	34	476 mbf	RR - 5 ac	Commercial Thin	Skyline – 34	Skyline – 476	
G23	44	616 mbf	RR - 17 ac	Commercial Thin	Skyline – 39 Heli -5	Skyline – 546 Heli – 56	
G25	96	1,344 mbf	RR - 43 ac	Commercial Thin	Skyline – 70 Heli - 26	Skyline – 980 Heli -364	Reopen 2 Unclass Rd – 0.35 mi.
G26	69	966 mbf	RR - 21 ac	Commercial Thin	Tractor – 59 Skyline – 10	Tractor – 826 Skyline – 140	Constr 1 Temp Rd – 0.02 mi. Reopen 2 Unclass Rd – 0.19 mi.
G27	50	700 mbf	RR - 5 ac	Commercial Thin	Tractor - 50	Tractor – 700	Reopen 2 Unclass Rd – 0.52 mi.
G28	43	602 mbf	RR - 18 ac	Commercial Thin	Tractor – 26 Skyline – 7 Heli - 10	Tractor – 364 Skyline – 98 Heli – 140	
G29	14	196 mbf	RR - 11 ac	Commercial Thin	Tractor – 14	Tractor – 196	Constr 1 Temp Rd – 0.42 mi.

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Riparian Reserves	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities
G30	88	1,232 mbf	RR - 27 ac	Commercial Thin	Tractor – 49 Skyline – 39	Tractor – 686 Skyline – 546	Reopen 3 Unclass Rd – 0.42 mi.
G31	97	1,358 mbf	RR - 16 ac	Commercial Thin	Tractor – 83 Heli -14	Tractor – 1,162 Heli – 196	Constr 1 Temp Rd – 0.16 mi. Reopen 1 Unclass Rd – 0.38 mi.
G32	78	1,092 mbf	RR - 10 ac	Commercial Thin	Tractor – 71 Skyline – 7	Tractor – 994 Skyline – 98	Reopen 3 Unclass Rd – 0.53 mi.
G33	96	1,344 mbf	RR - 13 ac	Commercial Thin	Tractor – 96	Tractor – 1,344	Reopen 1 Unclass Rd – 0.50 mi.
G48	88	1,232 mbf	RR - 21 ac	Commercial Thin	Tractor – 88	Tractor – 1,232	Reopen 1 Unclass Rd – 0.47 mi.
G49	24	336 mbf	RR - 6 ac	Commercial Thin	Tractor – 24	Tractor – 336	Reopen 1 Unclass Rd – 0.15 mi.
G51	68	952 mbf	RR - 7 ac	Commercial Thin	Tractor – 68	Tractor – 952	Reopen 1 Unclass Rd – 0.38 mi.
G58	18	252 mbf	RR - 3 ac	Commercial Thin	Skyline - 18	Skyline – 252	
G59	31	420 mbf	RR - 13 ac	Commercial Thin	Tractor – 24 Skyline – 2 Heli - 5	Tractor – 336 Skyline – 28 Heli – 70	Reopen 1 Unclass Rd – 0.27 mi.
G60	15	210 mbf	RR - 5 ac	Commercial Thin	Tractor – 15	Tractor – 210	Reopen 2 Unclass Rd – 0.33 mi.
G61	48	672 mbf	RR - 8 ac	Commercial Thin	Tractor – 48	Tractor – 672	Reopen 1 Unclass Rd – 0.09 mi.
G62	51	714 mbf	RR - 12 ac	Commercial Thin	Tractor – 51	Tractor – 714	Constr 1 Temp Rd – 0.10 mi. Reopen 1 Unclass Rd – 0.11 mi.
G64	37	518 mbf	RR - 5 ac	Commercial Thin	Heli - 37	Heli -518	
G67	40	560 mbf	RR - 7 ac	Commercial Thin	Tractor – 20 Skyline – 20	Tractor – 280 Skyline – 280	
G68	34	476 mbf	RR - 15 ac	Commercial Thin	Skyline - 34	Skyline – 476	
G69	40	560 mbf	RR - 15 ac	Commercial Thin	Tractor – 7 Skyline – 33	Tractor – 98 Skyline – 462	Reopen 4 Unclass Rd – 1.01 mi.
G81	44	616 mbf	RR - 15 ac	Commercial Thin	Tractor – 10 Skyline – 34	Tractor – 140 Skyline – 476	Reopen 1 Unclass Rd – 0.20 mi.
G82	14	210 mbf	RR - 7 ac	Commercial Thin	Skyline – 9 Heli - 5	Skyline – 126 Heli -70	
G91	55	770 mbf	RR - 17 ac	Commercial Thin	Tractor – 12 Skyline – 43	Tractor – 168 Skyline – 602	
G92	47	658 mbf	RR - 6 ac	Commercial Thin	Skyline - 47	Skyline – 658	Reopen 1 Unclass Rd – 0.28 mi.
H8	45	630 mbf	RR - 17 ac	Commercial Thin	Skyline - 45	Skyline – 630	Reopen 1 Unclass Rd – 0.12 mi.
HU1	14	196 mbf	RR - 9 ac	Commercial Thin	Tractor – 14	Tractor – 196	
HU2	20	280 mbf	RR - 1 ac	Commercial Thin	Tractor – 20	Tractor – 280	Constr 2 Temp Rd – 0.29 mi.
HU8	31	434 mbf	RR - 0 ac	Commercial Thin	Tractor – 31	Tractor – 434	Reopen 2 Unclass Rd – 0.40 mi.
HU10	68	952 mbf	RR - 24 ac	Commercial Thin	Tractor – 27 Skyline – 41	Tractor – 378 Skyline – 574	Constr 1 Temp Rd – 0.30 mi. Reopen 2 Unclass Rd – 0.56 mi.
H137	23	322 mbf	RR - 5 ac	Commercial Thin	Skyline – 4 Heli - 19	Skyline – 56 Heli -266	
63 Units	4,101 Acres	57,414 mbf	RR – 1,205 ac		Tractor – 1,932 Skyline – 1,645 Helicopter - 524 *RR-T = 388 ac* *RR-S = 697 ac* *RR-H = 120 ac*	Tractor – 27,048 Skyline– 23,030 Heli – 7,336	Constr 29 Temp Rds – 4.35 mi. Reopen 83 Unclass Rd – 19.04mi.

ALTERNATIVE B

Alternative B (Table 2-2 and maps in Appendix A) is a modification of the Proposed Action. This alternative is designed to reduce impacts in regard to the Key Issue of effects from road construction activities on aquatic resources while continuing to address the Purpose and Need. Under this alternative, potential impacts to the Key Issue would be reduced to a level considered less than that of the Proposed Action by reducing the amount of existing unclassified roads and temporary roads used within Riparian Reserve land classification that contains one or more of the following criteria: proximity to fish-bearing streams, number and/or size of stream crossings and juxtaposition to aquatic habitats, within areas considered as having a moderate instability hazard (high hazard areas were avoided in the Proposed Action), and/or within Riparian Reserves that would contain specific wildlife habitat attributes that are unique to the Planning Area. As with Alternative A, consideration would be given for the opportunity to improve the condition on existing roads and better decommission unclassified roads as part of the project.

- No treatment units would be dropped from consideration. As previously described this suite of treatment units resulted from an IDT review (both field and GIS) of all potential stands meeting the age criteria. Stands with resource or operational issues were previously dropped from consideration. The remaining units are important to treat in order to address the project's Purpose and Need, consequently none were excluded in this alternative. Issues were addressed by modifying road use and logging systems. By removing roaded access, harvest methods within 5 affected treatment units would change on 186 acres to reflect the lack of access as follows:

  Unit F18: 21 acres of skyline to helicopter
  Unit G29: 14 acres of tractor to skyline
  Unit G31: 83 acres of tractor to helicopter
  Unit HU1: 14 acres of tractor to helicopter
  Unit HU10: 27 acres of tractor and 41 acres of skyline to helicopter

- Remove from consideration: 2.20 miles of reopened existing unclassified roads and 0.93 miles of temporary road construction. This would result in the removal of approximately 3.13 miles of unclassified road reconstruction and temporary road construction. This change from the Proposed Action would affect 7 treatment units as follows:

  Unit F18: one unclassified road totaling 0.38 miles.
  Unit G3: one unclassified road totaling 0.20 miles. (Tractor yarding remains, although distances increase)
  Unit G25: all - two unclassified roads totaling 0.35 miles. (Skyline yarding remains, although distances and complexity increase)
  Unit G29: all - one temp road totaling 0.42 miles.
  Unit G31: all - one temp road and one unclassified road totaling 0.54 miles.
  Unit G60: all – two unclassified roads totaling 0.33 miles. (Tractor yarding remains, although distances increase)
  Unit HU10: all - one temp road and two unclassified roads totaling 0.86 miles.

- Acres of vegetation treatment within Riparian Reserves would remain the same. By removing roaded access, harvest methods within 14 acres of affected Riparian Reserves would change. This change from the Proposed Action would affect 4 treatment units as follows:

  Unit F18: 6 acres of skyline to helicopter

Unit G31: 4 acres of tractor to helicopter
Unit HU1: 3 acres of tractor to helicopter
Unit HU10: 1 acre of skyline to helicopter

Stand Density Treatment (Commercial Thinning) Activities: An estimated 57.4 million board feet of timber (mmbf) would be harvested from commercially thinning approximately 63 treatment units totaling about 4,101 acres. Harvest activities would use a combination of ground-based, skyline, and helicopter logging systems. (These figures are estimates based on observations made during field review.)

Tractor – 1,794 acres and 25.1 mmbf
Skyline – 1,597 acres and 22.4 mmbf
Helicopter – 710 acres and 9.9 mmbf

Riparian Reserve Treatment Activities: Subject to Project Design Criteria and included within the proposed stand density treatment, activities would occur within approximately 1,205 acres of land classified as Riparian Reserves. Harvest activities within Riparian Reserves would reflect the change in treatment unit logging systems.

Tractor – 381 acres
Skyline – 690 acres
Helicopter – 134 acres

Roading Activities: Existing roads would be brought up to specifications to facilitate product removal through normal road maintenance activities. No permanent roads are proposed to be constructed. See Appendix D for summary tables of roads proposed for use.

Open Roads – Approximately 3.5 miles of paved roads and 57.3 miles of gravel-surfaced open roads would require normal road maintenance activities to facilitate product removal. Existing open roads would be brought up to safe use specifications through normal road maintenance activities such as: roadside brushing, road blading, culvert/ditch clean-out, and surface rock replacement. In addition, existing culverts that have reached the end of their lifespan and have a potential to fail, would be replaced. Also about 7.4 miles of open roads would be brought up to safe use specifications, including installing additional ditch relief culverts or other road drainage improvements, as needed, to meet current water quality standards. After project use they would be closed with traffic control barriers for resource protection, with other work completed as needed for long term resource protection (other resource protection work is dependent on project funding and could include side cast pull back, culvert removal, and subsoiling compacted soil). The ultimate goal for these roads would be decommissioning, however the funding for this work is uncertain as timber sale contracts or KV funds are not viable options and a separate funding source would be needed.

Closed Roads – Approximately 4.0 miles of Forest System roads currently closed would be reopened and closed; and about 11.2 miles of Forest System roads currently closed would be reopened and closed after project use with traffic control barriers for resource protection, with other work completed as needed for long term resource protection (other resource protection work is dependent on project funding and could include side cast pull back, culvert removal, and subsoiling compacted soil). The ultimate goal for these roads would be decommissioning, however the funding for this work is uncertain as timber sale contracts or KV funds are not viable options and a separate funding source would be needed. In addition to normal road maintenance activities, these roads would require

activities to reopen them such as removing barricades and re-installing culverts.

Unclassified Roads – Approximately 76 unclassified road segments totaling about 16.8 miles would be opened (about 3.1 miles in Riparian Reserves). These roads would be treated as temporary roads and decommissioned after harvest operations.

Temporary Roads – Approximately 25 temporary road segments totaling about 3.47 miles would be constructed (about 0.3 mile in Riparian Reserves). Temporary roads would be decommissioned following harvest operations.

Helicopter Landings – Approximately 20 helicopter landings totaling about 20 acres would be constructed. Helicopter landings would be decommissioned following harvest operations.

Rock Quarry Pit Development – Four existing rock quarries (Elk Creek Pit, Wineglass Pit, Joe Creek Pit, and Damper Pit) would require additional pit development to produce surface rock that would be used for unclassified road, temporary road, and landing construction.

Fuels Reduction Activities:

Following timber harvest, concentrations of logging slash adjacent to open, well traveled Forest System Roads and other ownership property boundaries (up to 100 feet from the road or boundary) would be piled by hand and may be burned.

Danger Trees: Fall trees considered hazardous to the public along open roads. No old or large residual trees within the treatment units would be cut, except for danger trees. If old or large trees are felled as danger trees, they will not be authorized for removal as part of this project.

Table 2-2: West Fork Humptulips Alterative B Summary

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Mgt. Area	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities
E76	82	1,148 mbf	RR - 8 ac	Commercial Thin	Tractor - 82	Tractor – 1,148	
F4	283	3,962 mbf	RR - 99 ac	Commercial Thin	Skyline – 107 Heli - 176	Skyline – 1,498 Heli – 2,464	Reopen 4 Unclass Rd – 1.48 mi.
F5	130	1,820 mbf	RR - 67 ac	Commercial Thin	Tractor – 25 Skyline – 55 Heli - 50	Tractor – 350 Skyline – 770 Heli – 700	Reopen 2 Unclass Rd – 0.63 mi.
F6	84	1,176 mbf	RR - 29 ac	Commercial Thin	Tractor – 21 Skyline – 58 Heli -5	Tractor – 294 Skyline – 812 Heli – 70	
F7	96	1,344 mbf	RR - 44 ac	Commercial Thin	Skyline – 70 Heli -26	Skyline – 980 Heli – 364	Reopen 3 Unclass Rd – 0.68 mi.
F9	75	1,050 mbf	RR - 43 ac	Commercial Thin	Skyline - 75	Skyline – 1,050	Constr 1 Temp Rd – 0.09 mi.
F10	125	1,750 mbf	RR - 51 ac	Commercial Thin	Skyline - 125	Skyline – 1,750	Reopen 5 Unclass Rd – 1.34 mi.
F11	42	588 mbf	RR - 29 ac	Commercial Thin	Skyline – 35 Heli - 7	Skyline – 490 Heli – 98	
F15	48	672 mbf	RR - 14 ac	Commercial Thin	Skyline – 45 Heli -3	Skyline – 630 Heli – 42	
F16	48	672 mbf	RR - 23 ac	Commercial Thin	Skyline – 39 Heli - 9	Skyline – 546 Heli -126	Constr 1 Temp Rd – 0.15 mi. Reopen 1 Unclass Rd – 0.81 mi.
F17	44	616 mbf	RR - 20 ac	Commercial Thin	Skyline – 36 Heli - 8	Skyline –504 Heli -112	Reopen 2 Unclass Rd – 0.57 mi.
F18	88	1,246 mbf	RR - 41 ac	Commercial Thin	Skyline – 42 Heli - 46	Skyline –588 Heli -644	Constr 1 Temp Rd – 0.11 mi. Reopen 1 Unclass Rd – 0.06 mi.
F19	75	1,050 mbf	RR - 25 ac	Commercial Thin	Skyline – 63 Heli - 12	Skyline –882 Heli -168	Constr 1 Temp Rd – 0.15 mi. Reopen 2 Unclass Rd – 0.27 mi.
F20	51	714 mbf	RR - 20 ac	Commercial Thin	Tractor – 4 Skyline – 47	Tractor – 56 Skyline – 658	Reopen 1 Unclass Rd – 0.28 mi.
F21	41	574 mbf	RR - 11 ac	Commercial Thin	Tractor – 2 Skyline – 39	Tractor – 28 Skyline – 546	Reopen 2 Unclass Rd – 0.38 mi.

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Mgt. Area	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities
F22	43	602 mbf	RR - 12 ac	Commercial Thin	Tractor – 6 Skyline – 35 Heli -2	Tractor – 84 Skyline – 490 Heli – 28	Reopen 2 Unclass Rd – 0.29 mi.
F30	24	336 mbf	RR – 7	Commercial Thin	Skyline – 24	Skyline – 336	Reopen 2 Unclass Rd – 0.20 mi.
F54	5	70 mbf	RR – 1	Commercial Thin	Tractor – 4 Heli -1	Tractor – 56 Heli – 14	
G3	46	644 mbf	RR - 17 ac	Commercial Thin	Tractor – 46	Tractor – 644	Constr 1 Temp Rd – 0.10 mi. Reopen 1 Unclass Rd – 0.30 mi.
G5	65	910 mbf	RR - 14 ac	Commercial Thin	Tractor – 28 Heli -37	Tractor – 392 Heli – 518	
G6	72	1,008 mbf	RR - 12 ac	Commercial Thin	Tractor – 43 Skyline – 29	Tractor – 602 Skyline – 406	Reopen 4 Unclass Rd – 0.70 mi.
G7	69	966 mbf	RR - 14 ac	Commercial Thin	Tractor - 69	Tractor – 966	Reopen 1 Unclass Rd – 0.48 mi.
G8	53	742 mbf	RR - 18 ac	Commercial Thin	Skyline - 53	Skyline – 742	Constr 1 Temp Rd – 0.11 mi. Reopen 1 Unclass Rd – 0.27 mi.
G9	91	1,274 mbf	RR - 38 ac	Commercial Thin	Tractor – 70 Heli -21	Tractor – 980 Heli – 294	Constr 2 Temp Rd – 0.3 mi. Reopen 1 Unclass Rd – 0.21 mi.
G12	45	630 mbf	RR - 8 ac	Commercial Thin	Tractor - 45	Tractor – 630	Reopen 1 Unclass Rd – 0.29 mi.
G15	130	1,820 mbf	RR - 28 ac	Commercial Thin	Tractor – 79 Skyline – 46 Heli - 5	Tractor – 1,106 Skyline – 644 Heli – 70	Constr 2 Temp Rd – 0.37 mi. Reopen 5 Unclass Rd – 0.60 mi.
G16	273	3,822 mbf	RR - 35 ac	Commercial Thin	Tractor - 273	Tractor – 3,822	Constr 10 Temp Rd – 1.17 mi. Reopen 3 Unclass Rd – 0.46 mi.
G18	110	1,540 mbf	RR - 6 ac	Commercial Thin	Tractor - 110	Tractor – 1,540	Constr 2 Temp Rd – 0.51 mi.
G19	70	980 mbf	RR - 28 ac	Commercial Thin	Tractor - 70	Tractor – 980	Reopen 2 Unclass Rd – 0.42 mi.
G20	129	1,806 mbf	RR - 41 ac	Commercial Thin	Tractor – 48 Skyline – 65 Heli - 16	Tractor – 672 Skyline – 910 Heli – 224	Reopen 2 Unclass Rd – 0.48 mi.
G21	34	476 mbf	RR - 5 ac	Commercial Thin	Skyline – 34	Skyline – 476	
G23	44	616 mbf	RR - 17 ac	Commercial Thin	Skyline – 39 Heli -5	Skyline – 546 Heli – 56	
G25	96	1,344 mbf	RR - 43 ac	Commercial Thin	Skyline – 70 Heli - 26	Skyline – 980 Heli -364	
G26	69	966 mbf	RR - 21 ac	Commercial Thin	Tractor – 59 Skyline – 10	Tractor – 826 Skyline – 140	Constr 1 Temp Rd – 0.02 mi. Reopen 2 Unclass Rd – 0.19 mi.
G27	50	700 mbf	RR - 5 ac	Commercial Thin	Tractor - 50	Tractor – 700	Reopen 2 Unclass Rd – 0.52 mi.
G28	43	602 mbf	RR - 18 ac	Commercial Thin	Tractor – 26 Skyline – 7 Heli - 10	Tractor – 364 Skyline – 98 Heli – 140	
G29	14	196 mbf	RR - 11 ac	Commercial Thin	Skyline – 14	Skyline – 196	
G30	88	1,232 mbf	RR - 27 ac	Commercial Thin	Tractor – 49 Skyline – 39	Tractor – 686 Skyline – 546	Reopen 3 Unclass Rd – 0.42 mi.
G31	97	1,358 mbf	RR - 16 ac	Commercial Thin	Heli -97	Heli – 1,358	
G32	78	1,092 mbf	RR - 10 ac	Commercial Thin	Tractor – 71 Skyline – 7	Tractor – 994 Skyline – 98	Reopen 3 Unclass Rd – 0.53 mi.
G33	96	1,344 mbf	RR - 13 ac	Commercial Thin	Tractor – 96	Tractor – 1,344	Reopen 1 Unclass Rd – 0.50 mi.
G48	88	1,232 mbf	RR - 21 ac	Commercial Thin	Tractor – 88	Tractor – 1,232	Reopen 1 Unclass Rd – 0.47 mi.
G49	24	336 mbf	RR - 6 ac	Commercial Thin	Tractor – 24	Tractor – 336	Reopen 1 Unclass Rd – 0.15 mi.
G51	68	952 mbf	RR - 7 ac	Commercial Thin	Tractor – 68	Tractor – 952	Reopen 1 Unclass Rd – 0.38 mi.
G58	18	252 mbf	RR - 3 ac	Commercial Thin	Skyline - 18	Skyline – 252	
G59	31	420 mbf	RR - 13 ac	Commercial Thin	Tractor – 24 Skyline – 2 Heli - 5	Tractor – 336 Skyline – 28 Heli – 70	Reopen 1 Unclass Rd – 0.27 mi.
G60	15	210 mbf	RR - 5 ac	Commercial Thin	Tractor – 15	Tractor – 210	
G61	48	672 mbf	RR - 8 ac	Commercial Thin	Tractor – 48	Tractor – 672	Reopen 1 Unclass Rd – 0.09 mi.
G62	51	714 mbf	RR - 12 ac	Commercial Thin	Tractor – 51	Tractor – 714	Constr 1 Temp Rd – 0.10 mi. Reopen 1 Unclass Rd – 0.11 mi.
G64	37	518 mbf	RR - 5 ac	Commercial Thin	Heli - 37	Heli -518	
G67	40	560 mbf	RR - 7 ac	Commercial Thin	Tractor – 20 Skyline – 20	Tractor – 280 Skyline – 280	

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Mgt. Area	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities
G68	34	476 mbf	RR - 15 ac	Commercial Thin	Skyline - 34	Skyline – 476	
G69	40	560 mbf	RR - 15 ac	Commercial Thin	Tractor – 7 Skyline – 33	Tractor – 98 Skyline – 462	Reopen 4 Unclass Rd – 1.01 mi.
G81	44	616 mbf	RR - 15 ac	Commercial Thin	Tractor – 10 Skyline – 34	Tractor – 140 Skyline – 476	Reopen 1 Unclass Rd – 0.20 mi.
G82	14	210 mbf	RR - 7 ac	Commercial Thin	Skyline – 9 Heli - 5	Skyline – 126 Heli -70	
G91	55	770 mbf	RR - 17 ac	Commercial Thin	Tractor – 12 Skyline – 43	Tractor – 168 Skyline – 602	
G92	47	658 mbf	RR - 6 ac	Commercial Thin	Skyline - 47	Skyline – 658	Reopen 1 Unclass Rd – 0.28 mi.
H8	45	630 mbf	RR - 17 ac	Commercial Thin	Skyline - 45	Skyline – 630	Reopen 1 Unclass Rd – 0.12 mi.
HU1	14	196 mbf	RR - 9 ac	Commercial Thin	Heli – 14	Heli – 196	
HU2	20	280 mbf	RR - 1 ac	Commercial Thin	Tractor – 20	Tractor – 280	Constr 2 Temp Rd – 0.29 mi.
HU8	31	434 mbf	RR - 0 ac	Commercial Thin	Tractor – 31	Tractor – 434	Reopen 2 Unclass Rd – 0.40 mi.
HU10	68	952 mbf	RR - 24 ac	Commercial Thin	Heli – 68	Heli – 952	
H137	23	322 mbf	RR - 5 ac	Commercial Thin	Skyline – 4 Heli - 19	Skyline – 56 Heli -266	
63 Units	4,101 Acres	57,414 mbf	RR – 1,205 ac		Tractor – 1,794 Skyline – 1,597 Helicopter - 710 *RR-T = 381 ac* *RR-S = 690 ac* *RR-H = 134 ac*	Tractor – 25,116 Skyline– 22,358 Heli – 9,940	Constr 27 Temp Rds – 3.47 mi. Reopen 74 Unclass Rd – 16.84mi.

ALTERNATIVE C

Alternative C (Table 2-3 and maps in Appendix A) is a modification of the Proposed Action. This alternative is designed to further reduce impacts in regard to the Key Issue of effects from road construction activities on aquatic resources while continuing to address the Purpose and Need. Under this alternative, potential impacts to the Key Issue would be reduced to a level considered less than that of the Proposed Action by eliminating almost all of the unclassified roads from consideration and eliminating all construction of new temporary roads. Though unclassified, there is one road that accesses one treatment unit that is currently open and used by the public. Due to its current stable condition, this road remained under consideration for this alternative. As developed, this alternative would disclose a change in impacts to the Key Issue by:

- No treatment units would be dropped as described for Alternative A. By removing roaded access, harvest methods within 34 affected treatment units would change to reflect the lack of access as follows:

  Units F5, F20, F21, F22,G3, G6, G9, G12, G15, G26, G27, G29, G31, G32, G33, G48, G49, G59, G69, HU1, HU10: The amount of tractor yarding would be reduced by 380 acres.

  Units F4, F5, F7, F10, F15, F16, F17, F18, F19, F20, F21, F22,G6, G8, G15, G25, G30, G59, G69, G81, G92, HU10: The amount of skyline yarding would be reduced by 677 acres.

  All 34 Units: The amount of helicopter yarding would be increased by 1,057 acres.

- All existing unclassified roads would be removed from consideration except one of the roads that accesses Treatment Unit F17 which totals 0.26 miles. There would be no temporary road construction within the Planning Area. This change would result in

removal from consideration of approximately 84 unclassified roads totaling 18.74 miles and 28 temporary roads totaling 4.4 miles, as compared to Alternative A.

- Acres of treatment activities within Riparian Reserves (RR) would remain the same. By removing roaded access, harvest methods within 30 treatment units (four units have no riparian areas treated) totaling 252 acres of affected RR would change as follows:
  The amount of RR tractor yarding would be reduced by 47 acres.
  The amount of RR skyline yarding would be reduced by 205 acres.
  The amount of RR helicopter yarding would be increased by 252 acres.

Stand Density Treatment (Commercial Thinning) Activities: An estimated 57.4 million board feet of timber (mmbf) would be harvested from commercially thinning approximately 63 treatment units totaling about 4,101 acres. Harvest activities would use a combination of ground-based, skyline, and helicopter logging systems. (These figures are estimates based on observations made during field review.)

Tractor – 1,552 acres and 21.7 mmbf
Skyline – 968 acres and 13.6 mmbf
Helicopter – 1,581 acres and 22.1 mmbf

Riparian Reserve Treatment Activities: Subject to Project Design Criteria and included within the proposed stand density treatment, activities would still occur within approximately 1,205 acres of land classified as Riparian Reserves. Harvest activities within Riparian Reserves would reflect the change in treatment unit logging systems.

Tractor – 341 acres
Skyline – 492 acres
Helicopter – 372 acres

Roading Activities: Existing roads would be brought up to specifications to facilitate product removal through normal road maintenance activities. No permanent roads are proposed to be constructed. See Appendix D for summary tables of roads proposed for use.

Open Roads – Approximately 3.5 miles of paved roads and 57.3 miles of gravel-surfaced open roads would require normal road maintenance activities to facilitate product removal. Existing open roads would be brought up to safe use specifications through normal road maintenance activities such as: roadside brushing, road blading, culvert/ditch clean-out, and surface rock replacement. In addition, existing culverts that have reached the end of their lifespan and have a potential to fail, would be replaced. Also about 7.4 miles of open roads would be brought up to safe use specifications, including installing additional ditch relief culverts or other road drainage improvements, as needed, to meet current water quality standards. After project use they would be closed with traffic control barriers for resource protection, with other work completed as needed for long term resource protection (other resource protection work is dependent on project funding and could include side cast pull back, culvert removal, and subsoiling compacted soil). The ultimate goal for these roads would be decommissioning, however the funding for this work is uncertain as timber sale contracts or KV funds are not viable options and a separate funding source would be needed.

Closed Roads – Approximately 4.3 miles of Forest System roads currently closed would be reopened and closed; and about 10.2 miles of Forest System roads currently closed would be reopened and closed after project use with traffic control barriers for resource

protection, with other work completed as needed for long term resource protection (other resource protection work is dependent on project funding and could include side cast pull back, culvert removal, and subsoiling compacted soil). The ultimate goal for these roads would be decommissioning, however the funding for this work is uncertain as timber sale contracts or KV funds are not viable options and a separate funding source would be needed. In addition to normal road maintenance activities, these roads would require activities to reopen them such as removing barricades and re-installing culverts.

Unclassified Roads – One unclassified road segment totaling approximately 0.26 miles would be opened. This road would be treated as a temporary road and decommissioned after harvest operations.

Temporary Roads – No temporary road segments would be constructed.

Helicopter Landings – Approximately 29 helicopter landings totaling about 29 acres would be constructed. Helicopter landings would be decommissioned following harvest operations.

Rock Quarry Pit Development – Four existing rock quarries (Elk Creek Pit, Wineglass Pit, Joe Creek Pit, and Damper Pit) would require additional pit development to produce surface rock that would be used for unclassified road reconstruction and landing construction.

Fuels Reduction Activities:

Following timber harvest, concentrations of logging slash adjacent to open, well traveled Forest System Roads and other ownership property boundaries (up to 100 feet from the road or boundary) would be piled by hand and may be burned.

Danger Trees: Fall trees considered hazardous to the public along open roads. No old or large residual trees within the treatment units would be cut, except for danger trees. If old or large trees are felled as danger trees, they will not be authorized for removal as part of this project.

Table 2-3: West Fork Humptulips Alterative C Summary

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Mgt. Area	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities / Heli Landing Construction
E76	82	1,148 mbf	RR - 8 ac	Commercial Thin	Tractor - 82	Tractor – 1,148	
F4	283	3,962 mbf	RR - 99 ac	Commercial Thin	Skyline – 47 Heli - 236	Skyline – 658 Heli – 3,304	
F5	130	1,820 mbf	RR - 67 ac	Commercial Thin	Skyline – 8 Heli - 122	Skyline – 112 Heli – 1,708	
F6	84	1,176 mbf	RR - 29 ac	Commercial Thin	Tractor – 21 Skyline – 58 Heli -5	Tractor – 294 Skyline – 812 Heli – 70	
F7	96	1,344 mbf	RR - 44 ac	Commercial Thin	Skyline – 16 Heli -80	Skyline – 224 Heli – 1,120	
F9	75	1,050 mbf	RR - 43 ac	Commercial Thin	Skyline - 75	Skyline – 1,050	
F10	125	1,750 mbf	RR - 51 ac	Commercial Thin	Skyline – 8 Heli -117	Skyline – 112 Heli – 1,638	
F11	42	588 mbf	RR - 29 ac	Commercial Thin	Skyline – 35 Heli - 7	Skyline – 490 Heli – 98	
F15	48	672 mbf	RR - 14 ac	Commercial Thin	Skyline – 36 Heli -12	Skyline – 504 Heli – 168	
F16	48	672 mbf	RR - 23 ac	Commercial Thin	Heli - 48	Heli -672	
F17	44	616 mbf	RR - 20 ac	Commercial Thin	Skyline – 20 Heli - 24	Skyline –280 Heli -336	Reopen 1 Unclass Rd – 0.26 mi.

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Mgt. Area	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities / Heli Landing Construction
F18	88	1,246 mbf	RR - 41 ac	Commercial Thin	Skyline – 33 Heli - 55	Skyline –462 Heli -770	
F19	75	1,050 mbf	RR - 25 ac	Commercial Thin	Skyline – 17 Heli - 58	Skyline –238 Heli -812	
F20	51	714 mbf	RR - 20 ac	Commercial Thin	Tractor – 3 Skyline – 33 Heli -15	Tractor - 42 Skyline – 462 Heli – 210	
F21	41	574 mbf	RR - 11 ac	Commercial Thin	Skyline – 10 Heli - 31	Skyline – 140 Heli - 434	
F22	43	602 mbf	RR - 12 ac	Commercial Thin	Tractor – 3 Skyline – 13 Heli -27	Tractor – 42 Skyline – 182 Heli – 378	
F30	24	336 mbf	RR – 7	Commercial Thin	Skyline – 24	Skyline – 336	
F54	5	70 mbf	RR – 1	Commercial Thin	Tractor – 4 Heli -1	Tractor – 56 Heli – 14	
G3	46	644 mbf	RR - 17 ac	Commercial Thin	Tractor – 27 Heli - 19	Tractor – 378 Heli - 266	
G5	65	910 mbf	RR - 14 ac	Commercial Thin	Tractor – 28 Heli -37	Tractor – 392 Heli – 518	
G6	72	1,008 mbf	RR - 12 ac	Commercial Thin	Tractor – 39 Skyline – 4 Heli - 29	Tractor – 546 Skyline – 56 Heli - 406	
G7	69	966 mbf	RR - 14 ac	Commercial Thin	Tractor - 69	Tractor – 966	
G8	53	742 mbf	RR - 18 ac	Commercial Thin	Skyline – 10 Heli - 43	Skyline – 140 Heli - 602	
G9	91	1,274 mbf	RR - 38 ac	Commercial Thin	Tractor – 41 Heli -50	Tractor – 574 Heli – 700	
G12	45	630 mbf	RR - 8 ac	Commercial Thin	Tractor – 23 Heli - 22	Tractor – 322 Heli - 308	
G15	130	1,820 mbf	RR - 28 ac	Commercial Thin	Tractor – 50 Skyline – 17 Heli - 63	Tractor – 700 Skyline – 238 Heli – 882	
G16	273	3,822 mbf	RR - 35 ac	Commercial Thin	Tractor - 273	Tractor – 3,822	
G18	110	1,540 mbf	RR - 6 ac	Commercial Thin	Tractor - 110	Tractor – 1,540	
G19	70	980 mbf	RR - 28 ac	Commercial Thin	Tractor - 70	Tractor – 980	
G20	129	1,806 mbf	RR - 41 ac	Commercial Thin	Tractor – 48 Skyline – 65 Heli - 16	Tractor – 672 Skyline – 910 Heli – 224	
G21	34	476 mbf	RR - 5 ac	Commercial Thin	Skyline – 34	Skyline – 476	
G23	44	616 mbf	RR - 17 ac	Commercial Thin	Skyline – 39 Heli -5	Skyline – 546 Heli – 56	
G25	96	1,344 mbf	RR - 43 ac	Commercial Thin	Skyline – 66 Heli - 30	Skyline – 924 Heli -420	
G26	69	966 mbf	RR - 21 ac	Commercial Thin	Tractor – 49 Skyline – 10 Heli - 10	Tractor – 686 Skyline – 140 Heli - 140	
G27	50	700 mbf	RR - 5 ac	Commercial Thin	Tractor – 39 Heli - 11	Tractor – 546 Heli - 154	
G28	43	602 mbf	RR - 18 ac	Commercial Thin	Tractor – 26 Skyline – 7 Heli - 10	Tractor – 364 Skyline – 98 Heli – 140	
G29	14	196 mbf	RR - 11 ac	Commercial Thin	Skyline – 14	Skyline – 196	
G30	88	1,232 mbf	RR - 27 ac	Commercial Thin	Tractor – 49 Skyline – 24 Heli - 15	Tractor – 686 Skyline – 336 Heli - 210	
G31	97	1,358 mbf	RR - 16 ac	Commercial Thin	Tractor – 71 Heli -26	Tractor – 994 Heli – 364	
G32	78	1,092 mbf	RR - 10 ac	Commercial Thin	Tractor – 47 Skyline – 7 Heli - 24	Tractor – 658 Skyline – 98 Heli - 336	
G33	96	1,344 mbf	RR - 13 ac	Commercial Thin	Tractor – 31 Heli - 65	Tractor – 434 Heli - 910	
G48	88	1,232 mbf	RR - 21 ac	Commercial Thin	Tractor – 35 Heli - 53	Tractor – 490 Heli - 742	
G49	24	336 mbf	RR - 6 ac	Commercial Thin	Tractor – 15 Heli - 9	Tractor – 210 Heli - 126	
G51	68	952 mbf	RR - 7 ac	Commercial Thin	Tractor – 68	Tractor – 952	
G58	18	252 mbf	RR - 3 ac	Commercial Thin	Skyline - 18	Skyline – 252	

Treatment Unit #	Total Acres Treated	Harvest Volume (mbf)	Treatment within Mgt. Area	Treatment Method	Harvest System and Acres	Harvest System Volume (mbf)	Road Activities / Heli Landing Construction
G59	31	420 mbf	RR - 13 ac	Commercial Thin	Tractor – 16 Heli - 15	Tractor – 224 Heli – 210	
G60	15	210 mbf	RR - 5 ac	Commercial Thin	Tractor – 15	Tractor – 210	
G61	48	672 mbf	RR - 8 ac	Commercial Thin	Tractor – 48	Tractor – 672	
G62	51	714 mbf	RR - 12 ac	Commercial Thin	Tractor – 51	Tractor – 714	
G64	37	518 mbf	RR - 5 ac	Commercial Thin	Heli - 37	Heli -518	
G67	40	560 mbf	RR - 7 ac	Commercial Thin	Tractor – 20 Skyline – 20	Tractor – 280 Skyline – 280	
G68	34	476 mbf	RR - 15 ac	Commercial Thin	Skyline - 34	Skyline – 476	
G69	40	560 mbf	RR - 15 ac	Commercial Thin	Skyline – 15 Heli - 25	Skyline – 210 Heli - 350	
G81	44	616 mbf	RR - 15 ac	Commercial Thin	Tractor – 10 Skyline – 30 Heli - 4	Tractor – 140 Skyline – 420 Heli - 56	
G82	14	210 mbf	RR - 7 ac	Commercial Thin	Skyline – 9 Heli - 5	Skyline – 126 Heli -70	
G91	55	770 mbf	RR - 17 ac	Commercial Thin	Tractor – 12 Skyline – 43	Tractor – 168 Skyline – 602	
G92	47	658 mbf	RR - 6 ac	Commercial Thin	Skyline – 20 Heli - 27	Skyline – 280 Heli - 378	
H8	45	630 mbf	RR - 17 ac	Commercial Thin	Skyline - 45	Skyline – 630	
HU1	14	196 mbf	RR - 9 ac	Commercial Thin	Tractor – 5 Heli - 9	Tractor – 70 Heli - 126	
HU2	20	280 mbf	RR - 1 ac	Commercial Thin	Tractor – 20	Tractor – 280	
HU8	31	434 mbf	RR - 0 ac	Commercial Thin	Tractor – 31	Tractor – 434	
HU10	68	952 mbf	RR - 24 ac	Commercial Thin	Tractor – 3 Heli – 65	Tractor – 42 Heli – 910	
H137	23	322 mbf	RR - 5 ac	Commercial Thin	Skyline – 4 Heli - 19	Skyline – 56 Heli -266	
63 Units	4,101 Acres	57,414 mbf	RR – 1,205 ac		Tractor – 1,552 Skyline – 968 Heli – 1,581 *RR-T = 341 ac* *RR-S = 492 ac* *RR-H = 372 ac*	Tractor – 21,728 Skyline– 13,552 Heli – 22,134	Constr 0 Temp Rds – 0.0 mi. Reopen 1 Unclass Rd – 0.26 mi.

Mitigation Common to All Action Alternatives

The Forest Service is required by the Council on Environmental Quality (CEQ) Regulations to implement the procedural provisions of NEPA to identify all relevant, reasonable mitigation measures that could improve the project or reduce adverse environmental effects. Mitigation, as defined in the CEQ Regulations (40 CFR 1508.20), includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

Action Alternatives propose commercial tree harvest and removal that would be accomplished by private contractors. Contracts for commercial harvest operations would require mitigation measures to be incorporated as contract requirements. The Forest Service has long-standing experience in applying mitigation measures under traditional timber sale contracts, and

therefore, contract language that could be applied to contracts is included. Forest Service contract administrators are responsible for enforcing the implementation of contract provisions.

Proposed mitigation measures and standard operating procedures designed to avoid or minimize adverse effects (or implement positive effects) for the Action Alternatives are identified by resource topic area. These measures are specific to implementation of actions considered within this EA. Standards and Guidelines and mitigation measures identified in the Olympic National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan are incorporated by reference as required measures.

1. **Soils:** The following are specific mitigation measures for protection of soils. Mitigation measures designed for the protection of soils and site productivity (as well as water quality) are generally referred to as Best Management Practices (BMPs) and are described in *General Water Quality Best Management Practices,* Pacific Northwest Region, November 1988 (USDA 1988).

<u>Yarding Operations</u>

1. During tractor operations on sensitive soils, equipment shall not be operated when ground conditions are such that excessive damage will result. Purchaser shall adjust the kinds and intensity of erosion control work done to ground and weather conditions, and the need for controlling runoff. Erosion control work shall be kept current immediately preceding expected seasonal periods of precipitation or runoff. The objective of this measure is to limit the degree of soil compaction, rutting, and erosion as well as reduce the potential for offsite stream sedimentation.
2. On tractor operations, skid roads shall be approved by the Forest Service prior to felling operations (BMP T-11). Equipment shall generally be limited to slopes less than 30% (unless otherwise approved by the Timber Sale Administrator upon consultation with a soil scientist). Re-use old skid roads where possible in lieu of the construction of new ones as long as they are located in areas that would prevent sediment delivery to streams and avoid wet areas. Location of all skid roads shall be no closer than 110 feet apart, center-to-center. Skid roads should not exceed 12 feet in width and would have slash placed on them prior to use by equipment whenever possible. Avoid locating skid roads near snags that are greater than 16 inches dbh (CWD PDC). Lining-pulling operations may be accomplished by yarding material to lead, or at a 30-45 degree angle towards skid roads wherever possible. Suspension of logs is not required during lining operations.
3. On tractor operations, where skid trail rut depth exceeds 10 inches, the following actions will be required: 1) subsoiling the full width of the trail to the depth of the rut plus six inches, 2) returning all displaced soils on adjacent berms and any excavated material to the skid trail to approximate original soil contours, 3) replacing any disturbed large coarse woody debris as closely as possible to its original position, and 4) placing slash and stumps onto the trail so that it is contiguous with the surrounding area. Install erosion control devices such as backblading and waterbars, as necessary, on all skid roads.
4. (Seasonal-summer) Operation of ground-based equipment in harvest units E76A, F20-21, G3, G5, G8-9, G12, G16, G19-20, G26-27, G30-31, G48-49, G60-62, G81, H8, HU2, and HU8 will only be allowed between June 1 and October 31, unless otherwise

approved by the timber sale administrator after consulting a soil scientist. This restriction may be waived if soils are dry or frozen, or if the operator recommends alternative logging systems approved by the Forest Service. This will reduce the potential for compaction, deep rutting, displacement, and alteration of surface/subsurface water flow.

5. On skyline operations, location of all skyline corridors shall be approved by the Forest Service prior to felling operations. Limit skyline corridors to 12 feet in width. Parallel corridors will be at least 150 to 200 feet apart. Fan-shaped corridors will have either landings or external yarding limits at least 150 to 200 feet apart, depending on configuration. All skyline logging will be done with equipment capable of suspending one end of the log. Up to 75 feet lateral yarding will be accomplished by yarding material to lead, or at a 30-45 degree angle towards skyline corridors wherever possible (BMP T-12).
6. Where a mechanical feller/buncher is used to pre-bunch logs, prior approval will be required. Units will be reviewed by a watershed specialist to avoid unstable and sensitive soils. The tracked feller/buncher will be limited to areas outside of riparian no-cut buffers where slopes are less than 50 percent and soils are considered stable. The machine will travel up and down the slope perpendicular to the fall line and on a mat of slash generated from its limbing operations, with some travel parallel to the slope at the ends of the pre-bunching rows in order to move from row to row.
7. Feller/buncher corridors will be flagged by the Purchaser and approved by the Forest Service. Ephemeral streams, seeps, and wetland areas will be avoided where possible. If equipment cannot avoid these areas then if necessary "corduroy" logs will be laid down parallel to the direction of water flow in order to minimize alteration of hillslope hydrology, and if feasible additional slash/tops would be placed in the equipment's path.
8. Minimize soil rutting (greater than 6 inches deep) caused by feller/buncher equipment, especially on steeper slopes by ensuring adequate slash placement. If rutting does occur the affected areas should be rehabilitated by pulling in berms, ditching out any concentrated water, and placement of additional slash. Rehabilitation should occur prior to the equipment leaving the site.
9. Minimize any excavation of the road prism necessary for unit access by feller/buncher equipment. These areas will be rehabilitated.
10. Limit the number of passes of feller/buncher equipment to one in most cases. Equipment will remain within the approved corridor.
11. The "go-back" trail used for feller/buncher equipment fueling and servicing will be approved by the Forest Service and be in locations with suitable grades and where there would be minimal impacts to soils and water. These trails will be rehabilitated post use.

<u>Landings</u>

12. All landing locations shall be approved by the Forest Service prior to construction. Use existing landings where possible. Build skyline cable and helicopter landings in areas away from streamcourses, wet areas, and unstable soils. Use short landing extensions to reduce and control potential runoff.

13. Landings within Riparian Reserves, if necessary, should be located on existing roadways or on existing landings that may require only minimum reconstruction (e.g., clearing vegetation, sloping for drainage, or surfacing for erosion control purposes) to be made suitable for use.
14. Do not locate any landings or gap openings within designated riparian no-cut buffers to protect water quality and riparian values.
15. Rock will be used only when necessary to reduce erosion, puddling, and compaction on landings and temporary roads, and applied only where needed (spot rocking). The objective is to allow better substrate for vegetative growth and water infiltration following management activities.
16. Complete maintenance and erosion control on landings, disturbed cable corridors, skid roads, and temporary and permanent roads prior to the onset of extended periods of wet weather and following the completion of operations (BMPs T-13 & R-18).
17. Following use, scarify and mulch newly constructed helicopter landings. Mulching with weed-free straw or natural slash and coarse woody debris will be used unless waived by the Sale Administrator.

<u>Temporary Roads</u>

18. Temporary road locations shall be approved by the Forest Service prior to construction. Install sufficient ditch relief pipes on temporary roads to disperse road runoff onto the forest floor and divert flow before it reaches stream channels.
19. (Seasonal – Summer) Unless prohibited by other project design criteria, new temporary or reconstruction of unclassified roads will occur during the dry season (June through October) or upon approval of the Timber Sale Administrator. Purpose of mitigation is to minimize surface erosion and sedimentation, and minimize amount of rock surfacing needed. If roads are left open through extended wet weather, ensure the maintenance of erosion and sedimentation control measures. During operation on these roads outside the standard operating season, spot rock as needed to reduce off-site erosion and sedimentation risk.

<u>Log Haul</u>

20. Road surfaces used will be bladed and cross-drained as outlined under C(T)5.31#. Ditches and culvert inlets will be kept free of debris.
21. Weather conditions will be monitored, and log haul temporarily suspended during prolonged periods of precipitation when soil moisture becomes elevated. If maintenance cannot be performed adequately due to weather, haul will be discontinued until conditions improve.
22. Log haul will be allowed during freezing conditions, but will be suspended as roads begin to thaw. Purchaser will work with Forest Service Engineering Representative to develop standards for checking thaw.
23. Plowing of snow will be permitted as needed, if the T-803 Snow Removal requirements are met.
24. To minimize the amount of sediment delivered to streams along the haul route, sediment barriers (straw bales, slash filter windrow, and/or sediment fence) will be placed in ditchlines along the haul route or in areas where ground is disturbed and sediment has the potential for delivery to streams (i.e. stream crossing fills). Sediment

filters will be maintained and adjusted as directed by the sale administrator. Precautions will be followed to minimize transport of trapped sediment material during removal, including the following: a) removal will be done when site conditions are dry, and/or b) relocate captured sediment to a stable location away from streamcourses.

25. (Seasonal - winter) For gravel-surface roads, stream crossings with fish presence shall be rocked with a 3" lift where needed as determined by a fish biologist or road engineer to control sediment production.

26. (Seasonal – winter) If the purchaser's plan of operations includes log haul between November 1 and May 31, a watershed specialist/fish biologist and Timber Sale Administrator will review the purchaser's plan to prevent sediment from entering stream channels. This may include placing additional road surfacing, rock armoring ditches, constructing silt fencing, and straw mulching exposed soils along cutbanks and fillslopes.

27. (Seasonal –winter) Haul or maintenance is permitted on surfaced and un-surfaced roads under the following conditions:
    - Haul occurs when there are frozen conditions.
    - Ditches will not be bladed past the last cross-drain before a stream crossing.
    - Roads Exempt from Haul Restrictions include paved roads

2. Hydrology and Water Quality: Mitigation Measures designed for the protection of soils, site productivity, and water quality are generally referred to as Best Management Practices (BMPs) as described in General Water Quality Best Management Practices, Pacific Northwest Region, November 1988 (USDA 1988).

28. No gap openings would be created on slopes greater than 70%. Generally, no harvest will occur on slopes greater than 80%. Trees may be cut on these slopes for occasional cable logging corridors in order to access portions of units that are located on less than 80% slopes.

29. Directionally fall trees within treatment units away from stream and riparian buffers to protect riparian vegetation from damage. Retain trees accidentally felled into these buffers to minimize stream sedimentation or damage to riparian vegetation, unless specified by a fisheries biologist or watershed specialist. Trees felled in no-cut riparian buffers due to yarding operations will be left in stream or riparian area. In this case, trees will be felled toward the stream where possible.

30. Where cable yarding is planned, design logging systems to yard away from stream channels to minimize soil disturbance on stream-adjacent slopes. If this strategy is not feasible, maintain full suspension of logs over streams.

31. Locate skid trails a minimum of 25 feet away from the riparian no-cut buffers. Skidding equipment will be kept a minimum 75 feet back from streams and wetlands.

3. Fisheries

32. Follow all applicable provisions of the Memorandum of Understanding (MOU) between the Washington Department of Fish and Wildlife and USDA Forest Service, Pacific Northwest Region, Regarding Hydraulic Projects Conducted by USDA Forest Service, Pacific Northwest Region (January 2005). Follow all applicable general project provisions found in Appendix A of the MOU, p.8 – 10.

33. Follow all applicable specific project provisions found in Appendix A of the above referenced MOU for:

    Permanent culvert installation and replacement, p.12 - 13
    Temporary culvert installation and removal, p.15
    Culvert and bridge debris removal, p.21 - 22
    Timber felling and yarding, p.29

34. All instream work would occur between July 15th and October 15th for streams in the West Fork Humptulips watershed, and between July 15th and August 31st in the Quinault River watershed, under the work periods set forth in Table 1, Appendix D of the Hydraulic Project Approval (HPA). Other timing may be allowed on a site-specific basis if the Forest Service fisheries biologist and Washington Department of Fish and Wildlife Area Habitat Biologist agree that it would not be harmful to fish and fish habitat.

35. Temporary culverts are culverts installed for one work season and removed before the onset of high flows. They are not required to meet the Q 100 (see p.16, MOU/HPA). All Culverts (new or replacements) installed for more than one year are considered to be permanent culverts and need to meet the Q100 criteria (see p.12, MOU/HPA).

36. A pre-approved de-watering plan is required before instream work can proceed. The District fisheries biologist should be contacted to review the plan as part of the approval process.

37. Metal culverts removed from stream crossings and ditches will be transported off-site by the contractor to be recycled, reused, or disposed of at a landfill.

38. A watershed specialist or fish biologist shall be consulted prior to modifying any of the project design criteria that could impact aquatic resources.

39. Restoration of stream channel crossings will incorporate design features to prevent ATV's from using them as fording sites.

40. Minimize number of wet seasons that culverts on temporary roads are in place. Purchaser shall winterize temporary roads prior to winter rains. Purchaser is responsible for monitoring and maintenance of functional road drainage and sediment control structures.

41. Leave all existing wood in streams or wetlands unless designated for removal by a fisheries biologist.

4. Terrestrial Wildlife

42. If an active raptor nest is located during thinning operations, contact the Forest Service wildlife biologist for appropriate mitigation measures.

43. Protect and retain trees with inactive raptor nests to provide nesting quarters for opportunistic (non-nest building) raptors.

44. Any proposed removal of any tree larger than 36 inches dbh for road construction will require Forest Service wildlife biologist review (USDI 2003).

45. Employees and contractors will properly store and dispose of food and garbage while working on-site to avoid attracting corvids to reduce indirect impacts to murrelets and other wildlife.

46. Seasonal restrictions around known, active fisher denning sites (should they be located) between mid-March and late May for motorized, mechanized activities. Protection would include a 0.25 mile buffer from disturbance for those activities that are long in duration, such as timber harvest and associated activities (e.g., felling, yarding, and road building), as well as road construction. Seasonal restrictions would not be applied for hauling or for general road traffic. Adjustments for the buffer would be based on local conditions such as topography (USDI 2007c).
47. Small lakes and ponds greater than one acre in size will have a no-cut buffer of 300 feet. Those less than one acre will have a no-cut buffer of 100 feet.

5. Threatened & Sensitive Fauna Management

Bald Eagle: To protect bald eagles; the following measures are included as part of all Action Alternatives including potential Other Projects.

48. Seasonal Restrictions will be implemented to restrict activities with the potential to create noise above ambient levels during the period from January 1-August 15 (see Table 2-4 Prioritization of Humptulips Stands for seasonal restrictions).
49. Burning during the nesting season for bald eagles (January 1 to August 15) or during the wintering period (October 31 to March 15) will be conducted at least 1 mile away from any bald eagle use area.

Marbled murrelet and Northern spotted owl: To protect marbled murrelets and northern spotted owls, the following measures are included as part of all Action Alternatives including potential Other Projects.

50. Work will be done so there is no sound-generating activity 92 dB or greater within harassment distances during early breeding seasons within 0.7 mile of the known occupied spotted owl activity centers or within 0.5 mile of the centers of the seven mapped murrelet locations.
51. Thinning activities in 39 stands (out of a total of 63) would not take place between March 1 and August 5 to minimize impacts to nesting owls or murrelets which may inhabit adjacent, mapped suitable habitat within the planning area (see Table 2-4. Prioritization of Humptulips Stands for seasonal restrictions).
52. Additionally, activities in these stands from August 6 through September 15 that involve the use of heavy equipment and chainsaws would begin 2 hours after sunrise and would stop 2 hours before sunset to minimize effects to murrelets delivering food to their young.

Table 2-4. Prioritization of Humptulips Stands for seasonal restrictions.

Priority	***Humptulips Stands***	***When Project Work Could Occur***
High. Unit falls completely or > 50% within 0.7 miles of owl nest cores or 0.5 miles of mapped murrelet sites. No project work allowed during the owl and murrelet early breeding seasons.	F22, G6–7, G29, G32–33, G51, G59, G64, G67, G91–92,	August 6–February 28; from August 6–September 30 with 2-hour daily restrictions.
Medium. Adjacent to the West Fork Humptulips River and historic eagle nesting areas (this was determined and agreed to by planning team before bird was delisted). No project work allowed during the eagle breeding seasons, which also would include owl and murrelet early seasons.	G15, G18, HU1, HU10,	August 16–December 31
Medium. Adjacent to inventoried roadless area and/or large, contiguous blocks of suitable habitat. No project work allowed during the owl and murrelet early breeding seasons.	F5–7, F9–11, F15–16, F18–19, G23–25, G28, G58, G68–69	August 6–February 28; from August 6–September 30 with 2-hour daily restrictions.
Low. Adjacent to a relatively low and/or fragmented amount of suitable habitat. Work may be done during the early breeding seasons for owl and murrelet with daily restrictions.	E76A, F4, F17, F20–21, F30, F54, G3, G5, G8–9, G12, 16, G19–21, G26–27, G30–31, G48–49, G60–62, G81–82, H137, H8, HU2, HU8,	Year-round (2-hour daily restrictions from April 1-September 30), except for G21, G82, F4, F17, F30, F54, and H137, which would be August 6–February 28 with 2-hour daily restrictions from August 6–September 30.

53. Thinning activities in 24 stands may take place between March 1 and August 5 as long as sound generated does not exceed 92 dB. Additionally, during the murrelet breeding season (April 1 to September 15), work would begin 2 hours after sunrise and would stop by 2 hours before sunset to minimize effects to murrelets delivering food to their young.
54. Potential nest trees (PNTs) for murrelets have been marked and will each receive no-cut buffers in 12 of the proposed treatment stands. A total of 38 PNTs were marked, the majority of which were located adjacent to edges or roads where suitable habitat exists. These trees, as well as the legacy trees (25 marked) would be retained and would also each have a 100-foot no-harvest buffer (or one-half site-potential tree height, whichever is greater). Yarding (skyline corridors) and skid roads from ground-based equipment,

including tractors, skidders, and processors, will be avoided within the buffer around PNTs. They should also be avoided wherever possible around legacy trees.

55. Legacy snags were also marked with this effort (total of 41) and individual buffers would be 1 ½ times the height of each snag. Yarding and skid roads associated with tractors, skidders, and processors will be avoided wherever possible within these buffers.

56. No potential nest trees for marbled murrelets (trees at least 21 inches in diameter and that have at least one branch 4 inches in diameter that is 33 feet high {McShane et al. 2004} and can function as a platform, either by having a flat surface, some amount of moss or lichen, mistletoe, or other deformities) will be cut during the early or late murrelet breeding seasons.

57. No potential nest trees for spotted owls (trees at least 21 inches in diameter that have nesting structures such as large cavities, broken tops, hawk nests, mistletoe infections, and other evidence of decadence) will be cut during the early or late spotted owl breeding seasons.

58. Only small helicopters that generate sound levels of no more than 92 dB at 120 yards will be used during the early nesting seasons of marbled murrelet and spotted owls (March 1 – August 5).

59. If new stubs or temporary roads are needed for skyline systems such that trees must be felled that have nest characteristics suitable for marbled murrelets (trees at least 21 inches in diameter and that have at least one branch 4 inches in diameter that is 33 feet high{McShane et al. 2004} and can function as a platform, either by having a flat surface, some amount of moss or lichen, mistletoe, or other deformities) or spotted owls (trees at least 21 inches in diameter that have nesting structures such as large cavities, broken tops, hawk nests, mistletoe infections, and other evidence of decadence), then a wildlife biologist will be consulted.

60. If travel routes outside of treatment units are needed for processors associated with helicopter systems and the routes must traverse suitable habitat, then a wildlife biologist shall be informed as re-consultation with U.S. Fish & Wildlife Service will be necessary.

61. For any legacy trees or potential marbled murrelet nest trees within the boundaries of units within marbled murrelet critical habitat (which includes everything except for parts of G3, G5, and G6), no road building, yarding corridors or other vegetation removal will occur within the 100-foot buffer around individuals or groups of those trees.

62. Any removal of dispersal habitat within spotted owl designated critical habitat, for road construction beyond that already analyzed (approximately 14 acres), will require further review (ESA Consultation Level 1) (USDI 2003).

63. As stated in the programmatic Biological Opinion (USDI 2003), no suitable habitat of the marbled murrelet or northern spotted owl will be removed or adversely impacted from new or temporary road building, apart from 40 individual trees greater than 21 inches that may need to be removed around helicopter landings (estimated 32) and adjacent roads (estimated 8). This also includes individual potential nest trees and any other remnant old-growth trees identified by the Forest or District wildlife biologist or an appointed designee.

64. Danger tree removal that includes the removal of a tree at least 21 inches dbh within suitable marbled murrelet or suitable spotted owl habitat during the early murrelet breeding season (April 1—August 5) or early spotted owl breeding season (March 1—July 15) will require review by a Forest Service Biologist (USDI 2003).

65. If any individual spotted owl or marbled murrelet is observed, the contractors will inform a Forest Service Wildlife Biologist and measures will be applied to minimize and/or eliminate harassment.

66. Burning during the early breeding season for spotted owls (March 1 to July 15) or early breeding season for murrelets (April 1 to August 5) will be conducted at least 0.25 mile away from suitable nesting habitat.

6. **Sensitive Moss and Lichen Species:** Protection measures will be applied to 60 sites of the sensitive *Iwatsukiella leucotricha* moss and 13 sensitive lichen sites.

67. Twenty-one of these sites will have a buffer (skip) of 150 feet radius surrounding the moss site, where no thinning will occur. The other 39 sites are on individual trees to be designated as "no-cut trees" prior to thinning implementation. Create one tree-length buffer around the designated site. Directionally fall trees away and avoid designating skid trails in the vicinity of the buffer. Thirteen sensitive lichen sites will be conserved by applying a 150 foot radius buffer, where no thinning will occur. Three of the lichen sites are *Cetrelia cetrariodes*, another three are *Nephroma bellum*, and seven are *Usnea lognissima*.

7. **Invasive Plant Prevention and Management:** Prevention and control measures shall follow the Pacific Northwest Region Invasive Plant Program (USDA 2005a) and the 2008 Olympic National Forest Beyond Prevention: Site-Specific Invasive Plant Treatment Project (USDA 2008b).

68. When practical, treat existing invasive plant infestations with appropriate herbicide, mechanical, or manual methods before roads are reopened for use, decommissioned, or otherwise made impassable.

69. Clean all off-road equipment of dirt/mud, seeds, and other plant parts before being moved onto National Forest Service land. If operating in an area infested with invasive plants, clean all equipment before moving between sites or leaving the Project Area.

70. All material (e.g. soil, gravel, sand borrow, aggregate, etc.) transported onto National Forest System land or incorporated into the work shall be weed-free.

71. A Forest Service invasive plant specialist shall inspect proposed material sources to determine weed-free status to ensure all material is free of invasive plant seeds before use and transport. Fill material generated from a project site, containing or suspected to contain invasive plants, shall be stockpiled within the Project Area and as close to the infested source area as possible, for future treatment.

72. Hay, straw, or other mulch materials used on the project shall be weed-free. The Contracting Officer may request written documentation of methods used to determine the weed-free status of any and all materials furnished by the contractor.

73. Site restoration planning shall include an evaluation of the need to seed a site. When needed, use weed free straw and seed mixes/plantings with local native species as available. (Regional Standard 13)

74. Monitor all ground-disturbing operations in invasive plant infested areas at least once within two years following completion and treat any new infestations of concern.

8. Fire and Fuels: The following requirements will serve to minimize the risk of fire in areas of public vehicle access, and near or contiguous to private property or infrastructure. They will support the containment of any fires that may occur. The desired fuel profile in the buffer zones will be that of a Fuel Model 8 as found in "Aids to Determining Fuel Models For Estimating Fire Behavior" Hal E. Anderson General Technical Report INT-122 April 1982.

75. Fuel buffer zones will be created along any roadway left open to public use after management activities are completed and all boundaries with private lands. Buffer zones will be a one to three chain (66 to198 feet, fire spread is measured in chains per hour) wide strip from the areas of concern to the activity slash. Fire potential from activity slash will be minimized by the following measures: directional falling, redistribution by lopping and scattering or end hauling, or piling and burning. These measures will help limit increases in fuel bed depth and/or loading and potential fire behavior and flame length. The actual method and buffer distance for each unit will be site specific and determined after final layout and design of the units.

76. Design fuel treatment activities to minimize disturbance to riparian vegetation (Refer to the Northwest Forest Plan standards and guidelines FM-1, 3, 4, and 5 on pp. C-35, 36). Fuel management activities will not occur within no-cut buffers adjacent to wetlands or riparian areas. Contract provision 5.74 Slash Treatment Requirements (2/2002) will be included in the timber sale contract.

77. In addition to roadways discussed above, Treatment Units G8, H137 and HU8 abut other land ownership boundaries. These areas would also be subject to the creation of fuel buffer zones. Areas of concern such as private property or infrastructure that are upslope from activity slash may warrant the greater three chain buffer zone. Landing slash will also be treated. Methods may include redistributing slash along skid trails, allowing firewood gathering, and/or piling and burning.

78. Any burning will be done in compliance with the 1998 Washington State Smoke Management Plan.

79. Fuel treatment activities will be designed to meet Aquatic Conservation Strategy objectives and to minimize disturbance to riparian vegetation. Refer to the Northwest Forest Plan (FM-1, 3, 4, 5; pp. C-35, 36) for additional information.

80. If scattering of landing piles will not adequately address the fire hazard, landing slash within the fuel buffer zone can be burned. Follow-up planting with native, certified weed-free seed if landing is larger than 1/5 acre (about 95 by 95 feet) and has a native (non-rock) surface.

9. Recreation

81. To protect the integrity of the Moonlight Dome Inventoried Roadless Area; unit layout operations for Treatment Units F9, F10 and F11 will be coordinated with and reviewed by the Forest Planner to ensure that no indiscriminant boundary encroachment occurs.

82. Utilize partial area closures during commercial operations and/or burning operations to minimize the potential for accidental injury to recreationists during project activities. Utilize signing, press releases, and recreation opportunity guides to redirect recreation activities to safe use areas during project operations. Contractors will be required to set up project operation warning signs.

83. All project activities (Forest Service and contract) will comply with State and Federal Occupational Safety and Health (OSHA) codes. All Forest Service project operations will be guided by FS Handbook 6709.11 (Health and Safety Code Handbook).

10. Heritage

84. If subsurface archaeological evidence or previously unidentified cultural resources are located during implementation of this project, activities will cease pending an evaluation of cultural significance by a qualified archaeologist, who will determine appropriate mitigation measures, if any. The Forest will fulfill its consultation requirements in accordance with 36 CFR 800.11.

MONITORING ACTIVITIES

Implementation and effectiveness monitoring conducted in association with authorized management activities provide an opportunity for adapting management techniques as needed to better meet the intent of the selected alternative as planned and approved. This section identifies monitoring activities that may apply to the Action Alternatives. The activities may or may not occur depending on appropriate funding.

Implementation Monitoring

Monitoring by the Silviculturist begins prior to sale layout by verifying that a stand level prescription would meet the objectives. The Silviculturist shall work directly (as much as possible) with the layout crews during sale preparation. Monitoring prescription layout provides an adaptive management opportunity to modify a prescription based on site-specific evidence. When possible make two or three inspections with sale administration during logging operations.

Other Monitoring

Other monitoring should include the review of stands 3 to 5 years following project implementation to assess the stands for wind damage; the necessity for the creation of additional snags or CWD; and the necessity for artificial reforestation of skid trails, temporary roads, and landings within the project area. Sampling could be used to re-evaluate stand density 10 to 15 years following treatment. This sampling would be a combination of qualitative and quantitative information such as species composition, tree diameters, crown closure, snag and CWD abundance, and a verbal description of stand characteristics such as layer development. The information gathered would allow for monitoring of the effectiveness of the treatment, the assessment of the need for an understory thinning treatment, and could be used to identify further treatments or activities which would hasten the development of late-successional characteristics within these stands.

The Forest Soil Scientist would monitor a representative number of stands harvested with ground-based logging systems during wet soil condition logging operations. The purpose would be to determine the extent and degree of detrimental soil conditions, and whether seasonal operation restrictions are needed to avoid permanent long term soil and water impacts. Several of the stands are subject to seasonally high water table, and soils may be permanently impaired if units are logged during wet soil conditions. A soil quality monitoring methodology would be used to assess the extent and degree of soil impacts.

OTHER PROJECTS

With implementation of the West Fork Humptulips Project, there may be an opportunity to improve various forest resource conditions in proximity to the proposed treatment activities. These opportunities are not necessary or critical for implementing the Proposed Action or any alternatives, but may be considered as Other Projects. Implementation of these projects is contingent on funding and may or may not occur. They may be financed through: collections generated via scheduled timber sale receipts from implementing the West Fork Humptulips Project (i.e., Knutson-Vandenberg funds), Forest Service appropriated resource and restoration funding, or stewardship contract agreements. These other improvement projects (or activities) that may be associated with the Action Alternatives are described below. Potential resource impacts from the entire list of other project activities are considered during the environmental analysis process.

- **Decommission additional unclassified roads not used under the West Fork Humptulips Thinning Project –** To enhance or improve watershed conditions, unclassified roads (not a Forest Transportation System road and not open to vehicular use) in the vicinity of project activities would be decommissioned if funds are available. Table 2-5 lists the potential candidate unclassified roads considered as high and medium-high priority for decommissioning that would not be used to access treatment units.

Table 2-5. Priority candidate unclassified roads to be decommissioned.

Recommended Priority	Road #	Miles	Estimated Cost
High	F7-004	0.32	$125,000
High	F08-001	0.28	$150,000
High	G5-001	0.25	$50,000
High	G5-002	0.08	$50,000
High	G14-001	0.16	$10,000
High	G14-002	0.20	$7,000
Medium-High	G14-003	0.14	$10,000
Medium-High	G82-001	0.19	$35,000
Medium-High	HU10-002	0.3	$35,000

- **Decommission Maintenance Level (ML) 1 roads (roads currently closed to vehicular use) –** To enhance or improve watershed conditions, approximately 13.6 miles of ML1 roads in the vicinity of project activities would be decommissioned, if funds are available. Identification and prioritization of ML1 roads was subject to the 2003 Access and Travel Management Plan (ATM) and refined through an iterative process based on such factors as: expected future use, road stability problems, number of existing stream crossings, proximity to Riparian Reserves, and proximity to streams with the potential to affect downstream water quality and fish habitat. Table 2-6 lists the potential ML1 candidate roads considered as high and medium-high priority for decommissioning.

Table 2-6. Priority candidate ML1 roads to be treated.

Recommended Priority	Road #	Miles	Treatment	ATM Objective	Treatment Unit Access	Estimated Cost
High	2204068	1.20	Decom	Decom – Pri 2	G20, G26	$60,000
High	2204070	2.69	Decom	Decom – Pri 1	G28 - 31	$70,000
High	2204073	0.69	Decom	Decom – Pri 2	G30, G67	$30,000
High	2204072	0.63	Decom	Decom – Pri 2	G30, G67	$30,000
High	2204076	0.47	Decom	Decom – Pri 2	G31, G41	$15,000
High	2280040	1.00	Decom	Decom – Pri 1	G24	$75,000
Medium-High	2220080	0.90	Decom	Decom – Pri 2	G7, HU10	$25,000
Medium-High	2220084	0.20	Decom	Decom – Pri 3	G7	$20,000
Medium-High	2220090	0.50	Decom	Decom – Pri 2	HU10	$30,000
Medium-High	2258037	0.10	Decom	Decom – Pri 1	G69	$6,000
Medium-High	2259040	3.00	Decom	Decom – Pri 2	F21, F30, G6	$12,000
Medium-High	2259043	0.65	Decom	Decom – Pri 1	G81, G82	$10,000
Medium-High	2259048	1.14	Decom	Decom – Pri 2	F22	$40,000
Medium-High	2259049	0.18	Decom	Decom – Pri 2	F21	$6,000
Medium-High	2259149	0.20	Decom	Decom – Pri 2	F21	$15,000

- **Decommission Maintenance Level 2 roads (roads currently open to high clearance vehicular use) –** To enhance or improve watershed conditions, ML2 roads in the vicinity of project activities would be decommissioned if funds are available. Identification and prioritization of ML2 roads was subject to the 2003 Access and Travel Management Plan (ATM) and refined through an iterative process based on such factors as: expected future use, road stability problems, number of existing stream crossings, proximity to Riparian Reserves, and proximity to streams with the potential to affect downstream water quality and fish habitat. Table 2-7 lists the potential candidate roads determined to be very high and high priority for decommissioning.

Table 2-7. Priority candidate ML2 roads to be decommissioned.

Recommended Priority	Road #	Miles	ATM Objective	Treatment Unit Access	Estimated Cost
Very High	2208030	1.80	Decom – Pri 1	G91, G92	$250,000
Very High	2258031	1.68	Decom – Pri 1	G68, G69	$150,000
High	2258020	1.50	Decom – Pri 2	F6	$40,000
High	2259042	0.70	Decom – Pri 2	G81	$60,000

- **Culvert Replacement on Existing Roads -** To enhance or improve fish passage within the watershed, existing culverts considered barriers to fish passage would be replaced on roads in the vicinity of project activities if funds are available. Table 2-8 lists the potential candidate culverts considered as very high and medium priority for replacement.

Table 2-8. Priority candidate road culverts to be replaced.

Recommended Priority	Culvert ID	Road #	Species
Medium	DY6	2204	Resident
Medium	DY4,5 (double pipes)	2200	Resident

- **Invasive Plant treatment –**According to the Olympic National Forest 2008 Invasive Plant Inventory database, eight invasive plant species are known to occur in the Planning Area. Treat invasive plant infestations in accordance with the March 17, 2008 *Olympic National Forest Beyond Prevention: Site-Specific Invasive Plant Treatment Project Record of Decision*.

- **Snag Creation within and adjacent to treatment units –** Based on information provided by DecAID, snag enhancement would focus on managing natural conditions rather than targeting specific species. Therefore, a range of sizes (dbh and tree height), species, and decay stages would be sought, in clumps and distributed throughout the stands. Methods may include topping, girdling, or inoculation.
- **Coarse woody debris structures / Superior tree enhancement (murrelets) -** Create coarse woody debris structures (aka "log pyramids") in proximity to murrelet nest trees.
- **Elk forage planting –** Plant elk forage seed and shrubs on temporary roads, landings, and some gaps.
- **Pre-Commercial Thinning –** Conduct pre-commercial thinning on young, dense stands as a result of past regeneration harvest activities over approximately 500 acres.

Comparison of Alternatives

Table 2-9 provides general information for comparing and summarizing the alternatives analyzed in detail. Table 2-10 summarizes effects associated with the Key Issue for comparing the alternatives analyzed in detail. Indicators were developed by the interdisciplinary team to reflect potential impacts to the environmental issues. The information in Table 2-11 represents a brief summation of the effects associated with Other Issues. All effects are addressed in more detail in Chapter 3 of this document.

Table 2-9: Comparative Summary of Alternatives – GENERAL INFORMATION

Information/Activity		No Action	Alternative A	Alternative B	Alternative C
Total # of Units		0	63	63	63
Total Acres Treated		0	4,101 acres	4,101 acres	4,101 acres
Total Volume		0	57.4 mmbf	57.4 mmbf	57.4 mmbf
Number of units directly affected by change to PA		0	0	7 Units	34 Units
Treatment acres and percent by Harvest System	Tractor	0	1,932 ac/47%	1,794 ac/44%	1,552 ac/38%
	Skyline	0	1,645 ac/40%	1,597 ac/39%	968 ac/24%
	Helicopter	0	524 ac/13%	710 ac/17%	1,581 ac/38%
Riparian Reserve Treatment acres by Harvest System (Included within treatment acres)	Tractor	0	388	381	341
	Skyline	0	697	690	492
	Helicopter	0	120	134	372
	Total	0	1,205 acres	1,205 acres	1,205 acres
Open Roads Normal Maintenance	Paved	0	3.5 miles	3.5 miles	3.5 miles
	Gravel	0	57.3 miles	57.3 miles	57.3 miles
Open Roads Maintenance and Storage	Gravel	0	7.4 miles	7.4 miles	7.4 miles
Closed Roads Reopened and Closed	Gravel	0	4.3 miles	4.0 miles	4.3 miles
Closed Roads Reopened and Storage	Gravel	0	12.1 miles	11.2 miles	10.2 miles
Existing Unclassified Roads Reopened and Decommissioned	# Segments	0	85	76	1
	Miles	0	19.0 miles	16.8 miles	0.26 mile
New Temp Roads Constructed and Decommissioned	# Segments	0	28	25	0
	Miles	0	4.4 miles	3.47 miles	0
Rock Quarry / Pit Development			4	4	4
Constr Heli Landings			20	20	29

Table 2-10: Comparative Summary of Alternatives – KEY ISSUE

ISSUES and INDICATORS		No Action	Alternative A	Alternative B	Alternative C
KEY ISSUE					
Effects to aquatic conditions from road construction activities	Miles and acres of new temporary road construction and reconstruction of unclassified abandoned roads	0	23.4 miles 44.3 acres	20.3 miles 38.3 acres	0.3 mile 0.5 acre
	Miles and acres of new temporary road construction and reconstruction of unclassified abandoned roads in Riparian Reserves	0	4.7 miles 8.9 acres	3.4 miles 6.5 acres	0
	Number of stream crossings directly affected by road construction/reconstruction activities	0	14	10	0

Table 2-11: Comparative Summary of Alternatives – OTHER ISSUES

ISSUES and INDICATORS		No Action	Alternative A	Alternative B	Alternative C
OTHER ISSUES					
Hydrology	Change in Peak Flows	No Change	No Effect	No Effect	No Effect
	Watershed Function	No Change	Maintain/Improve With rd restoration	Maintain/Improve With rd restoration	Maintain
Water Quality	Affected 303 (d) Listed Streams	No Change	No Effect	No Effect	No Effect
	Affected Municipal Watershed	No Change	No Effect	No Effect	No Effect
ACS* Objectives	Maintain or restore conditions	No Change	Maintain/Improve with veg treatment and rd restoration	Maintain/Improve with veg treatment and rd restoration	Maintain/Improve with veg treatment
Fire/Fuels	Treat activity generated fuels	No Change	LP* all and HP* 100' along open rds and adjacent pvt property	LP all and HP 100' along open rds and adjacent pvt property	LP all and HP 100' along open rds and adjacent pvt property
Air Quality	Follow Smoke Management Guidelines	No Change	Yes	Yes	Yes
Botany	Adverse impacts to botanical populations	None	None	None	None
Sensitive Plants	Adverse impacts to botanical populations	No Change	Buffer designated sites-No Risk	Buffer designated sites-No Risk	Buffer designated sites-No Risk
Noxious Weeds	Invasive Plant management and prevention	Continual increase in new sites	Reduction of infestations	Reduction of infestations	Reduction of infestations
ESA* Wildlife	Adverse impacts to wildlife populations	No Change	Not likely to jeopardize - Timing and buffer PNTs*	Not likely to jeopardize - Timing and buffer PNTs	Not likely to jeopardize - Timing and buffer PNTs
Other Wildlife	Other listed species protected	No Changes	Improve habitat diversity across WA*	Improve habitat diversity across WA	Improve habitat diversity across WA
Snags and CWD*	Meet minimum requirements	No Changes	Improve #'s now and improve size over time	Improve #'s now and improve size over time	Improve #'s now and improve size over time
Fisheries	Adverse impacts to fish populations - sedimentation	No Change	NLAA – short-term pulse of sediment not to exceed RNV*	NLAA – short-term pulse of sediment not to exceed RNV	NLAA – short-term pulse of sediment not to exceed RNV
	Adverse impacts to fish populations – CWD*	No Change	Improve future recruitment potential	Improve future recruitment potential	Improve future recruitment potential
Wilderness	Affect to Wilderness	No Change	Short-term indirect noise	Short-term indirect noise	Short-term indirect noise
Roadless	Affect to Roadless Areas	No Change	Short-term indirect noise	Short-term indirect noise	Short-term indirect noise
Visuals	Meets VQO* Standards	No Changes	Retention - Yes	Retention - Yes	Retention - Yes
River Corridor	Meets VQO Standards	No Changes	Retention - Yes	Retention - Yes	Retention - Yes
Safety	Follow state and Federal requirements	No Changes	Yes	Yes	Yes
Electronic Site	Affect access to site	No Change	Short-term delays	Short-term delays	Short-term delays
Economics	Present Net Value	0	$ 2,041,655	$ 1,446,470	$ 127,127
	Benefit / Cost Ratio	0	2.03	1.73	1.06
	% Helicopter Yarding	0	13 %	17 %	38%

*Acronyms: ACS – Aquatic Conservation Strategy; CWD – Coarse Woody Debris; ESA – Endangered Species Act; HP – Hand Pile Slash; LP – Machine Pile Landing Slash; NLAA – Not Likely to Adversely Affect; PNT – Potential Nest Tree; RNV – Range of Natural Variability; and VQO – Visual Quality Objectives