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Lower Skokomish Vegetation Management

Environmental Assessment

Hood Canal Ranger District, Olympic National Forest
Mason County, Washington

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Table of Contents

List of Tables

List of Figures

Executive Summary

This Environmental Assessment documents analysis of the proposed action and the no action alternatives considered for acceleration of late successional conditions within the Lower North Fork and Lower South Fork Skokomish River watersheds on the Olympic National Forest, Hood Canal Ranger District. Proposed activities analyzed within this assessment include: commercially thinning timber; conducting temporary road construction, reconstruction, and National Forest System road maintenance; treating activity-generated slash (fuels); and implementing connected actions within the Late-Successional Reserve, Adaptive Management Area, and Riparian Reserve land allocations.

The Lower Skokomish Vegetation Management project proposed treatment units are located within the Late-Successional Reserve and Adaptive Management Area land allocations, and also include Riparian Reserves which overlay these other land allocations. Late-Successional Reserves are to provide habitat for late-successional and old-growth related species including the northern spotted owl and marbled murrelet. The Late-Successional Reserve Assessment for this area, identified the need for commercial thinning in stands less than 80 years old with the objectives of accelerating growth, increasing plant species diversity, increasing structural diversity, and providing a mechanism to create standing dead tree habitat and down wood where needed. The project seeks to implement the recommendations from both the Late-Successional Reserve Assessment and watershed analysis documents which recommend thinning in forests that are mid-successional in order to accelerate the goal of developing late-successional conditions. Adaptive Management Areas serve to provide opportunities for development, demonstration, and testing of techniques that place an emphasis on the restoration of late-successional forest conditions and riparian areas.

The primary purpose and need is to accelerate late-successional habitat in mid-seral stands in order to support fish and wildlife species. To meet the purpose and need, the Forest is proposing to restore habitat by commercially thinning about 4,900 acres of young forest stands.

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1.0 INTRODUCTION

1.1 Document Structure

This Environmental Assessment (EA) documents the analysis of the proposed action and a range of alternatives for commercial thinning and associated activities in the Lower Skokomish Vegetation Management Project (LSVMP) area, located on the Hood Canal Ranger District of the Olympic National Forest (ONF).

Chapter 1 describes the purpose of and need for action, the proposed action, and alternatives for the Lower Skokomish Vegetation Management EA. This chapter also identifies and describes the project area, outlines applicable management direction, addresses the scope of the decision to be made, and lists the issues identified during scoping.

Chapter 2 describes the proposed action and alternatives, the process by which the proposed action was designed, the alternative development process, and the project design criteria (PDCs) and mitigation measures (MMs) that would apply to the project.

Chapter 3 describes the affected environment and the environmental consequences of the proposed action and the no action alternative. The chapter is divided into sections based on resource area.

Chapter 4 includes a list of preparers and agencies consulted during this EA process.

Chapter 5 contains acronyms and a glossary of terms used throughout this document.

Chapter 6 contains reference citations used in this document.

Appendices A, B, C, and D include maps (Appendix A), supplementary information tables for roads and stand information (Appendix B and C respectively), response to public scoping comments received (Appendix D), and additional information received during public scoping efforts.

The following list describes changes made to this EA after the 30 day comment period on the preliminary EA. Minor editorial changes are not noted.

- Section 2.4.2.2, descriptions regarding temporary road construction and post-implementation decommissioning were clarified.
- Section 2.4.2.3 regarding road use on private lands requiring access was updated.
- Corrections to acres based on rounding and mapping calculations for Riparian Reserve treatments were made to Tables 2-1 and 2-2.
- Three additional Project Design Criteria were added to Table 2-4: AQUA-04b, which specifies no gaps or heavy thinning adjacent to no-cut buffers along fish-bearing streams; and, REC-02 and REC-03 for addressing log haul logistics near the Brown Creek area.
- Previously decommissioned NFS road names were corrected in Tables Fisheries-7, Fisheries-10, and B-1.

- The Fisheries and Water Quality Section was corrected with 303d stream information, including the addition of Figure Fisheries-5a and Figure Fisheries-1.
- The effect determination for Northern Spotted Owl Designated Critical Habitat was listed as may affect, likely to adversely affect (preliminary EA, pg. 148). This was corrected with the determination of: may affect, not likely to adversely affect Northern Spotted Owl Designated Critical Habitat (pg. 158) as a result of additional review while preparing the Biological Assessment for consultation with the US Fish and Wildlife Service.
- Response to comments on the Preliminary EA were compiled and added to Appendices D and E.

1.2 Relationship to the Forest Plan and Other Management Direction

The Forest Service has prepared this EA in compliance with the National Environmental Policy Act (NEPA) and its implementing regulations (40 Code of Federal Regulations [CFR] §1500-1508) as well as those requirements established by Federal environmental laws and regulations. This EA tiers to several broader documents. Per 40 CFR 1508.28: "Tiering refers to the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses…incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared." This EA is tiered to the Record of Decision (ROD), and incorporates by reference, the Final Environmental Impact Statement (FEIS) for the ONF Land and Resource Management Plan (Forest Plan) (USDA Forest Service 1990a) and the 1990 ONF Land and Resource Management Plan (USDA Forest Service 1990b). In addition, management direction is provided in three major Forest Plan Amendments:

- The Final Supplemental Environmental Impact Statement (FSEIS) on Management of Habitat for Late Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management 1994a) as adopted and modified by the April 1994 ROD for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, provides additional standards and guidelines (USDA Forest Service and USDI Bureau of Land Management, 1994b). These two documents are commonly referred to collectively as the Northwest Forest Plan (NWFP). The 1994 ROD added land allocations to the allocations in the 1990 Land and Resource Management Plan. The standards and guidelines it established for these land allocations supersede management direction in the 1990 Forest Plan unless the 1990 Forest Plan is more restrictive or provides greater benefits to late-successional forest related species. The key elements of the Northwest Forest Plan are they system of Riparian and Late Successional Reserves, the Aquatic Conservation Strategy, and various standards and guidelines affecting each of the land allocations.

Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA USDI 2001). The Northwest Forest Plan included mitigation measures for management of known sites, site-specific pre-habitat disturbing surveys, and/or other landscape scale surveys for about 400 rare and/or isolated species. These are species that due to rarity or lack of information it was uncertain as to whether they would be adequately protected by the other elements authorized in the 1994 NWFP ROD. The standards and guidelines for these mitigation measures are known as Survey and Manage, Protection Buffers, and Protect Sites From Grazing. Survey and Manage species are addressed further in the section below.

- Pacific Northwest Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision (USDA Forest Service 2005).

In this EA, the term "Forest Plan" refers to the 1990 Forest Plan as amended by the 1994 NWFP ROD and additional amendments thereof.

Survey and Manage

The key elements of the mitigation measures for Survey and Manage species are summarized above. The LSVMP applies a 2006 Exemption from a stipulation entered by the court in litigation regarding Survey and Manage species and the 2004 ROD related to Survey and Manage Mitigation Measure in *Northwest Ecosystem Alliance v. Rey*, No. 04-844-MJP (W.D. Wash., Oct. 10, 2006). Previously, in 2006, the District Court (Judge Pechman) invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation entered into a stipulation exempting certain categories of activities from the Survey and Manage standards and guidelines, including both pre-disturbance surveys and known site management. Also known as the Pechman Exemptions, the Court's Order from October 11, 2006 directs:

"Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

a. Thinning projects in stands younger than 80 years old;
b. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;
c. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and
d. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management

requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

The LSVMP is a thinning project in stands under 80 years of age, and so meets Exemption a.

Other connected actions within the project area do not fall within this exemption, as they are disturbing activities not adjacent to or within treatment units. These actions include rock pit development (from existing sources) rock extraction, and rock crushing. Surveys are not required where habitat for Survey and Manage species is not present. See the wildlife section and botany section in Chapter 3 for information on Survey and Manage species requirements for these actions.

Other Documents

In addition to the Forest Plan documents and its associated amendments described above, this EA also tiers to the following documents:

- The ONF ROD – Beyond Prevention: Site-Specific Invasive Plant Treatment (USDA Forest Service 2008) and associated EIS tiers to the Pacific Northwest Invasive Plant Program Record of Decision (USDA 2005). This 2008 ROD provides forest-level direction for the site-specific treatment of invasive plant infestations. Invasive plant management actions directly associated with this project are authorized by the ONF Beyond Prevention ROD.

This EA incorporates the following guidance documents by reference:

- The ONF Strategic Plan (USDA Forest Service 2004a). The Strategic Plan was developed using an interdisciplinary process to identify priority areas for aquatic and terrestrial ecosystems, restoration needs, and opportunities to integrate projects to achieve multiple benefits.
- The ONF Access and Travel Management Plan (ATM) (USDA 2004b). The ATM documented priorities and recommendations for National Forest System (NFS) road management objectives on the ONF. The ATM summarized recommendations gathered during an interdisciplinary review of the ONF transportation system and considered the effects of the NFS roads on a variety of resources. This review informed the development of the Road Management Objectives for each segment of road on the ONF. NFS road management decisions at the Forest and District levels are informed by this analysis and adhere to these guidelines and objectives wherever feasible.
- Road construction/reconstruction activities needed to safely conduct operations associated with the Proposed Action are developed utilizing the standards and guidelines set forth in the following documents with authority under 36 CFR Parts 212, 251, 261, and 295: Forest Service Manual (FSM) 7700 – Travel Management; FSM 7710 – Travel Planning; FSM 7730 Transportation System Road Operation and Maintenance; Highway Safety Act of 1966 (P.L. 89-564) in compliance with applicable Highway; Safety Program Guidelines, as specified in the Memorandum of Understanding found in FSM 1535.11; Forest Service Handbook (FSH) 7709.55 – Travel Analysis Handbook; FSH 7709.58 – Transportation System Maintenance Handbook; and, FSH 7709.59 – Transportation System Operations Handbook.

- The Hood Canal South Late Successional Reserve Assessment (LSRA) (USDA Forest Service 1995). The LSRA examines the historic and current uses of the LSRs; discusses vegetative condition and late-successional forest associated species known to exist within the LSR; presents criteria for developing treatments for achieving LSR objectives; and identifies areas for potential treatment.
- The Lower South Fork Skokomish Watershed Analysis (USDA Forest Service 2013), and Lower North Fork Skokomish Watershed Analysis (USDA Forest Service 2014). The watershed analyses provide a scientifically-based understanding of the ecological structures, functions, processes, and interactions within the watershed and identify desired trends, conditions, and restoration opportunities, and recommendations.
- The Olympic Adaptive Management Area Overview (USDA Forest Service 1995) identifies goals, features, characteristics, conditions, and potential management strategies associated with AMA that influence planning of activities within the Olympic AMA.
- The ONF Draft Fire Management Plan (USDA Forest Service 2015, Draft) is currently being revised and includes management recommendations for fuels treatment and fire management on the ONF.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the ONF Headquarters in Olympia, Washington. The project record and all references cited are hereby incorporated by reference into this EA.

1.3 Project Location

Areas where activities are proposed lie within T22N, R5W, Sections 1-14, 16-22, 24, 26, 28-3, 31-34, 36; T22N, R6W, Sections 13, 22, 23; and T23N, R4W, Sections 7-9; Willamette Meridian in Mason County, WA (see map, Figure 1-1). Stands were selected on the basis of the need for treatment, accessibility by existing NFS roads, and economic feasibility. The 31,000-acre project planning area is located within the Lower North Fork Skokomish River, Lower South Fork Skokomish River, and the Middle North Fork Skokomish River 6th field watersheds which lie within the larger 5th field Skokomish River watershed. Of 31,000 total acres, National Forest System lands cover about 25,000 acres, the rest of the acreage is owned by the State of Washington or private entities.

1.4 Purpose and Need for Action

Northwest Forest Plan Land Management Allocations

Land allocations within the planning area are LSR (15,150 acres) and AMA (8,487 acres), RRs and Key Watershed. RRs overlie all other allocations and cover about one-third of the planning area. The Key Watershed allocation also overlies all other land allocations. The Skokomish River watershed was selected as a Tier 1 Key Watershed for directly contributing to anadromous salmonid and bull trout conservation.

Desired Future Condition

The general desired condition for this area is diverse, multi-storied stands that provide improved habitat for late-successional and old-growth dependent species. Such stands would also contain openings and enhance herbaceous plants on the forest floor. Management objectives for RR are to maintain and restore riparian structures and functions of streams, lakes, and wetlands and confer benefits to riparian-dependent species. The desired future condition for the portions of proposed project stands in RR is similar to that for the underlying land allocation, with additional considerations to meet the Aquatic Conservation Strategy objectives

Existing Condition

The forest in the project planning area has been heavily influenced by past logging activities. Approximately 17,000 acres of National Forest System lands within the planning area were clear cut between 1927 and 1989. Most of that acreage was replanted after harvest. As a result of this activity, much of the current forest consists of relatively dense second growth plantations in a structurally simplified stage. These stands do not provide high-quality habitat for species associated with old-growth and late-successional forests. Riparian areas that once supported large conifers now have high percentages of small-diameter conifers and hardwoods, and the available supply of trees for recruitment of large wood, an important habitat component for many species, including fish has been reduced.

The purpose and need for the proposed project was developed to close the gap between existing and desired conditions, and effectively implement the management objectives of the Forest Plan. The purpose and need of the LSVMP is four-fold.

1. *Increase structural and habitat diversity and accelerate the development of late-successional forest characteristics by decreasing stocking in dense, previously managed stands in Late-Successional Reserve.*

The purpose of LSR is to maintain and enhance late-successional forest as a network of existing old-growth forest ecosystems (USDA and USDI 1994b). The following list contains the characteristics of late-successional and old-growth forest (Franklin et al. 1986; Carey and Johnson 1995; Carey and Curtis 1996; Rapp 2003) that describe the desired future condition of the stands proposed to be treated in this project. Old-growth stands are characterized by:

- a patchy, multilayered forest canopy with high crown closure and trees of several age classes;
- a variety of herbs, shrubs, and coniferous tree seedlings and saplings on the forest floor;
- over-story trees exceeding 36 in in diameter at breast height (dbh) with large crowns, large branches, broken tops and other indications of old and decaying wood in some of them;
- understory trees with a range of diameters and ages;
- large standing dead trees; and
- coarse woody debris (CWD) on the forest floor.

2. *Manage Riparian Reserves for desired conditions needed to attain Aquatic Conservation Strategy (ACS) objectives (USDA Forest Service and USDI Bureau of Land Management 1994b, p.B-11; C-32).*

   RRs are a central component of the ACS, and include areas along streams, wetlands, ponds, lakes, and unstable or potentially unstable areas. Generally, standards and guidelines for RRs prohibit or restrict activities that delay or prevent attainment of ACS objectives. Silvicultural practices "to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives" are allowed within RRs. Desired conditions include:

   - late-successional characteristics (see purpose 1., above);
   - appropriate stream shading;
   - accelerated growth of conifers to provide future large wood for recruitment into streams (in-stream large wood is an important structural component of aquatic habitat).
   - maintenance of streambank and hillslope stability.
   - appropriate instream habitat conditions and connectivity.
   - stable roads that do not impact streams and waterbodies.
   - appropriate hydrology and soil productivity.

3. *Increase structural and habitat diversity and accelerate the development of late-successional forest characteristics in dense, previously managed stands in the Adaptive Management Area. Test a variety of techniques intended to restore late-successional forest and riparian conditions.*

   AMA land allocation is also meant to provide opportunities for development, demonstration, and testing of techniques that emphasize restoration of late-successional forest conditions and riparian zones, and integrate commercial timber harvest with ecological objectives (USDA Forest Service and USDI Bureau of Land Management 1994b, p.C-21;D-1). The silvicultural objective within AMA is to add structural and tree species diversity to the stands, which includes many of the desired conditions described above.

4. *Contribute directly and indirectly to the viability of local community economies.*

   While maintaining and enhancing late successional forest is the primary objective, there is a need to contribute positively to the viability of the local community economies (Forest Plan pg.IV-7). In addition, a goal of the NWFP is to provide a sustainable level of forest products for local and regional economies and to provide jobs. The Olympic AMA allocation stated emphasis is to "…test innovative approaches at the stand and landscape level for integration of ecological and economic objectives." Implementation of an economically viable project alternative that directly meets the primary benefit of improving conditions in LSR, RR, and

AMA land allocations as described above, will provide the added benefit to local economies through utilization of local industry capabilities and infrastructure.

Relevant measurable quantitative and qualitative indicators are used to measure how project activities meet the purpose and need as described above. Indicators assessed in this environmental analysis include:

- Acres within LSR with variable density thinning silvicultural treatments.
- Acres of habitat moving toward old-growth conditions.
- Acres of suitable habitat (nesting, roosting, and foraging) and dispersal habitat for NSO.
- Effects determinations for terrestrial threatened, endangered, and proposed species and their designated critical habitat.
- Acres treated with variable density thinning silvicultural treatments.
- Matrix pathway of indicators for aquatic habitat: temperature, sediment, substrate embeddedness, streambank condition, drainage network increase, road density and location.
- Effects determinations for listed aquatic species and their critical habitat.
- Benefit cost ratio of project activities.

The individual resources sections in Chapter 3 present results of effects analyses in terms of these indicators. Effects are summarized in Table 2-7.

1.5 Proposed Action

The ONF proposes to commercially thin second growth forest stands to accelerate the development of some of the structural and compositional features of late-successional forests and accelerate growth of forest stands in LSR, AMAs and RR land management allocations (as described in Section 1.4; shown in Table 2-2) within the Skokomish River 5th field watershed in Mason County, Washington.

The approximately 31,000 acre planning area includes approximately 4,484 acres proposed for commercial thinning in forest stands that are between 44 and 78 years old (See Appendix A for maps, and Appendix B, Table B-4 for a list of project treatment units). Under the Proposed Action, the selected stands would be commercially thinned using variable density thinning (VDT). On the majority of the treated acres, the thinning would utilize a "thinning from below" treatment which generally retains the larger trees, and would include skips (un-thinned areas), gaps (small openings), and some more heavily thinned areas to provide for growth and a mix of species and non-uniform spacing within the stands proposed for treatment. Minor tree species would generally not be cut.

Logging systems would include a combination of ground-based, cable, and helicopter logging. Current NFS roads, unclassified or abandoned road grades, and new temporary roads would be used to access the stands. For more details regarding road development, and truck haul routes, see Chapter 2, Section 2.4.2 and Appendix B of this document.

Opportunities may exist to decommission (or remove) additional system and non-system roads, improve drainage on additional NFS roads, and to implement other restoration and

habitat improvement work with funds (receipts) generated by the project (see Chapter 2, Section 2.4.2.5).

The Proposed Action is represented by Alternative B in Chapter 2.

1.6 Decision Framework

The Responsible Official is the Hood Canal District Ranger of the ONF. The District Ranger will review the proposed action and other alternatives proposed, the environmental effects associated with the alternatives, and comments received during the public comment periods. Based on that review, the District Ranger will decide whether or not to authorize the implementation of vegetation management activities and what management requirements, project design criteria, and mitigation measures are needed.

1.7 Project Implementation

Anticipated implementation of this project would begin the first summer after a decision is signed. The earliest possible start of implementation is the fall of 2016.

1.8 Project Scoping/Public Involvement

The project was first listed in the ONF's quarterly Schedule of Proposed Actions (SOPA), a public database, on December 19, 2013. The project status will remain on the SOPA until a decision is made, and through the calendar quarter following the decision. The project, along with associated documents and information, has appeared on the forest's public website (http://www.fs.fed.us/nepa/nepa_project_exp.php?project=43401). A letter initiating formal government-to-government consultation with the Skokomish Tribe, was distributed on September 11, 2014. In addition, as part of the public involvement process, the agency provided updates and project information at Skokomish Watershed Action Team (SWAT) meetings and field trips in 2014 and 2015. A public scoping letter was sent to interested individuals on September 24, 2014. Seven responses were received. All of the responses received were considered by the project's Interdisciplinary Team (IDT) as they developed the project proposal and considered alternatives to the proposed action. A response to public scoping comments can be found in Appendix D. This response includes the process used to categorize comments and differentiate relevant issues from other comments and concerns. Relevant issues can also initiate from within the IDT. All internal and external (public) relevant issues identified by the IDT are presented below. Each issue was discussed and an outcome was determined by the responsible official who considered the following options: modification of the proposed action; include PDCs or MMs to eliminate or minimize the issue; develop an action alternative that addresses the issue to compare to the other alternatives; or develop an alternative that may be dismissed from further analysis for other reasons (e.g., does not meet the purpose and need, is not within the scope of actions being considered for the project).

1.8.1 Objection Process (36 CFR 218 Objection Regulations)

Section 428 of the consolidated appropriations Act of 2012 included a provision establishing a pre-decisional objection process (36 CFR 218) for projects and activities implementing land management plans in lieu of the post-decisional appeal process (36 CFR 215) used by

the agency since 1993. This project is subject to a project-level pre-decisional administrative review process (Objection Process) as identified in 36 CFR 218, subparts A and B.

Rather than being able to seek higher-level review of unresolved concerns after a project decision has been made under the former Appeal process, those who are eligible will be able to seek that review before the project decision has been signed under 36 CFR 218. The Forest Service believes that considering public concerns before a decision is made aligns with our collaborative approach to public land management and increases the likelihood of resolving those concerns resulting in better, more informed decisions. The Forest Service also believes this will aid in our efforts to be more efficient with documenting environmental effects (NEPA).

Opportunity for public comment on this project includes scoping, and this 30-day comment period on the preliminary environmental analysis. Individuals and entities (non-governmental organizations, businesses, partnerships, state and local governments, Alaska Native Corporations, and Indian Tribes) who submit timely, specific written comments regarding a proposed project or activity during any designated opportunity for public comment may file an objection.

Written comments are those submitted to the Responsible Official or designee during a designated opportunity for public participation provided for a proposed project. Specific written comments should be within the scope of the Proposed Action, have a direct relationship to the Proposed Action, and must include supporting reasons for the responsible official to consider.

1.9 Issues

Comments, questions, and issues were raised by the public and internally. Issues are points of discussion, dispute, or debate about the environmental effects of proposed actions. All comments and associated issues were categorized as discussed in Appendix D. Issues were reviewed to determine whether they were relevant, or key issues. Relevant issues are defined as concerns about effects that may be directly or indirectly *caused by* implementing *the proposed action*. Upon review for this project, all potentially relevant issues were resolved through alternative or PDC development, or modification of the proposed action. No relevant issues were identified that warranted an action alternative to the proposed action. A list of comments, associated issues, and responses to those comments and issues is available in Appendix D.

The following list includes selected issues raised during scoping.

1. Thinning in Riparian Reserves: A commenter suggested not thinning in Riparian Reserves due to the fact that scientific literature showing that benefits outweigh the damaging effects of this activity does not exist.

   Project Design Criteria were developed, as an important part of the proposed action, to minimize impacts of thinning activities in riparian reserves while also meeting the purpose and need of the project (see EA Table 2-4). Riparian buffers are used to mitigate impacts associated with thinning treatments adjacent to streams. Treatment is restricted to areas outside of buffered riparian areas. These PDCs are effective in

minimizing effects to riparian areas while still bestowing benefits of thinning treatments within riparian areas but outside of buffered areas to meet the purpose and need of the project (see Chapter 3 of this EA).

2. There was a concern that treatments proposed within Adaptive Management Areas could be more aggressive to better meet the intent of the AMA land management allocation (Appendix D, IF-6.1).

   Treatments in AMA are aligned with the intent of the NWFP AMA guidance which states goals as "restoration of structural complexity" and to find "the treatment or mix of treatments that most successfully meshes ecological and economic objectives". In addition the AMA guide concludes that "Principal opportunities for expanding our knowledge of the use of timber management were identified as follows: Exploring treatments that accelerate the development of late-successional features or provide other avenues for meeting LSR objectives more quickly or more effectively." Proposed treatments in AMA are different than those proposed for LSR. (see Chapter 2, Section 2.4.2.6.)

3. There was an internal IDT concern that the season of implementation could have effects on fish species and habitat, water quality, soil, and wildlife and wildlife habitat – there was the opposing concern that seasonal restrictions can reduce the feasibility, and subsequently, the economic viability of the project.

   The IDT members conducted extensive reconnaissance and analysis of units proposed for treatment to determine the operating season for each treatment unit. This process weighed the risks and benefits to species and habitats affected by season of operation. As a result many units are designated as summer or winter operations only to address terrestrial wildlife or aquatic resource concerns respectively. In addition, the IDT considered an alternative eliminated from further analysis that addresses this issue (Section 2.3).

2.0 THE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the process used to develop the proposed action and its alternatives. Included in this section is a description of the Proposed Action (Alternative B), and the No Action alternative (Alternative A) which was included to provide a baseline for comparison between the alternatives. Also described are two alternatives considered but eliminated from detailed study. This chapter also includes a discussion of potential improvement and restoration projects that might be implemented in association with the project. The chapter concludes with a discussion and list of the management requirements –PDCs, MMs, and best management practices (BMPs) – that are an integral part of project design, analysis of effects, and implementation.

2.1 Development of the Proposed Action

The development of the proposed action began with an identification of previously harvested stands in the LSVMP project area that would respond favorably to a silvicultural thinning treatment designed to accelerate the development of late-successional forest habitat conditions for old-growth associated wildlife species, including the marbled murrelet and northern spotted owl. The stands identified for this project range in age from 44 and 78 years of age as of 2014. A total of 4,484 acres of such stands were identified and included in the proposed action (Alternative B). The Proposed Action has been designed to meet the Purpose and Need.

2.2 Development of Alternatives to the Proposed Action

No relevant issues were identified that warranted development of action alternatives to the proposed action.

2.3 Alternatives Considered but Eliminated From Further Analysis

Original Proposed Action - Alternative C

This alternative was the original, preliminary proposed action that included about13,500 acres of restoration/thinning treatment. Field reconnaissance was conducted in all preliminary units to determine feasibility of, and the need for, restoration treatments in each unit. Criteria included: access using both the existing road network and consideration of new construction, stand age, and resource related concerns (such as suitable habitat for NSO). This alternative addresses public comments that proposed treating the most acres possible. This alternative was not considered any further after the coarse scale preliminary review, as much of the area was not ready for commercial treatment (i.e., stands were too young to benefit) or the resource risks of developing access and/or treating the stands precluded the benefits of restoration in the stands proposed for treatment. The proposed action, Alternative B (as described in the following Section 2.4, reflects the resulting treatment acres after screening this initial alternative.

The Year-Round Operating Seasons - Alternative D

This alternative was considered internally by the IDT to serve as a basis from which to compare effects between the proposed action which imposes seasonal operating restrictions on some units versus an alternative that has no seasonal restrictions. Specifically, this alternative would allow for comparison of the restoration benefits and impacts to resources as well as the costs of placing seasonal operating restrictions on units. This alternative was not considered further because the short-term effects of conducting the treatment would not meet the intent of the Forest Plan due to the risk that short-term impacts pose to threatened species and their habitat during the breeding season, aquatic species and their habitat, and fragile soil conditions during wet weather operations (winter) in certain units. The Proposed Action, Alternative B, was planned to designate seasons of operations for each unit based on seasonal operating windows and the associated resource concerns for each unit.

2.4 Alternatives Considered in Detail

This EA considers one action alternative, and includes a no-action alternative (Alternative A) as a baseline for comparison. Alternative B is the Proposed Action.

2.4.1 Alternative A No Action

This alternative is included to provide a baseline of the existing condition for comparison with the action alternatives. Under the No Action alternative, no thinning treatments or associated activities would be implemented. Forest stands in the project area would not move toward the desired, restored condition. This alternative would also retain all existing roads – authorized NFS roads, decommissioned roads, and unclassified abandoned roads – in their current condition. No timber harvest or related economic activity would take place. There would be no potential for funds to be generated from this project for additional restoration or resource improvement opportunities in the project area. The No Action alternative does not represent a static condition. Forested stands would continue to develop.

2.4.2 Alternative B The Proposed Action

2.4.2.1 Treatment Acres and Logging Systems

Forest Plan Management Allocations

Of the total 4,484 acres (including skips), 2,025 acres are in LSR, 2,459 acres are in AMA, and 1,529 acres are overlain by RRs. Table 2-2 displays a summary of treatment acres by logging system and the AMA, RR, and LSR Forest Plan land management allocations. Treatment acres (not differentiated by logging system) within the1990 Forest Plan Management Allocations are as follows (rounded to the nearest acre, acres are approximated from GIS): Developed Recreation Administrative Sites, 50 acres; General Level River Corridor, 107 acres; Minimum Level River Corridor, 50 acres; Scenic, 704 acres; Timber Management, 3,540 (Appendix A, Maps A-1 through A-4). Compliance with associated Standards and Guidelines from the Forest Plan Management Allocations is documented in the Forest Plan Consistency Checklist in the project record.

Alternative B includes approximately 4,237 acres of commercial thinning treatments. Proposed logging systems include ground-based skidding, cable yarding, helicopter yarding,

and helicopter yarding with ground-based pre-bunching equipment (Table 2-1; See also Appendix B, Table B-4). Alternative B also includes 247 acres of pre-designated skips, which would receive no thinning treatment. These skips are located in portions of units in which other resource concerns or conditions preclude either access for, or feasibility of, available logging systems. They are within thinning unit boundaries (described as the boundaries of the original clear cut harvest units) and would be identified as skips in the silvicultural prescription.

The proposed treatment of 4,237 acres is gross acres. Although 4,237 acres are designated for thinning; skips, riparian no-cut buffers, and other resource protection buffers and exclusions described in the PDC section of this chapter will be identified on the ground during sale layout and would decrease the number of acres that would actually be thinned by approximately 25 to 30 percent.

Table 2-1. Total acres to be treated listed by logging system.

Logging System	Total Acres
Cable	2,081
Downhill Cable	172
Ground Based	1,604
Helicopter	380
Skip	247
Total Acres	4,484

Table 2-2. Total Acres to be treated within Forest Plan allocations.

Logging System	Adaptive Management Area	Late Successional Reserve	Riparian Reserve[1]	Total (not including Riparian Reserve)
Cable	1,241	840	657	2,081
Downhill Cable	39	133	35	172
Ground Based	889	715	178	1,604
Helicopter	195	185	109	380
Skip	96	151	104	247
Total Acres	2,460	2,024	979	4,484

[1]Riparian reserves overlay all other land allocations and are therefore not included in total acres.

2.4.2.2 Road Development and Landings

Road Development

The project includes constructing temporary roads to facilitate conventional logging systems (ground-based and cable logging systems). Temporary roads are roads that are built to access treatment units, utilized for timber haul during the project, and decommissioned upon

completion of harvest activities. Decommissioning of temporary roads (also referred to as rehabilitation) typically includes: removal of culverts and associated fills, installation of waterbars as needed to control drainage, scarification of the road surface to improve infiltration and restore soil productivity, and blocking of roads to discourage motor vehicle use. The Proposed Action includes a total of 18.7 miles of temporary road development. Approximately 5.4 miles of new temporary roads would be constructed on previously undisturbed ground. Approximately 13.5 miles of temporary road would be constructed on old existing abandoned roadbeds (unclassified roads) or previously decommissioned roads. (See Table 2-3 a summary review of condition and rationale for use of previously decommissioned roads is available in the project record). Throughout this document, the term temporary road applies to any of the three road scenarios presented in Table 2-3 below.

Table 2-3. Temporary road development planned for project implementation.

Road Type	Total Miles of Road
Reconstruction of previously decommissioned road	3.1
Construction on old existing abandoned roadbeds (unclassified roads)	10.4
Construction of new temporary road on previously undisturbed ground	5.2
Total	18.7

To minimize impacts to natural resources, pre-existing road beds would be utilized wherever practical. There are cases where it is not feasible to use the existing roadbeds or landings. New temporary roads are proposed to access stands where existing NFS roads and grades are not adequate for accessing treatment units.

The temporary roads located on previously decommissioned roads minimize environmental impacts by utilizing old roadbeds on previously disturbed grounds. When planning the locations of temporary roads for use, stream crossings would be avoided as much as is practical (see Table 2-4, PDC). The Fisheries and Water Quality section in Chapter 3, Table Fisheries-7 identifies five stream crossings that would be required on the proposed temporary roads. One stream crossing would be constructed on a new temporary road. Three stream crossings would be constructed on existing unclassified roadbeds that cross streams. One stream crossing would be constructed on a previously decommissioned road segment.

The exact locations of temporary roads may change during the layout phase of this project, however the intention is to depict their locations as accurately as possible on the related maps (Appendix A). Some locations of temporary roads along existing road alignments may change due to historical mapping errors and land features.

Landings

Alternative B includes landings to facilitate all logging systems (helicopter, cable, and ground-based logging). Landings are areas on or directly adjacent to roads where logs are transferred to be loaded onto log trucks. Landing sizes vary depending on the logging system and the types of equipment that need to be safely accommodated. Typically landings are

about 1 acre in size for ground based, cable yarding, and helicopter operations. Landings are assumed to involve clearing about one acre of vegetation, and this is generally trees and brush within the thinning stand. Alternative B includes up to 7 proposed helicopter landings to accommodate the units proposed for helicopter yarding.

After thinning is complete, all temporary roads and landings would be rehabilitated as described in the PDCs (Table 2-4).

2.4.2.3 Private Lands: Haul Routes, Road Access, and Boundaries

Approximately 125 miles of NFS roads have been identified as haul routes (Appendix A provides a list of haul routes). Maintenance may be required to reduce resource impacts associated with log haul on roads (in accordance with associated mitigation measures, PDCs in Table 2-4 below). Approximately 6 miles of existing roads occur on private lands and will require the necessary permissions (temporary road use permit or permanent easement) to use the roads to access project stands and to use as haul routes in connection with NFS roads. A total of about 0.2 miles of road construction will be required on private lands in order to access units or connect with existing road beds or newly constructed temporary roads (planned as part of this project). See Appendix B, Table B-3 and Figure B-1 for a list and map of these road segments. A portion of the NFS 2340000 road is washed out at milepost 4.6 may be repaired. This section of road is currently under easement with the landowner, Green Diamond. Boundary surveys would be conducted for private NFS land boundaries where survey information is not available. Boundary surveys would be completed prior to project implementation.

2.4.2.4 Rock Sources

Three existing rock sources in the project planning area would provide material for road development and maintenance associated with this project (see Logging Systems maps in Appendix A for locations of rock sources): Big Creek quarry at the Forest Road 2354200, Brown Creek Quarry at the junction of NFS road 2354000 and the 2354300; and V1043 quarry off of Forest Road 2360100. Up to two acres of development per rock source pit is proposed for the LSVMP, for a total of up to 6 acres of rock source development for the project. These identified pits have been used in the past as sources of rock. Effects of rock pit development activities are considered in individual resource sections in Chapter 3. Mitigation measures in terms of seasonality of activities to mitigate disturbance to recreational users and wildlife are described in Section 2.4.4, Table 2-6 below.

2.4.2.5 Additional Restoration Activities

There are habitat enhancement and sale area improvement activities that may be implemented after commercial thinning activities in an area are complete, if funding allows. In general, "sale area" refers to the thinning units themselves and the surrounding area within one quarter of a mile of unit boundaries. In the case of a stewardship contract rather than a standard timber sale contract, the sale area improvement refers to the overall project planning area. This EA assumes that all the activities listed here would be implemented, and resource analyses take into account the environmental effects of implementing them. However, implementation is dependent on funding and market conditions. Recommended sale area improvements are presented here by resource area.

Wildlife

Limited mortality, windthrow or breakage of leave trees is expected following the commercial thinning treatment, however given the generally low levels of snags within project stands, the active creation of snags (and possibly CWD) would enhance the habitat values provided by the project stands. An inventory of CWD should be conducted 3 to 5 years after the commercial thinning treatment, however at least 5 years and preferably 10 years should be allowed prior to a snag inventory so that the contribution of natural mortality to desired snag numbers can be more fully assessed in the project stands. Information from DecAID analysis and other wildlife habitat objectives should be used to inform snag and CWD objectives. Where post-thinning inventories reveal a large disparity between the current condition and the desired future condition, snag and CWD creation could be used to make progress toward the long-term goals. Snag creation should employ a variety of methods (girdling, topping and fungal inoculation) that will delay mortality of some trees and produce snags in multiple decay classes. Additionally, nesting structures for flying squirrels have proven useful in stands with few natural cavities and these may be placed in some of the proposed thinning units. Log pyramids may be constructed to resemble large coarse wood material on the landscape.

Planting trees and shrubs in the understory of the stands and along decommissioned roads and landings following the commercial thinning would increase species diversity and contribute to desired late-successional characteristics. Western redcedar and western white pine are absent or underrepresented in most stands, and could be planted throughout the stands or concentrated within heavy thin patches and gaps (approximately 25 to 50 trees per acre) to supplement the anticipated natural regeneration of western hemlock. Planting of deciduous tree and shrub species would increase species diversity, provide forage for ungulates and accelerate the development of the desired future conditions. Formal stand prescriptions would specify the species and planting density for each stand based on site conditions and current stand composition.

Botany and Invasive Species

Invasive plant species treatments will be applied over a maximum distance of 75 miles (approximately 180 acres) of roads within the planning area. Funding will be used for initial treatments and follow-up treatments; total road mileage and/or acreage completed may be higher. Treatments will be applied over several years.

Aquatics

There is a fish culvert barrier at the FSR 2340 and Frigid Creek crossing that was identified in a fish culvert barrier survey in 2000, identifier FR1. The culvert is a barrier to resident cutthroat trout, preventing access to approximately 0.8 miles of fish habitat above the barrier. The culvert is under a large amount of road fill.

Previously undetected issues with roads and drainage that may affect aquatic resources could be discovered during project implementation. Restoration projects may include decommissioning of previously unidentified unclassified roadbeds, addition ditch relief pipes at locations that may be discovered during timber haul/harvest, and removal of pre-existing culverts on temporary roads that cannot otherwise be removed as part of the timber sale contract.

2.4.2.6 Commercial Thinning Description

Summary of Proposed Treatment

The long-term desired future condition for the project stands is includes well-developed characteristics of late-successional forest, as described in Chapter 1(Purpose and Need, Section 1.4). To place the project stands on a trajectory to attain the desired future condition, a variable density thinning treatment would be implemented within the project stands. The objective of the proposed treatment would be to increase structural diversity and to accelerate the development of late-successional characteristics. The proposed treatments are designed to reduce stand density, 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 and saplings, shrubs, and herbs, increase the number of snag recruitment trees suitable for cavity nesters, and contribute to the CWD element. The sections below detail the components of the proposed variable density thinning VDT and differences in stand treatments related to stand conditions and land designation.

A thinning from below silvicultural treatment will be applied to a majority of the area within the project stands. Boundaries would be located using existing, historical boundaries of the dense, plantation conifer stand type and the application of the PDC given in Chapter 2. The Designation by Description (DxD) contract specification would be used to implement the prescription, which results in variably spaced trees and a wider range of leave-tree diameters than a strict thinning from below prescription, but generally removes smaller trees and leaves larger trees. Thinning would generally remove trees of the most abundant conifer species, while leaving less abundant conifer species and hardwood species in the stand, however individual trees (less abundant conifer or hardwood species) would be cut if they pose a safety hazard or for operational reasons, such as for skid trails, yarding corridors, landings and road locations that would be used for the proposed treatment. Leave trees would be selected irrespective of whether the tree has any damage, so that trees with defects, potential cavity or nesting trees and other similar features of structural diversity may be retained in the stands (Knowles 1996a). In this case, the term "damage" refers to breakage, double tops, crooks, heart rots, ants, etc., that cause loss of wood volume, but do not usually 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 favored for cutting by the proposed treatment.

Cut-tree diameter limits

Within LSR stands, trees greater than 20 in dbh would not be cut as part of the thinning treatment, and where possible, individual trees greater than 20 in dbh cut for safety or operational reasons would remain on site as CWD (Knowles 1996a). Within AMA stands, trees greater than 27 in dbh would not be cut as part of the thinning treatment. Trees greater than 20 in dbh may be converted to snags or CWD. Trees less than 8 in dbh would be retained in all stands.

Skips (no-cut areas)

Skips are undisturbed areas within thinning operations that continue to suppress the development of an understory and maintain a component of dense overstory lacking much understory vegetation, and would provide for species that prefer closed canopy forest. Skips provide for the continued production of small diameter snags through competition-induced

tree mortality, patches of smaller trees, thermal and visual cover for wildlife species, and protection for snags and CWD. Skip areas would include no-cut riparian buffers, buffers for suitable nest trees (SNT), legacy trees, legacy snags, and additional no-cut buffers designated in the PDC for protection or conservation of other species or features. Potential additional skip locations could include rock outcrops, concentrations of CWD, groups of snags, brushy areas, vine maple clumps or other unique features that would benefit from protection. The use of skips to protect sensitive features within stands would increase stand complexity by adding an element of randomness to the placement of skips. Additional designed skips 0.5 to 1.5 acre in size would be assigned as needed in areas that lack these features.

Heavy thinning and gaps

Patches of heavy thinning and gaps would be incorporated in the thinning treatment to increase structural and spatial complexity, obtain desired characteristics such as longer live crowns and larger live branches on individual trees and encourage growth of understory trees and vegetation. Low tree density within heavy thinning patches would allow the maximization of individual tree growth and the development of understory trees and vegetation. Gaps would allow the development of very large crowns and stems on edge trees that are able to occupy additional growing space and would allow the rapid introduction and development of a mid-level canopy of conifers and hardwood trees and shrubs. Heavy thinning patches and gaps would be located to enhance existing desirable stand characteristics or to develop these characteristics in areas that lack these features. Possible locations could include patches of leave trees with the potential to develop desired crown structure more quickly, locations designed to ensure the continued presence of minor tree species in the stand, and existing concentrations of understory trees or vegetation. Heavily thinned patches would be thinned to 20 to 50 trees per acre (TPA)(Knowles 1996a, Muir et. al 2002), retaining hardwoods and minor conifer species. All conifers larger than the minimum diameter limit (but not over 20 in dbh in LSR stands) would be removed from gaps (except any western redcedar, *Thuja plicata* and western white pine, *Pinus monticola*), while all hardwoods would be retained.

Treatment specific to LSR stands

The Regional Ecosystem Office (REO) provided general recommendations for variable density thinning within LSR which were deemed to "have a high likelihood of benefiting late-successional forest conditions" (Knowles 1996a, Knowles 1996b). The REO recommendations provide the basis for the general prescription proposed for the LSR stands, which would be a thinning from below (generally removing smaller trees and leaving larger trees) with at least 10 percent of the stand area in skips (unthinned areas) and up to 10 percent of the area in a combination of areas of heavy thinning and gaps (small openings). Areas of heavy thinning ranging up to 1.5 acre in size would be included in the prescribed treatment of the stands, and gaps 0.1 to 0.25 acre in size would be designed for these stands in areas protected from wind and away from roads and landings. The thinning treatment would reduce stand relative density to between 30 percent and 40 percent of maximum stand density index (SDI), a level between maximizing growth at the stand level and maximizing individual tree growth (Drew and Flewelling 1979, Long 1985). Approximately 100 to 180 trees per acre would remain in the post-treatment stands, and estimated average canopy closure would range from about 60 percent to 80 percent at the stand level.

Treatment specific to AMA stands

The treatments proposed for stands in the AMA meet the definition of a VDT by incorporating patches of differing tree densities within a stand, however patch sizes would be larger and fewer trees would remain than in stands treated with a prescription following the REO recommendations for LSR stands. Consistent with the intent of AMA under the Forest Plan, the application of a wider range of potential commercial thinning treatments within AMA stands would be an alternative approach (to the REO recommendations for LSR stand) to meeting desired future condition in these stands. The proposed treatments for AMA stands would be based on the research which indicates that lower stand density following thinning treatments may allow for the more rapid development of late-successional characteristics (Chan et al. 2006, Garman et al. 2003, Newton and Cole 1987, Tappeiner et al. 2007, pp. 356-7).

A thinning from below treatment would reduce stand density to 20 percent to 30 percent of maximum SDI, a level that should allow for greater individual tree growth (Drew and Flewelling 1979, Long 1985) and provide more resources for the growth of trees, shrubs and herbs in the understory of the stand. Following the thinning treatment (and subsequent creation of snags and CWD) an average of approximately 50 to 100 TPA would remain in the stands, and estimated average canopy closure would range from about 40 percent to 60 percent at the stand level. Minor tree species would be retained; however, in locations designated for lower tree density following treatment, some minor species may be cut to maintain tree species diversity in the overstory of the stand. Skips would be incorporated in the thinning treatment and total up to 20 percent of the stand area. Created gaps 1 to 5 acres in size would comprise up to 30 percent of stand area.

Treatment Specific to Riparian Reserves

The portions of stands adjacent to streams or wetlands would be left untreated as specified by the PDC in Chapter 2. The portion of the Riparian Reserves outside the specified no-cut buffers would receive a VDT treatment similar to the surrounding stand. Gaps would not be located adjacent to untreated buffers along fish-bearing streams.

Fuels Treatments

Material (slash or fuels) generated by commercial thinning activities would be treated using a variety of fuel treatment methods including but not limited to: machine piling and burning at landings, piling and burning within treatment units, chipping and hauling away from sites, or directional falling of trees outside of treatment units where follow up treatment is not needed. Some piles at landings could be made available for firewood first and then burned. The amount of slash removed from units is dependent on proximity to NFS roads and the fuel conditions within each unit. Guidelines for slash removal distances can be found in the PDC Table 2-4 and will be further refined in the brush disposal plan at project implementation. Yarding of material back into units is not recommended due to the increased fire danger that it poses and long response times to reach any potential ignitions. Woody slash can be wholly or partially removed by the purchaser to be processed off site for additional uses or minimally processed on site to be dispersed or removed. Minimally, processing could cover actions such as bucking, limbing, chipping, and grinding.

Reforestation

Post-harvest surveys would be conducted to evaluate reforestation needs for created gaps, temporary roads and landings. Where there would be insufficient natural reseeding, or where resource concerns warrant, reforestation would be accomplished with an appropriate mix of native species.

Other Treatments

Following the proposed commercial thinning, the creation of snags and CWD, and the planting of trees and shrubs in the project stands would contribute to the attainment of the long-term desired future condition (see below).

Snag and CWD Creation

Limited mortality, windthrow or breakage of leave trees is expected following the commercial thinning treatment, however given the generally low levels of snags within project stands, the active creation of snags (and possibly CWD) would enhance the habitat values provided by the project stands. An inventory of CWD should be conducted three to five years after the commercial thinning treatment, however at least 5 years and preferably 10 years should be allowed prior to a snag inventory so that the contribution of natural mortality to desired snag numbers can be more fully assessed in the project stands. Where post-thinning inventories reveal a large disparity between the current condition and the desired future condition, snag and CWD creation could be used to make progress toward the long-term goals. Snag creation should employ a variety of methods (girdling, topping and fungal inoculation) that will delay mortality of some trees and produce snags in multiple stages of decay.

Underplanting for Species Diversity

Planting trees and shrubs in the understory of the stands following the commercial thinning would increase species diversity and contribute to desired late-successional characteristics. Western redcedar and western white pine are absent or underrepresented in most stands, and could be planted throughout the stands or concentrated within heavy thin patches and gaps (approximately 25 to 50 TPA) to supplement the anticipated natural regeneration of western hemlock (*Tsuga heterophylla*). Planting of shrub species would increase species diversity, provide forage for ungulates (hooved animals) and accelerate the development of the desired future conditions. Formal stand prescriptions would specify the species and planting density for each stand based on site conditions and current stand composition.

Thinning and Windthrow Risk

Historically, stand level windthrow was uncommon within the planning area and was mostly confined to vulnerable topographic positions, however individuals and groups of trees would be blown down over extensive areas (USDA 1995). Windstorms have the potential to become a problem in recently thinned stands by acting as a stand replacing disturbance. Future wind events will result in the windthrow of individual trees or groups of trees and snapped tree tops within the project stands, especially in the first few years following treatment, which would provide some gaps, contribute to CWD and create new snags. Wind events will increase the variation in tree spacing and structural complexity of the stands by creating some of these elements that are currently lacking in the stands proposed for treatment.

The areas where wind throw has had a major (negative) impact have exhibited some or many of the following 10 risk factors (without attempting to order them or quantify the risk associated with each):

- Predominantly hemlock and Sitka spruce stands – shallow rooting (Harris 1999)
- Stands adjacent to clearcuts that occur within a few years after thinning
- Stands with H/D ratios exceeding 80 (Wonn and O'Hara 2001)
- Large flats
- Exposure to storm winds (Harris 1999)
- Shallow soils (Harris 1999)
- Wet soils
- Stands 50 years and greater in age that have not been thinned in the past
- Narrow buffer strips between clearcuts and roads
- Stands heavily infected with root rots

The stands proposed for treatment exhibit some of these risk factors. Some are on shallow and/or wet soils, some are unthinned stands over 50 years of age, and the stands exhibit varying degrees of root rot occurrence. Windthrow during winter storm events can be a major disturbance on the west side of the Olympic peninsula, however within the planning area, historic wind disturbance has been minor, and primarily associated with past harvesting practices.

Each stand would be assessed individually when the formal silvicultural prescriptions for restoration are written which will, and prescriptions would minimize the risk of windthrow in locations classified as a high risk. In stands with a high risk of extensive windthrow, one or more of the following methods would be used to minimize the risk: First, thinning to a level that does not open the stands to windthrow must be considered. Some Alaska studies (Harris 1999) indicate that no more than about 1/3 of stands basal area should be removed when there is a high risk of windthrow. Second, windward edges (or potential windward edges) of the stands can be left unthinned to serve as a wind screen. Third, any created gaps should be kept small and should be located in sheltered areas of the stands.

After the thinning treatment, individual or small patches of dead standing or downed trees resulting from spotty windthrow or mortality from root disease would constitute snags and CWD, and would be left in the stand to contribute valuable components of wildlife habitat.

2.4.2.7 Monitoring Associated with the Project

Implementation Monitoring

Monitoring by the Silviculturist would begin prior to sale layout by verifying that a stand level prescription would meet the objectives. The Silviculturist would 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. During operations, ongoing inspections by timber sale administration personnel would verify proper implementation of the stand prescription.

Other Monitoring

Other monitoring would 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 CWD;

and the necessity for artificial reforestation of created gaps, temporary roads, and landings within the project area. An inventory of snags would be taken at least 3 to 5 years (and preferably 10 years but a minimum of 5 years) following treatment to allow for the development of snags through natural processes and to allow for the development of an adequate quantity of trees (20 in dbh or larger) suitable for conversion to large snags. 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.

Field review by the IDT would be completed in the project stands following implementation of the commercial thinning, tree planting, and snag and CWD creation. The review would include an assessment of whether short-term prescription objectives were met (leave tree density, CWD cover, snag density and understory tree density), the effectiveness of PDCs for the protection of soils, leave trees and existing CWD and snags, and the effectiveness of mitigations measures such as the rehabilitation of skid trails and temporary roads.

2.4.3 Project Design Criteria

The Forest Service developed the following project design criteria (PDCs) to address overall project objectives, to minimize resource impacts, and ensure Forest Plan and/or legal compliance. Table 2-4 below displays the PDCs developed for this project along with the applicable units. PDCs, mitigation measures (MMs), and BMPs are management requirements developed to address potential for adverse effects associated with the activities in the action alternatives. They are based on law, policy, and the professional judgment of the resource specialists on the IDT. They apply project-wide. They are embedded in the silvicultural prescription, the design and implementation of the treatments and associated activities, and in the physical layout of the project on the ground. All analyses of environmental effects in chapter 3 of this EA presume that these requirements are implemented wherever they are applicable.

While they are generally arranged here by resource area, some of these requirements and restrictions intentionally serve multiple purposes: for instance, riparian no-cut buffers protect water quality (fisheries) as well as habitat for amphibians (wildlife); leaving CWD in place protects lichens and mosses (botany), habitat for terrestrial mollusks and small rodents (wildlife), and site productivity (soils and silviculture). To avoid repetition, each requirement is described only once.

All logging activities will be approved by the Forest Service Timber Sale Administrator. Where there are site-specific uncertainties about the applicability of a restriction, an appropriate Forest Service specialist will be consulted. Any request for modification to a project design criterion is subject to approval by the District Responsible Official and Timber Sale Contracting Officer, in consultation with appropriate resource specialists.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
Aquatic Resources[1]				
AQUA-01	Mainstem streams or rivers – i.e., SF Skokomish River	Streams are defined as an area with a flowing body of water confined within a bed and banks. Those areas that may not contain	No-cut buffer width of 200 feet, measured from outer edge of the channel migration zone on either side of channel. [2]	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		flowing water at time of delineation but have the characteristics of a bed, bank, and visible scour within a channel are also classified as streams.		
AQUA-02	All other fish-bearing streams (includes intermittent fish-bearing streams).		No cut buffer width of 100 feet, measured from the outer edge of the streambank or to the top of the slope break, whichever distance is greater.	Applies to all units.
AQUA-03	Non-fish-bearing perennial, intermittent, and ephemeral streams	Ephemeral channels are those that may or may not flow during storm events and have a definite, visible scour channel.	No cut buffer width of 50 feet, measured from the outer edge of the streambank, or to the top of the slope break, whichever distance is greater.	Applies to all units.
AQUA-04	Riparian Reserves	Riparian reserves are designated in the Forest Plan	No gap openings or heavily thinned areas will be created adjacent to no-cut buffers within the Riparian Reserve on slopes greater than 70 percent.	Applies to all units.
AQUA-04b	No-cut buffers adjacent to fish-bearing streams	Fish-bearing streams	No gap openings or heavily thinned areas will be created adjacent to no-cut buffers adjacent to fish-bearing streams.	Applies to all units.
AQUA-05	Lakes and natural ponds	The riparian area surrounding a lake, pond, or wetland includes the body of water (if any), and the area to the outer edges of the riparian vegetation, or to the extent of	No cut buffer to outer edge of riparian area or 300 feet from edge of waterbody, whichever is greater.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		perennially saturated edge of lake, pond, or wetland.		
AQUA-06	Wetlands greater than 1.0 acre	The riparian area surrounding a lake, pond, or wetland includes the body of water (if any), and the area to the outer edges of the riparian vegetation, or to the extent of perennially saturated edge of lake, pond, or wetland.	No cut buffer to outer edge of riparian area or 150 feet from edge of wetland, whichever is greater.	Applies to all units.
AQUA-07	Wetlands 0.5 to 1.0 acre	The riparian area surrounding a lake, pond, or wetland includes the body of water (if any), and the area to the outer edges of the riparian vegetation, or to the extent of perennially saturated edge of lake, pond, or wetland.	No cut buffer to outer edge of riparian area or 100 feet from edge of wetland, whichever is greater.	Applies to all units.
AQUA-08	Perennial wet areas less than 0.5 acres, including seeps and springs	The riparian area surrounding a lake, pond, or wetland includes the body of water (if any), and the area to the outer edges of the riparian vegetation, or to the extent of perennially saturated edge of lake, pond, or wetland. Seeps and springs are characterized by	No cut buffer extends 30 feet from edge of perennially wet area. Use skips (buffer along wetted edge of interlocking trees) to protect unique habitat patches. Avoid equipment entry into these areas. Directionally fell trees away from these features. Upon review by a watershed specialist, the no-cut buffer width may be waived or modified to allow use of ground based equipment with appropriate protection (corduroy logs, slash placement).	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		(characterized as small depressions less than 0.5 acres in size) with hydrophytic plants present. Site is normally saturated during the growing season and is dry in summer months.		
AQUA-09	Hydraulic projects	All road construction.	Project activities will 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 (2012). Follow all applicable general and project-specific provisions found in Appendix A of the MOU.	Applies to all units.
AQUA-10	Temporary roads[3] and wetlands	All road construction.	Construction of new temporary roads that intersect wetlands of any size is not allowed. Reconstruction of existing NFS roads or unclassified roads must be reviewed by a watershed and wildlife specialist if placement or removal of fill would encroach on a wetland.	Applies to all units.
AQUA-11	Temporary culverts	All road construction. Q100: is a one hundred year flood event that has a 1% probability of occurring in any given year. The number is based on the expected 100-year flood flow rate in a given	Temporary culverts are instream culverts installed to accommodate a single season of work, and are to be removed prior to the onset of high flows. They are not required to meet Q100 criteria, and shall only remain in place between July 15 and September 30 or as agreed upon by the Forest Service Fisheries Biologist and Washington Department of Fish and Wildlife.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		creek, river, or surface water system.		
AQUA-12	Ditch relief culverts	Reconstruction, repair, and maintenance of existing NFS roads.	Additional ditch relief culverts will be installed as needed to divert runoff away from stream channels.	Applies to all units.
AQUA-13	Cutslope vegetation	Reconstruction, repair, and maintenance of existing NFS roads.	Cutslope vegetation will be maintained to reduce soil erosion, ditch plugging, road maintenance and impacts to water quality.	Applies to all units.
AQUA-14	Unstable sidecast	Reconstruction, repair, and maintenance of existing NFS roads.	Unstable sidecast located along fillslopes that are within harvest units and near landings will be stabilized and/or hauled to stable waste disposal area to the extent feasible.	Applies to all units.
AQUA-15	Sidecast of waste material	Reconstruction, repair, and maintenance of existing NFS roads.	Sidecasting of waste material along fillslopes and ditchlines is prohibited.	Applies to all units.
AQUA-16	Timing of road reconstruction	Reconstruction, repair, and maintenance of existing NFS roads.	All road reconstruction will occur during the summer season: from June 1 through October 31 unless otherwise agreed.	Applies to all units.
AQUA-17	Road drainage	Log haul.	Aggregate and unsurfaced road surfaces used for log haul will be bladed and cross-drained as outlined under contract provision C(T)5.31#. Ditches and culvert inlets will be kept free of debris.	Applies to all units.
AQUA-18	Erosion control	Log haul.	To minimize the amount of sediment delivered to streams along the haul route, sediment filters (including but not limited to straw wattles, slash	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			filter windrow, and/or sediment fence) will be placed in ditchlines along the haul route 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. Removal of sediment filters will be done when site conditions are dry, and captured sediment will be relocated to a stable location away from streamcourses.	
AQUA-19	Wet conditions	Log haul.	Weather conditions will be monitored, and log haul temporarily suspended during prolonged periods of precipitation when soil moisture becomes elevated and there is a high likelihood of sediment being delivered to streamcourses. If maintenance cannot be performed adequately due to weather, haul will be discontinued until conditions improve.	Applies to all units.
AQUA-20	Freezing conditions	Log haul.	Log haul on surfaced and un-surfaced roads 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.	Applies to all units.
AQUA-21	Snow plowing	Log haul.	Plowing of snow will be permitted as needed, if Snow Removal requirements in the contract are met.	Applies to all units.
AQUA-22	Winter maintenance	Log haul.	For winter maintenance on surfaced and un-surfaced roads, ditches will not be bladed past the last cross-drain before a stream crossing.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
AQUA-23	Winter erosion control	Log haul.	If the purchaser's plan of operations includes log haul between November 1 and May 31, the Sale Administrator and a Forest Service watershed specialist or fish biologist will review and approve the purchaser's plan to prevent sediment from entering stream channels. This may include, but is not limited to, placing additional road surfacing, rock armoring ditches, constructing silt fencing, and straw mulching exposed soils along cutbanks and fillslopes.	Applies to all units.
AQUA-24	Timing of temporary road and helicopter landing construction	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	All temporary road and helicopter landing site construction will occur during the summer season: from June 1 through October 31 unless otherwise agreed.	Applies to all units.
AQUA-25	Temporary road location approval	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	Temporary road locations shall be approved by the Sale Administrator prior to construction.	Applies to all units.
AQUA-26	Temporary road location	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	New temporary roads will be located and designed to minimize disruption to hydrologic flows by following the contour of the terrain; minimizing clearing limits (generally no more than 16 feet on level ground, 20 feet for curves, slightly more for steeper grades); minimizing excavation of cutslopes and fillslopes; and routing road drainage away from potentially unstable hillslopes, sidecast fillslopes and channels.	Applies to all units.
AQUA-27	Potentially unstable areas or sidecast	Location construction, and use of temporary roads,	Roads that are located in potentially unstable areas and/or have potentially unstable sidecast fillslopes	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		log landings, and helicopter landing sites.	will have additional emphasis on road drainage and stabilization.	
AQUA-28	Road stabilization	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	Stabilization measures will be required if a temporary road is in place for more than one year.	Applies to all units.
AQUA-29	Cross-drains or waterbars	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	Prior to the wet season, cross-drains or waterbars will be installed approximately every 150 feet, or more frequently where slopes exceed 5 percent.	Applies to all units.
AQUA-30	Unstable landforms	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	Construction or reconstruction of temporary roads and landings within or directly adjacent to potentially unstable landforms will be assessed on the ground by a Forest Service geotechnical engineer or soils scientist prior to approval by the Sale Administrator.	Applies to all units.
AQUA-31	Failing culverts	Location construction, and use of temporary roads, NFS roads, log landings, and helicopter landing sites.	Existing culverts on temporary or NFS roads that are not functioning, or whose use for log haul in the current condition may impact water quality, will be replaced as necessary.	Applies to all units.
AQUA-32	Wet conditions	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	If roads are left open through extended wet weather, erosion and sedimentation control measures will be maintained. Spot rocking will be used as needed to reduce off-site erosion and sedimentation risk.	Applies to all units.
AQUA-33	Helicopter landing location approval	Location construction, and use of temporary roads,	All helicopter landing site locations will be approved by the Sale Administrator prior to construction. Existing landings will be reused where possible.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		log landings, and helicopter landing sites.		
AQUA-34	Helicopter landing size	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	New helicopter landing sites will be limited to one acre in size. Some vegetation may need to be removed outside of this one-acre area to facilitate flight paths and safe operating procedures	Applies to all units.
AQUA-35	Helicopter landing location in riparian reserves	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	If landing sites must be located within Riparian Reserves, they will be placed on existing roadways or on existing landings that require only minimum reconstruction (e.g., clearing vegetation, sloping for drainage, or surfacing for erosion control purposes) to be made suitable for use.	Applies to all units.
AQUA-36	Helicopter and log landing location	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	Helicopter and log landings will not be located within or adjacent to designated riparian no-cut buffers.	Applies to all units.
AQUA-37	Helicopter and log landing location – wet areas	Location construction, and use of temporary roads, log landings, and helicopter landing sites.	Skyline/cable and helicopter landings will be placed in areas away from streamcourses, wet areas, and unstable soils. Short landing extensions may be used to reduce and control potential runoff.	Applies to all units.
AQUA-38	Decommissioning of temporary roads after use	Decommissioning of temporary roads, skid trails, & landings	All temporary roads will be scarified as necessary to improve water infiltration and restore soil productivity. Available logging slash will be placed across the decompacted surface.	Applies to all units with the exception of unit 33to protect trail.
AQUA-39	Timing of Decommissioning	Decommissioning of temporary roads, skid trails, & landings	All temporary road and helicopter landing obliteration will occur during the summer season: from June 1 through October 31, unless otherwise agreed.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
AQUA-40	Skid trail rehabilitation	Decommissioning of temporary roads, skid trails, & landings	Skid trails will be rehabilitated as needed to restore long term soil productivity. The Sale Administrator will collaborate with the soil scientist to determine skid trail rehabilitation prescriptions.	Applies to all units.
AQUA-41	Culverts and fills	Decommissioning of temporary roads, skid trails, & landings	All culverts and all road fills within wet areas will be removed and stream bank profiles reestablished to restore hydrologic function.	Applies to all units.
AQUA-42	Culvert removal	Decommissioning of temporary roads, skid trails, & landings	Culverts removed from stream crossings and ditches will be transported off forest by the contractor.	Applies to all units.
AQUA-43	Cross-drains or waterbars	Decommissioning of temporary roads, skid trails, & landings	Waterbars or cross ditches will be installed as needed to control drainage.	Applies to all units.
AQUA-44	Potentially unstable landforms	Decommissioning of temporary roads, skid trails, & landings	Road surfaces in potentially unstable landforms will be scarified and outsloped as needed. All sidecast material will be removed and placed in a stable location.	Applies to all units.
AQUA-45	Unauthorized motorized access	Decommissioning of temporary roads, skid trails, & landings	Post-harvest motorized access to all temporary roads and landings will be prevented by construction of an approved closure device (e.g., earth berm, large boulder placement and planting of native materials).	Applies to all units.
AQUA-46	Revegetation	Decommissioning of temporary roads, skid trails, & landings	Road surfaces would be revegetated with appropriate native or specified non-native grass seed and/or native shrub and tree seedlings as needed. Acceptable seed types, types of weed free mulch, and application rates will be determined by the Forest Service. (See PDC, BOT-07, BOT-08, BOT-09, BOT-10)	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
AQUA-47	Rock Pit Development	Development of rock pits including clearing vegetation, blasting, and crushing rock.	Rock pit development activities will be conducted outside of Riparian Reserves.	Applies to all rock pits proposed for development.
Archaeology				
ARCH-01	Previously undetected archaeological, historical, or cultural resources		If subsurface archaeological evidence or previously unidentified cultural resources are located during implementation of the project, activities will cease pending an evaluation of cultural eligibility by a qualified Forest Service archaeologist, who will determine appropriate mitigation measures. The Forest will fulfill its consultation requirements in accordance with 36 CFR 800.11.	Applies to all units.
Fire and Fuel				
FUEL-01	Open roadways		A slope distance fuels buffer strip will be created along all affected roadways that are left open to the public after the project has been completed. This includes road-adjacent turnouts and landings used for the project. Surface fuel conditions within the buffer strip will resemble pre-thinning conditions. All units are shown, but not all units will require treatment. Fuels buffer widths will be based upon a slope and aspect rating for each unit ranging from 0-4, with greater distances applied to steeper slopes and southerly aspects. Treatment distances are measured from the road edge and are as follows: • Rating of 0 = 30 ft uphill and downhill	***Units classified as 0*:** 11, 9, D3A-01, D3A-02, D1A-21 ***Units classified as 1*:** D23, D28, D10B, D15 ,R5, D1B-01, D1A-18, D10B, D2-02, D3B-02, D2-03, D1A-21, D1A-42, D3B-03, D3B-04, D3A-03, D3B-05, D3C, D2-04, D2-05, D2-06 ***Units classified as 2*:** D10A, D10C, S2, V4, 35, 36, D25, V26, V22, D29C, R12, R23, D10, D12B, D23B, D9, D12, S4, D30, D21A, V26, D21-04, D1B-04, D21-05, D1A-13, D1A-16, D1A-24, D1A-

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			• 1 = 60 ft uphill and 30ft downhill • 2 = 90 ft uphill and 30ft down • 3 = 120ft uphill and 60 downhill • 4 = 150ft uphill and 60ft downhill.	15, D1A-46, D1A-45, D1A-47, D1A-14, D21-07, D1A-51, D1A-49, D29D, D29E, V14, V5, D25A, D11, D24A, D23A, D20, D3B-01, D1A-22, D1A-39, D1A-08, D1A-01A, D1A-01, R11, D24B ***Units classified as 3*:** 33, D12A, D1A-03, D1A-04, D1A-06, D1A-07, D1A-17, D1A-19, D1A-20, D1A-25, D1A-26, D1A-26A, D1A-27, D1A-31, D1A-35, D1A-40, D1A-48, D21-11, D22, D22A, D24, D29, D29A, D29B, D29E, R12, R18, R23, R7, R9, V33 ***Units classified as 4***: 37, R11, R23, R8, V1
FUEL-02	No-cut resource protection buffers within units	NA	No fuel treatments will occur in no-cut buffers within units.	Applies to all units.
FUEL-03	Riparian areas	NA	Fuel treatments will be designed to meet Aquatic Conservation Strategy objectives and to minimize disturbance to riparian vegetation.	Applies to all units.
FUEL-04	Fuel Piles	NA	Piles of slash created on machine and helicopter landings should be placed as far as possible from surrounding forest vegetation so as to reduce the risk of causing any damage to the forest when they are burned. Any piles that are created are to be covered with	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			plastic over 40 to 60 percent of the pile area and must be free of unburnable material such as rock and soil to allow complete and efficient combustion when conditions are appropriate for burning.	
FUEL-05	Burning	NA	All burning will be conducted in compliance with the current Washington State Smoke Management Plan.	Applies to all units/adjacent areas used for burning.
Soil				
SOIL-01	Landforms prone to mass movement. Specifically, Escarpments and Inner Gorges within this project area.	Landforms prone to mass movement are defined as: Potentially unstable areas based on landform, signs of instability, and history of disturbance.	25 feet upslope from a major slope break that defines an escarpment, inner gorge, or potentially unstable area. The project soil scientist will delineate and map escarpments, inner gorges and other potentially unstable areas within project area. These areas will be field verified by the project soil scientist during layout. If legitimate concern for potential mass movement due to project activities exists, the soil scientist and a member of the layout crew will consult in the field to ensure effective buffers are maintained. A map showing potential units of concern **((D10)(c), D15(c),D29(c), V1(c), V5(c))** will be provided to layout crew.	Applies to all units.
SOIL-02	Ground-based skidding	Ground-based skidding	Ground-based skidding operations will be designed and implemented to minimize the extent and degree of detrimental soil disturbance. When soil conditions are such that operation of conventional ground-based equipment would result in extensive deep rutting in mineral soil, creating areas of standing water, loss of soil structure, and/or	Applies to all units with ground-based skidding.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			complete displacement of topsoil*, operations will be restricted to methods that minimize compaction, displacement and rutting, (such as placing slash in the skid trails), or operations will be postponed until conditions improve such that yarding may proceed without causing excessive soil compaction, displacement, and rutting and the long-term impacts to soil productivity and moisture absorption capacity that can result. ***These impacts would generally be consistent with Soil Disturbance Class 3 in the USDA Forest Service Soil Disturbance Field Guide (Napper et al., 2009).***	
SOIL-03	Soil disturbance	Ground-based skidding	Ground-based skidding activities would create some low-level Soil Disturbance Class 3 impacts throughout most primary and secondary skid trails. Excessive soil impacts such as rutting greater than 12 inches deep in mineral soil, creating areas of standing water, deep puddling, or total removal of the topsoil layer* would potentially occur, but this degree of soil impact would be rare and limited to small, isolated areas. ***These impacts would generally be consistent with Soil Disturbance Class 3 in the USDA Forest Service Soil Disturbance Field Guide (Napper et al., 2009).***	Applies to all units with ground-based skidding.
SOIL-04	Reuse of existing skid trails	Ground-based skidding	Existing skid trails and landings from prior harvest will be used to the extent feasible unless unacceptable resource damage would result due to location or site conditions.	Applies to all units with ground-based skidding.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
SOIL-05	Operating on steep slopes	Ground-based skidding	Operation of conventional ground-based skidding equipment will be restricted to sustained slopes that are 30 percent or less.	Applies to all units with ground-based skidding.
SOIL-06	Detrimental soil conditions	Ground-based skidding	Detrimental soil conditions resulting from previous and current logging activity will not exceed 20 percent of the area of any individual harvest unit, including roads and landings. If detrimental soil conditions from previous logging activity exceed 20 percent of the unit area, the amount of area in detrimental soil condition will not be increased.	Applies to all units with ground-based skidding.
SOIL-07	Skid trail approval	Ground-based skidding	Operation of ground-based yarding and skidding equipment will generally be restricted to authorized skid trails. Equipment may be allowed to operate off of designated skid trails occasionally to resolve operational issues. These instances would be rare and will be limited to a single out and back pass by a single piece of equipment.	Applies to all units with ground-based skidding.
SOIL-08	Equipment exclusion zone	Ground-based skidding	Operation of ground-based skidding equipment will be restricted within 30 feet of harvest unit boundaries. This will provide additional protection where riparian no-cut buffers serve as harvest unit boundaries.	Applies to all units with ground-based skidding.
Nonnative invasive species[4]				
NNIS-01	Existing herb Robert (*Geranium robertianum*) infestations	Weeds/Ground disturbing activities	Avoid ground disturbance within 50 feet of herb Robert (*Geranium robertianum*) infestations.	D10A, 33, 35, 36, 37,D29, D29A, D29B, D29C, D29E and R23
NNIS-02	Existing weed infestations along access roads	Weeds/Ground disturbing activities	Avoid ground disturbance on access roads entering units with known infestations until infestations on the roads are controlled to a point where risk of	Lake Cushman units: 33, 35, 36, and 37

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			spreading weeds through project activities is low, as determined by an invasive plant specialist.	
NNIS-03	Treat existing infestations	Invasive plant infested areas	Treat existing invasive plant infestations with appropriate herbicide, mechanical, or manual methods before ground disturbing activities begin when practical. If timing or resources prevent treatment before the project begins, then treat infestations in the project area upon completion of the project in order to prevent invasive plants from colonizing the disturbed ground.	Applies to all units.
NNIS-04	Equipment cleaning	**Off-road equipment: includes** all machinery other than log trucks, chip vans, pickup trucks or vehicles used to transport personnel on a daily basis.	Clean all off-road equipment of dirt/mud, seeds, and other plant parts before it is moved onto National Forest System land. If operating in an area infested with invasive plants, clean all equipment before moving between sites or leaving the project area. For cleaning equipment on Forest Service land, the Contractor and Forest Service shall agree on methods of cleaning, locations of the cleaning, and control of off-site impacts, if any. **'Off-road equipment' includes** all machinery other than log trucks, chip vans, pickup trucks or vehicles used to transport personnel on a daily basis.	Applies to all units.
NNIS-05	Work/travel in infested areas	Invasive plant infested areas	Forest Service shall flag locations of high priority invasive plant infestations prior to work commencing and provide the contractor with a map of these locations. These areas shall be avoided during work and travel associated with the project unless otherwise directed by the Contracting Officer. If directed to work in infested area, the contractor shall be required to prevent spreading the infestation into un-infested areas by cleaning	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			vehicles and equipment. The contractor shall use wash stations approved by the Contracting Officer.	
NNIS-06	Weed-free material, Gov. and Contractor provided	NA	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. 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. Contractor-provided expertise and methods to establish weed-free status must be appropriate for the weeds on the current Washington State noxious weed list (http://www.nwcb.wa.gov/weed_list/weed_list.htm). A Forest Service weed specialist shall inspect proposed sources to determine weed-free status. The contractor shall provide the Contracting Officer written notification of proposed material sources 14 days prior to use. If weed species are present in the proposed source, appropriate mitigation measures may allow conditional use of the source as required by the Contracting Officer.	Applies to all units.
NNIS-07	Disposal of infested fill	NA	Fill material generated from the 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. The material shall not be broadcast for disposal.	Applies to all units.
NNIS-08	Weed-free mulch	NA	Mulch used on the project shall be weed-free. The Contracting Officer may request written documentation of methods used to determine the	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			weed-free status of any and all materials furnished by the contractor. Contractor-provided expertise and methods to establish weed-free status must be appropriate for the weeds on the current Washington State noxious weed list (http://www.nwcb.wa.gov/weed_list/weed_list.htm). *(Refer to the North American Weed Free Forage Program standards, Regional EIS, Appendix O)*	
NNIS-09	Weed-free seed	NA	Seed used in the project shall be weed-free and meet state and local noxious weed laws. Refer to the Olympic National Forest Native Plant Handbook for guidelines and/or consult Forest Service Invasive Plant, Botany, or Native Plant staff for guidance.	Applies to all units.
Botany				
BOT-01	Plant natives	NA	Give priority to seed mixes and plantings with local native species. Refer to the Focus List for Olympic National Forest for guidelines and/or consult Forest Service Invasive Plant, Botany, or Native Plant staff for guidance.	Applies to all units.
Wildlife[5]				
WL-01	Suitable nest trees (SNTs) for marbled murrelet in stands that have been surveyed for SNTs by FS staff	SNTs (individual trees with potential nesting platforms) are defined as: a live conifer at least 18 inches dbh that contains one or more platforms located in the live crown of the tree 33 feet or more above the ground; is within 55 miles of marine waters; with one branch	• No-thin buffer that includes the SNT and all trees with intermingling branches. • No yarding or skidding through buffer. • If SNTs outside of thinning unit need to be used as anchor trees, then a Forest Service wildlife biologist should be consulted. Proposed thinning units will be surveyed for SNTs in LSR using the following priorities: high probability of SNT component and density; adjacency to contiguous OG; probability of SNT	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		that is at least 4 inches in diameter at a height of 33 feet or higher on the tree . A platform is defined as a relatively flat surface on the branch at least 4 inches in diameter that can function as a platform and may or may not have some amount of moss or lichen, mistletoe, witch's broom, and/or other deformities; some degree of cover to the potential nesting platforms that is provided by adjacent trees.	component of various density. Surveys for SNTs in AMA will be done in proposed thinning stands with a high probability of SNT components.	
WL-02	Marbled murrelet SNTs in stands that have not been surveyed for SNTs by FS staff.	Western hemlock and Western red cedar 28-inch or greater dbh, and Douglas-fir 32-inch or greater dbh in stands that have not been surveyed for SNTs.	No-thin buffer that includes the tree and all trees with intermingling branches. Yarding and skidding may occur within buffer but should be avoided if possible. If legacy trees outside of thinning unit need to be used as anchor trees, then a Forest Service wildlife biologist should be consulted.	Applies to all units.
WL-03	Legacy Trees	Legacy trees are defined as having at least three of the following characteristics: 32-inch or greater dbh; deeply furrowed bark (applicable to Douglas-fir only); one	No-thin buffer that includes the legacy and all trees with intermingling branches. Yarding and skidding may occur within buffer, but should be avoided if possible.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
		or more branches 3 inches or greater in diameter; substantially (at least 25% or more) more crown cover than adjacent trees; one or more dead tops or multiple live tops; platforms of mistletoe (western hemlock); platforms from epicormic branching (Douglas-fir).	If legacy snags outside of thinning units need to be used as anchor trees, then a Forest Service wildlife biologist should be consulted.	
WL-04	Legacy Snags	Standing dead trees that are 30- inch or greater dbh and 12 feet tall or taller.	Legacy snags will be retained wherever possible and, where necessary for worker safety, will be given a no-cut buffer of 1.5 times the height of the snag.	Applies to all units.
WL-05	Created Wildlife Trees	Topped trees created as future wildlife trees are scattered throughout the planning area and are identified with brown "Wildlife Tree" tag and/or orange paint.	Trees will not be felled; if felling is needed for safety concerns, tree will be left on site.	Applies to all units.
WL-06	Suitable marbled murrelet or northern spotted owl habitat	Coniferous forest mapped as "suitable habitat" and/or forest stands that meet late-successional characteristics (large trees and logs, multiple canopies, high amount of canopy cover, etc.)	No harvest of suitable spotted owl/murrelet nesting habitat. This also precludes harvest of suitable habitat in areas of temporary road or helicopter landing locations, or any other areas related to harvest activity of second-growth stands	Applies to all units mapped as "suitable habitat".

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
WL-07	Suitable marbled murrelet or northern spotted owl habitat	Suitable habitat adjacent to thinning unit boundaries and/or associated activities	No gaps, heavy thins, or new road construction will occur within 100 feet of suitable habitat edge. Where the boundary between suitable habitat and the thinning unit is an existing NFS road, temporary road reconstruction into the thinning unit will be allowed. Unit boundary adjacent to late seral/old growth will have buffer depth of intermingled branches.	Applies to all units.
WL-08	Unsurveyed suitable marbled murrelet habitat	Unsurveyed suitable habitat of marbled murrelet adjacent to thinning unit boundaries and/or associated activities	In all cases where timber harvest or associated activities (e.g., road construction) take place within the specified harassment distance of equipment being used or visual disturbance during the marbled murrelet breeding season, there will be 2-hour daily restrictions between April 1 and September 23: work may not commence until 2 hours after sunrise, and must cease two hours before sunset.	Applies to all units mapped as "suitable habitat" not previously surveyed.
WL-09	Individual spotted owls or marbled murrelets	Adult or young spotted owls or marbled murrelets observed during project operations.	If any individual spotted owl or marbled murrelet is observed during project operations, a Forest Service wildlife biologist will be notified and measures to minimize or eliminate harassment will be applied.	Applies to all units.
WL-10	Marbled murrelets	To minimize nest predation by corvids (crows, ravens, jays).	Contractors and other project workers will properly store and dispose of food and garbage while working on site.	Applies to all units.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
WL-11	Coarse Wood	Existing dead and down wood on the forest floor exceeding 30 inches in diameter.	Coarse wood may be moved for access, however disturbance should be minimized. Big, old stumps will be kept intact and not uprooted wherever possible.	Applies to all units.
WL-12	Marbled murrelet nesting season	The breeding season for marbled murrelet is April 1 through September 23.	Timber harvest units and/or associated activities identified for operational restrictions will be identified on the timber sale area map for areas of avoidance.	Applies to all units.
WL-13	Northern spotted owl nesting season	The breeding season for northern spotted owl is March 1 through September 30. The early breeding period is March 1 through July 15; the late season is July 16 to September 30.	Timber harvest units and/or associated activities identified for operational restrictions will be identified on the timber sale area map for areas of avoidance.	Applies to all units.
WL-14	Pacific fisher known, active denning sites		If any active denning sites are known or discovered, motorized/mechanized activities will be restricted between Mid-March and late May in these areas.	Applies to all units.
			Recreation	
REC-01	Big Creek Campground and Big Creek Campground Loop Trail	Development of the Big Creek rock pit.	Rock Pit expansion should be limited to the north side of the existing pit, or at least 200 feet from the Big Creek Loop trail corridor.	Applies to the Big Creek Rock Pit only.
REC-02	FS Road 2340 Milepost 12.9 to 13.3 near Browns Creek Campground	Log haul restrictions.	Log Haul on Forest Service Road 2340 (MP 12.9 to MP 13.3) will not be permitted on Friday, Saturday, Sunday or holidays.	Applies to road indicated.

Table 2-4. Project Design Criteria.

Design Criteria	Feature	Definition/Description Or Not Applicable (NA)	Management Requirement Description	Applicable Units
			Log haul will occur Monday through Thursday between 8:00 am and 6:00 pm along this section of road. A news release will be prepared well in advance of any log hauling along this section of 2340. Loaded log trucks must maintain a speed at or below 15 mph along this section of road.	
REC-03 .	Intersection of FSR 2340 and 2354.	Log haul and rock haul restrictions	A traffic control plan will be developed for the intersection at FSR 2340 and 2354 prior to implementation	Applies to road indicated.

[1]These measures are designed to provide protection of fish, soil, and water resources. They cover activities associated with construction, use, and rehabilitation of roads, landings, and skid trails; and logging system equipment use. Many of these measures are standard practices or are contained in standard timber sale contract language.

[2] The objective of the no-cut riparian buffers is to retain riparian vegetation to provide shade to maintain or improve stream temperatures, minimize soil erosion, protect riparian vegetation, and provide protection for aquatic and riparian-dependent species. Buffer distances are measured along the slope. The appropriate Forest Service watershed specialist, botanist, or wildlife biologist will be consulted to determine riparian and wetland buffer location at layout stage.

[3]Temporary roads include: newly constructed road and reconstructed existing, unclassified (non-system) or previously decommissioned roads.

[4] There are many known infestations of invasive plants and noxious weeds in the project area. The following design criteria and mitigation measures are designed to prevent the spread of existing infestations in the vicinity of project activities, and to prevent the introduction and spread of new infestations. They are drawn from the ONF's 2008 Environmental Impact Statement and ROD – Beyond Prevention: Site-Specific Invasive Plant Treatment (USDA Forest Service 2008).

[5] These criteria are in place to protect and benefit marbled murrelets, northern spotted owls, cavity nesters, amphibians, and other wildlife species. Some of the criteria protect specific habitat structures, and some are intended to minimize the potential for disturbance during nesting and breeding seasons.

2.4.4 Seasonal Operating Restrictions

Seasonal operating restrictions are imposed for resource protection.

Road construction

In order to provide maximum protection to water quality and soil productivity, road construction activities will occur during the dry summer months, from June 1 through October 31. This includes rehabilitation of temporary roads.

Wildlife priority

Operating seasons are driven primarily by the need to prevent or minimize the potential for harassment to northern spotted owls and marbled murrelets during the combined breeding season for both species from March 1 through September 23. Stands were rated as having "high" (H), "medium" (M), or "low" (L) priority for seasonal restrictions based on: 1) proximity to current owl activity centers or mapped marbled murrelet sites; 2) proximity to inventoried roadless areas or relatively large contiguous blocks of suitable habitat (for murrelets); and 3) adjacency to a relatively low and/or fragmented amount of suitable habitat and private land. The final product taking into account the different resource concerns, including soils and fisheries values, is shown in Table 2-5 below (Appendix A, Map A-8), which lists the operating period for each unit. Note that some units are mentioned twice because some units utilize more than one logging system due to topography, etc. which results in different effects to resources.

In all cases where thinning or road construction activities take place within harassment distance (110 yards) of suitable habitat during the breeding season, there will be two-hour daily restrictions (for marbled murrelets) between April 1 and September 23: work may not commence until two hours after sunrise, and must cease two hours before sunset.

Soils feasibility

Units with soils considered to have the lowest feasibility for winter ground-based operations (highest risk of detrimental soil disturbance) were incorporated into the table below with operating period in summer months only (June 1 through October 31). Special attention to soil conditions would be necessary during wet weather operations in these units. If, during ground-based operations in wet weather, conditions become such that detrimental soil disturbance exceeds the thresholds described in the PDC Table 2-4, the Forest Service may require that operations be suspended until conditions improve or alternative methods or different equipment are proposed and approved.

Aquatic risk

Units considered to have highest risk of sediment delivery are proposed for summer months only (June 1 to October 31) in the table below. Special attention to erosion control and drainage would be necessary during wet weather operations. If, during wet weather operations, the risk delivery of sediment to aquatic habitat from thinning operations or log haul becomes high, the Forest Service may require that operations be suspended until conditions improve or alternative methods or different equipment are proposed and approved.

Recreation Use

Where road use for thinning activities is planned near the Big Creek Campground and near existing trails associated with the campground, an operating window from September 15-October 31 is recommended for public safety.

Table 2-5. Seasonal Operating Periods by treatment unit (see also Map A-8 in appendix A).

Operating Period	Lower South Fork/North Fork Skokomish Thinning Units
July 16-October 31(shoulder)	33
June 1 – October 31(summer)	D10 , D10A, D10B, D10C, D11, D12, D12A, D12B, D15, D1A-01, D1A-01A, D1A-03, D1A-04, D1A-06, D1A-07, D1A-08, D1A-13, D1A-14, D1A-15, D1A-16, D1A-17, D1A-18, D1A-19, D1A-20, D1A-21, D1A-22, D1A-24, D1A-25, D1A-26, D1A-26A, D1A-27, D1A-31, D1A-35, D1A-39, D1A-40, D1A-42, D1A-45, D1A-46, D1A-47, D1A-48, D1A-49, D1A-51, D1B-01, D1B-04, D2-02, D2-03, D2-04, D2-05, D2-06, D20, D21-04, D21-05, D21-07, D21-11, D21A, D22, D22A, D23, D23A, D23B, D24, D24A, D24B, D25, D25A, D28, D29, D29B, D29C, D30, D3A-01, D3A-02 D3A-03, D3B-01, D3B-02, D3B-03, D3B-04, D3B-05, D7, D9, R12, R18, R23, R6, R7, R8, R9, V14, V22, V26, V33, V8, 35, 36, 37.
September 15-October 31	9, 11
September 24-February 28(winter)	D29, D15, D29D, D29E, D3C, R11, R5, S2, V1, V4, V4, V5.
Year-round	None

Rock Pit Development Operational Restrictions

Rock pit development requires an operating season to minimize or eliminate disturbance from blasting to wildlife and recreational users. Pit development time can take two weeks to one month.

Table 2-6. Rock pit development operational restrictions.			
Rock Pit	**Activities for Development**	**Season of Operation**	**Additional Considerations**
Big Creek Pit	Clearing vegetation, blasting, and crushing	September 24-February 28	Development area should occur at least 200 feet from existing trail (see PDC Rec-01). No pit development activities within Riparian Reserves.
Brown Creek Pit	Blasting and crushing	September 24-February 28	No pit development activities within Riparian Reserves.
Pit V-1043	Blasting and crushing	September 24-February 28	No pit development activities within Riparian Reserves.

2.5 Summary of Alternatives

Table 2-7. Summary of Actions proposed for each alternative and effects (as summarized from Chapter 3).		
Action/Resource Area	**Alternative A (no action)**	**Alternative B (proposed action)**
Silviculture		
Total Acres proposed for thinning/ acceleration of old-growth characteristics	0	4,484
Acres proposed for thinning in AMA	0	2,460
Acres proposed for thinning in LSR	0	2,024
Acres proposed for thinning in Riparian Reserve	0	979
Acres proposed for ground-based logging	0	1,604
Acres proposed for cable logging	0	2,081
Acres proposed for downhill cable logging	0	172
Acres proposed for helicopter logging	0	380
Designated Skip Areas	0	247

Table 2-7. Summary of Actions proposed for each alternative and effects (as summarized from Chapter 3).

Action/Resource Area	Alternative A (no action)	Alternative B (proposed action)
Stands	Over time, opportunities for thinning would be reduced or eliminated, and as a result the opportunity to hasten the development of late-successional characteristics in these stands could be lost. Stands would remain in the stem exclusion stage of stand development for another 100 years or more, providing little value for species dependent upon late-successional habitat.	The proposed action would meet the purpose and need by: • reducing the density of stands, increasing the growing space available to individual trees, and transferring part of the stands' growth potential from the upper canopy to the forest floor; • emphasizing retention of minor species overlooked by past management practices (i.e., western redcedar, western white pine, and deciduous species) while thinning the dominant tree species, thereby, increasing the relative abundance of those minor species; and • increasing the ground cover of CWD.
Wildlife		
Northern spotted owl, northern spotted owl designated critical habitat, marbled murrelet, and marbled murrelet designated critical habitat (More details on ESA Effects determinations and analysis consulted on with the US Fish and Wildlife Service is included in the Biological Assessment for the project)	Overall, reduced availability and distribution of stands that could develop into suitable habitat for late successional habitat-related species.	Northern Spotted Owl – The proposed action may affect, likely to adversely affect individual northern spotted owls potentially nesting in suitable habitat adjacent to management activities within the planning area due to harassment during the breeding season. Northern Spotted Owl Designated Critical Habitat- The proposed action may affect, not likely to adversely affect critical habitat within the planning area because 1) there would not be removal or degradation of suitable habitat, and 2) there would be approximately 12 acres of dispersal habitat removal (temporary road construction and rock pit expansion), 2 acres of which include permanent removal. The individual stands, the planning area, and critical habitat will continue to function for dispersal. Marbled Murrelet – The proposed action may affect, likely to adversely affect individual murrelets potentially nesting in suitable habitat adjacent to management activities within the planning area due to harassment during the breeding season. Marbled Murrelet Designated Critical Habitat – The proposed action may affect, likely to adversely affect critical habitat since limited numbers of primary constituent element (SNTs) may be removed.
Forest Service Sensitive wildlife species	Conditions would continue along current trajectory.	The proposed action will not cause any direct, indirect, or cumulative impacts to the Olympic marmot, Olympic pocket gopher, common loon, golden hairstreak, Makah copper, Olympic artic, Puget blue, lupine blue and valley silverspot, and will not contribute to the loss of viability or move any of these species toward federal listing. The proposed action may impact individuals or habitat of the Northern goshawk, peregrine falcon, bald eagle, harlequin duck, Van Dyke's salamander, Olympic torrent salamander, Townsend's big-eared bat, Keen's myotis, little brown myotis, Puget Oregonian, Malone's jumping slug, Keeled jumping slug, Broadwhorl tightcoil, western bumblebee, and Johnson's hairstreak) but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Table 2-7. Summary of Actions proposed for each alternative and effects (as summarized from Chapter 3).		
Action/Resource Area	**Alternative A (no action)**	**Alternative B (proposed action)**
Effects on Forest Service Sensitive/ Survey and Manage mollusks	Conditions would continue along current trajectory.	The proposed action will have no direct, indirect or cumulative impacts on the Hoko Vertigo snail. The proposed action may have minor impacts on the individuals or habitat of the Puget Oregonian snail, Malone's jumping slug, keeled jumping slug, and Blue-Gray tail dropper slug, but less than 5% of habitat components in the project area would be affected.
Effects on Management Indicator Species	Conditions would continue along current trajectory.	The proposed action may have minor impacts on individuals or habitat but should be expected to maintain the viability of the Pacific bald eagle, American marten, pileated woodpecker, primary cavity excavators, Roosevelt elk, and Columbia black-tailed deer on the Olympic National Forest.
Effects on neotropical migratory birds	Conditions would continue along current trajectory.	The proposed action would not contribute toward the need for additional conservation action for these species.
US Fish and Wildlife Service Species of Concern	Conditions would continue along current trajectory.	No effect on the Makah copper butterfly. Benefits to bat species, goshawks, olive-sided flycatchers. Short-term negative effects on western toads, if individuals are present. Effects to terrestrial (adult) Cascades frogs and tailed frogs would be unlikely due to no-cut riparian buffers. No need for conservation action for all species of concern.
Roads		
Total miles of construction on old existing abandoned road beds	0	10.4
Total miles of decommissioned roads to be reconstructed	0	3.1
Total miles of new temporary road construction	0	5.2
Total miles of road development	0	18.7
Soil		
Slope stability	Current slope stability within stands and associated roads would continue along the current trajectory. There would be limited opportunities to increase road conditions through project associated restoration treatments such as repairing culverts and cross drains.	Thinning of the proposed units, road development, and associated activities are not expected to contribute to any new landslides within or adjacent to the activity areas. Thinning would not have a serious effect on hillslope stability in the short term because the roots of the remaining trees already intermingle with those trees that would be cut, and new root growth would result before the roots of cut trees decay and lose their strength. Over the long term, the thinning would enhance tree growth and tree root development, restoring hillslope stability to original levels. Existing shallow landslide and small rotational failures within the activity area would be protected and would continue to slowly stabilize and revegetate.
Proportion of treatment units in detrimental soils condition	Detrimental soil conditions would remain unchanged, averaging 5%. Opportunities to alleviate detrimental soil compaction on existing landings and skid trails would not be implemented.	An overall average of 14% of the activity areas would be in detrimental soil condition due to ground based thinning operations. PDCs will be implemented to minimize and contain these effects.
Aquatic habitat and fisheries		
Temperature	Current conditions would be maintained.	Given the riparian no-cut buffers and silvicultural prescriptions, changes in stream shading or stream temperature would be unlikely.
Sediment/turbidity and substrate embededness	Present sediment recruitment rates into stream channels would continue. The current amounts of bedload and suspended sediments would be slowly reduced over time, through regrowth of the cutover areas.	Buffers on all streams in the sale area would provide a sufficient distance from water sources to protect them from sediment related to felling, yarding, skidding, and slash disposal activities from entering streams. This also includes locations of helicopter landings.

Table 2-7. Summary of Actions proposed for each alternative and effects (as summarized from Chapter 3).

Action/Resource Area	Alternative A (no action)	Alternative B (proposed action)
Streambank condition	Current conditions would be maintained.	At the project scale, temporary road construction would have a short-term, localized negative impact to this indicator. Effects to fish species or fish habitats would be negligible.
Drainage network increase	Current conditions would be maintained.	Due to the relatively low amount of new temporary road building, especially in the RR, effects to this indicator would be neutral. Temporary road construction will include frequent installation of ditch-relief culverts which will act to disconnect ditchlines from streams and prevent creation and scouring of first order streams at the outlets of ditch-relief culverts. Effects to fish species or fish habitats would be negligible.
Road density and location	Current conditions would be maintained.	There would be a temporary negative effect to road densities primarily in the McTaggert, Frigid, and Lower South Fork Skokomish drainages. However after timber harvest activities road densities would return to pre-project levels.
Riparian reserve function	Current condition would be maintained.	By implementing riparian reserve stand treatments, positive changes would be expected in the structure and composition of the large wood within riparian reserves as late-successional conditions develop over time. Immediate effects to fish species or fish habitats would be negligible.
Forest Service Sensitive fish species effects	Conditions would continue along current trajectory.	The proposed action may impact individuals or habitat for river lamprey, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
Threatened Fish Species (ESA consultation with the US Fish and Wildlife Service is in progress)	Conditions would continue along current trajectory.	The effects determinations for the proposed action are: "No Effect" to Hood Canal summer chum and its critical habitat; "Not Likely to Adversely Affect" Puget Sound Chinook, Coastal Puget Sound bull trout, and Puget Sound steelhead; and "Not Likely to Adversely Affect" critical habitat for Puget Sound Chinook, Coastal Puget Sound bull trout, and Puget Sound steelhead.
Botany		
Effects on federally listed vascular plants, bryophytes, fungi, or lichen species	Conditions would continue along current trajectory.	No effect PDCs will mitigate effects to federally listed species.
Effects on Sensitive/ Survey and Manage vascular plant species	Conditions would continue along current trajectory.	No effect. (No risk to species viability or a trend toward listing.)
Effects on Sensitive/ Survey and Manage bryophytes (mosses and liverworts)	Conditions would continue along current trajectory.	No effect. (No risk to species viability or a trend toward listing.)
Effects on Sensitive/ Survey and Manage fungi	Conditions would continue along current trajectory.	No effect. (No risk to species viability or a trend toward listing.)
Effects on Sensitive/ Survey and Manage lichen	Conditions would continue along current trajectory.	No effect. (No risk to species viability or a trend toward listing.)
Effects on Invasive Plants	Existing infestations would likely persist and continue to spread via future road management activities and other Forest use, and would eventually extend beyond the project boundaries into adjacent areas.	Required mitigation and project design criteria will provide positive results in preventing spread and treating existing infestations.
Recreation		
Impacts to recreation (access)	No effect.	Temporary effects to access in the area.
Visual Quality		
Compliance with Forest Plan Visual Quality Objectives	No effect.	Compliant with VQO standards.
Fire		
Changes to fire risk; probability of wildfire	No effect.	Effects of thinning: Increases in fuel loadings and the increased availability of fuels due to the opening of the canopy and the reduction of wind and sun sheltering. Increase in fire danger in thinned areas

Table 2-7. Summary of Actions proposed for each alternative and effects (as summarized from Chapter 3).		
Action/Resource Area	**Alternative A (no action)**	**Alternative B (proposed action)**
		could be expected. Indirectly, fires occurring in activity generated fuels provide a much greater difficulty to suppress than fires in a natural fuel loading. All of these direct effects will be minimized or eliminated with implementation of fuels treatments and prescriptions as proposed in Chapter 2.
Economics		
MBF	0	81,663
Estimated value of wood products	0	$1,611,556
Net present value (value – cost)	0	-88,336
Benefit/cost ratio	0	0.93
Heritage Resources		
Effects on Heritage Resources	No effect.	No known effects on heritage resources.

3.0 ENVIRONMENTAL CONSEQUENCES

Chapter Organization

This chapter is organized by resource areas: silviculture and stand development, wildlife, botanical resources and invasive plants, soils and landslide risk, aquatic resources and fisheries, cultural resources, recreation and visual quality, fire and fuels, economic viability, and climate change. The chapter concludes with a summary of other effects and compliance with other law, regulation, and policy.

Description of Effects as Presented in This Document

Direct and Indirect Effects

Direct effects are effects which are caused by the action and occur at the same time and place, and "indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and… related effects on air and water and other natural systems, including ecosystems"(40 CFR 1508.8).

Cumulative Effects

"Cumulative effects" are defined in the White House Council of Environmental Quality's NEPA regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" 40 CFR 1508.7. The Council on Environmental Quality (CEQ) interprets this regulation as referring only to the cumulative impact of the direct and indirect effects of the proposed action and its alternatives when added to the aggregate effects of past, present, and reasonably foreseeable future actions on all land ownerships across an area that is deemed appropriate for the impacts being analyzed.

The analysis conducted for this project follows the "Guidance on Consideration of Past Actions in Cumulative Effects Analysis" issued by CEQ Chairman on June 24, 2005. The guidance states the expectation that agencies determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects and further notes that CEQ regulations do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Because the geographic area of consideration varies by resource, the analysis of cumulative effects for each resource may differ in temporal and spatial scale, as well as the activities that are considered in cumulative effects discussions for each resource.

Past, completed activities:

- Unless otherwise noted in the following resource analyses sections, past actions are considered part of the affected environment as discussed above.

Ongoing activities:

- Upper South Fork Vegetation Management Project (ongoing)
- Skokomish Road and Trail Remediation Project (ongoing)

- Elk Forage Enhancement Project (ongoing)
- Skokomish Prairie Burn (ongoing)
- Adjacent state, county, and private timber lands harvesting and associated activities
- NFS Road and Trail Maintenance (ongoing)

Future Activities:

- Adjacent state, county, and private timber lands harvesting and associated activities

3.1 Silviculture

Methodology

Overview of Methodology

The project Silviculturist spent a total of 44 field days on the Lower Skokomish Vegetation Management project. All stands were given formal stand exams, with the majority completed under contract. The Silviculturist performed walk-through exams on all stands proposed for treatment, completed formal stand exams on several stands and performed inspections on the formal stand exams accomplished by contractors. The data gathered included overstory tree and stand level characteristics, snag abundance, understory plant and tree species and abundance, CWD cover and probable plant associations. Summary stand statistics were calculated for all stands. These data were used to compare the current condition to the desired future condition and to assess the potential for treatments to move stands toward desired future conditions.

Analysis Indicators

The number of acres treated to promote the development of late-successional characteristics was be used as the analysis indicator for this report.

Spatial and Temporal Context

The stands proposed for treatment provided the spatial extent of the analysis. Treatments would be applied at the stand level, and proposed treatments would affect trees and other vegetation from the level of individual plants up to the stand scale. The temporal bound for the within-stand effects was generally limited to 30 to 40 years following the commercial thinning treatment. However, consideration was given to the long-term development of late-successional conditions within project stands and for landscape level connectivity between current and future patches of late-successional habitat within the project area boundary over about the next century.

Affected Environment

Historic Disturbance and Previous Management

Historic information was compiled from vegetation management records, the Lower South Fork Skokomish Watershed Analysis (USDA Forest Service 1995) and the Lower North Fork Skokomish Watershed Analysis (USDA Forest Service 2014). Historically, large scale disturbances on the landscape were dominated by fire. Fires were generally stand-replacing disturbances greater in extent than the planning area. Large fires in 1100, 1250, 1308, 1508, 1668, 1701 and 1750 burned all or part of the planning area (USDA Forest Service 1995), creating large areas of even-aged forests, which moved through successional stages as large blocks. Prior to the onset of large scale human disturbances in the project area, forested stands in

most of the planning area originated following fires in 1701 and 1750 (northern and eastern portions) and the remainder following fires in 1668 (western portion). Within the last 200 years, there have been at least ten recorded windstorms with hurricane-force winds, including the '21 blow in 1921 and the Columbus Day storm in 1962 (Henderson et. al 1989). Historic records do not indicate extensive patches of windthrow within the planning area associated with large historic windstorms. Patches of windthrow have been associated with road building and clearcut harvesting, especially where these activities created high-contrast edges in vulnerable topographic locations. In the more recent history, human activities have been the dominant disturbance on the landscape. Clearcut harvest units generally 60 to 100 acres in size and associated road building fragmented contiguous patches of old growth forest, and created landscape level vegetation patterns that differ from those created by the historic fire regime. Prior to 2002 the project area was included in the Shelton Multiple Use Sustained Yield (MUSY) unit, and as a result the project area was subjected to more intensive management than most other locations on the ONF. Clearcut harvesting in the project area began in the 1940's, peaked in the 1980's, and ended in the early 1990's. Following clearcut harvesting (and broadcast burning in most cases), stands were regenerated by a combination of planted Douglas-fir seedlings and natural regeneration resulting from seedfall from adjacent stands. According to vegetation management records, the total acreage clearcut in the Lower Skokomish Vegetation Management Project planning area was 16,948 acres (69 percent of the planning area), and the majority of the clearcut acreage (13,763 acres) was broadcast burned. Since the 1960's, a total of 7,378 acres were pre-commercially thinned at age 15-20 to about a 10-foot spacing in anticipation of a commercial thin at 40 to 50 years of age. Aerial application of fertilizer to increase tree growth was accomplished on 10,461 acres, primarily in the late 1980's and in 2001. About 2,180 acres within the project area have received a commercial thinning treatment. Table C-1 in Appendix C displays past vegetation treatments for the stands proposed for treatment.

Current Stand Conditions

Current stand conditions were assessed in the stands proposed for treatment using a combination of walk-through exams and formal stand exams. The data gathered included overstory tree and stand level characteristics, snag abundance, understory plant and tree species and abundance, CWD cover and probable plant associations. The stands proposed for treatment were between 44 and 78 years of age in 2014 (Table C-2 in Appendix C).

A mix of Douglas-fir and western hemlock comprise the overstory of these stands, with variation in the relative abundance and dominance of these tree species from stand to stand. Occasional western redcedar, western white pine, red alder, bigleaf maple and black cottonwood are also present in the overstory. Some stands contain scattered legacy trees and/or suitable nest trees for marbled murrelet that remain following the previous clearcut harvest which are primarily located near edges with old growth stands. Overstory trees generally have a dbh ranging from 6 in to 24 in (with occasional larger trees in some stands), with variation in the diameter distribution between stands attributable to site quality, tree density, species composition, treatment history and other factors. Similarly, the size and abundance of understory trees are variable both within and between stands, and are predominately western hemlock, and western redcedar. Scattered vine maple clumps are present in some stands, in addition to sapling or pole-sized western redcedar, red alder, and Douglas-fir associated with small canopy gaps.

Table C-2 in Appendix C provides summary statistics for the project stands. There are between about 90 and 300 trees per acre in the overstory of these stands, with most stands in the range of

150-300 trees per acre. Stand quadratic mean diameter (QMD) is generally 13 to 14 in dbh (with a range of about 9.6 to 18.1 in dbh). QMD is inversely related to trees per acre and positively related to stand age. In the 5 to 10 years previous to measurement for this project, most stands displayed pronounced reductions in radial tree growth attributable to high stand density. Stand basal areas are in the range of about 87 to 313 square feet per acre, with an average stand condition of approximately 230 square feet per acre. Current canopy closure ranged from 60 percent to 95 percent, and was approximately 80 percent in most stands. The stands that were given a previous commercial thinning treatment are generally at the lower end of the ranges for trees per acre and basal area, and at the higher end of the range of QMD for the stands proposed for treatment.

Plant associations that best characterize stands proposed for treatment are in the western hemlock series. Major plant associations identified (in order of decreasing occurrence) include TSHE/GASH/POMU (western hemlock /salal/swordfern), TSHE/GASH-BENE (western hemlock/salal/Oregon grape) and TSHE/BENE/POMU (western hemlock/Oregon grape/swordfern). Minor plant associations identified (in order of decreasing occurrence) include TSHE/GASH (western hemlock/salal), TSHE/GASH-VAOV2 (western hemlock/salal/evergreen huckleberry) and TSHE/GASH/XETE (western hemlock/salal/ beargrass). These plant associations generally indicate moderate growth potential for trees (Site Classes 3 and 4). The percent cover of understory vegetation is relatively high (60 percent to 80 percent) in most stands due to the prevalence of salal in the project area. However, the stands display a wide range of conditions in the species composition of understory vegetation depending on the plant association and stand treatment history.

Some stands contain numerous small snags less than 6 in dbh, and the older stands have low to moderate numbers of snags greater than 10 in dbh, but there are generally few snags 20 in dbh or larger in the project stands (Table C-3 in Appendix C). Legacy snags are widely scattered and are generally located along the perimeter of adjacent old growth stands. The project stands have generally low-to-moderate levels of CWD (Table C-3), with an average stand condition in the range of 6 percent to10 percent cover.

The stands proposed for treatment include about 1,110 acres that had a previous commercial thinning treatment (Table C-1). A traditional commercial thinning (without skips, gaps and heavy thin patches) was accomplished in these stands between 1978 and 2005. Current overstory tree characteristics within these stands (Table C-2) are similar to the rest of the stands in the proposed project, although these stands generally have greater crown ratios and lower height-to-diameter ratios. These stands display an increase in the percent cover and vigor of understory vegetation and trees when compared to adjacent untreated areas. In most cases, the overstory trees have reoccupied the growing space since treatment, with canopy closure approaching pre-treatment levels, inter-tree competition intensifying and reduced growing space available for understory development.

Stand Health and Vigor

Symptoms of infection with *Armillaria* root disease (*Armillaria ostoyae*) was noted on scattered individual live trees in some stands, and on recently dead trees. In western Washington and Oregon, tree mortality caused by *Armillaria* has most often been associated with Douglas-fir plantations less than 30 years of age, and with trees exhibiting low vigor (Shaw et al. 2009). Observations of trees exhibiting symptoms of infection and recent mortality in these stands

confirmed that most of the affected individuals were trees of low vigor (in the intermediate or suppressed crown classes) which were stressed by density-related competition for resources.

Tree mortality due to laminated root rot (*Phellinus weirii*) was noted in scattered locations in some stands; however the pockets of infection were typically confined to small groups of trees.

Hemlock dwarf mistletoe (*Arceuthobium tsugense*) is present on individual western hemlock trees in many of the stands included in this project. Dwarf mistletoe is typically associated with previously suppressed trees that were released following clearcut harvest or trees that are located near stand edges with adjacent old-growth stands. Individual trees display witches' brooms (either alive or dead) on lower limbs, but in general the upper tree crowns appear to be unaffected. Dwarf mistletoe is likely causing some growth loss for infected individuals, but the witches' brooms have the potential to contribute to structural diversity within the stand and provide valuable habitat for a variety of wildlife species.

Stand Density Index (SDI) is a relative density measure that was developed to quantify the level of site occupancy based on tree number and size (Reinecke 1933), which can be used to assess the degree of inter-tree competition in a stand. Calculated SDI (English units) ranged from 138 to 497 which is 23 percent to 84 percent of the maximum SDI for Douglas-fir (Reinecke 1933). The threshold which triggers widespread density-dependent tree mortality occurs at about 55 percent of maximum SDI (Drew and Flewelling 1979). The majority of the project stands are currently at or above this threshold, and most stands with lower density are projected to reach this condition within about a decade. A few of the stands that were given a previous commercial thinning treatment (D1A, D1B, D7 and D21) are an exception, with current values of 23 percent to 44 percent of maximum SDI for Douglas-fir. Relative densities of 40 percent to 55 percent maximize stand growth, and maximum tree sizes are attained by managing near 15 percent relative density (Drew and Flewelling 1979) or below the onset of inter-tree competition at about 25 percent (Long 1985). Flewelling, Wiley and Drew (1980) state that "most of a site's (growth) potential is captured if relative density is maintained at 40 percent or higher, and over 90 percent of the site's potential is captured if the relative density is maintained at 30 percent."

Intense inter-tree competition is occurring in most stands proposed for treatment, as evidenced by the calculated SDI, density-related tree mortality, *Armillaria* activity and reduced diameter growth. Current average live crown ratios of 35 percent to 45 percent and average height-to-diameter ratios of 60 to 75 indicate that trees have the potential to utilize increased resources and display a relatively low risk of windthrow and stem breakage. The stands also exhibit potential for the development of two-storied stands in the form of light, scattered understories of western hemlock and western redcedar, which would likely be lost to mortality with increasing stand density.

Environmental Consequences

Alternative A – No Action

Direct Effects and Indirect Effects

Under the No Action Alternative, none of the approximately 4,484 acres of second-growth stands would be commercially thinned.

The No Action Alternative would have no direct effects on stand development. The indirect effect of the No Action Alternative, however, is that stands would continue through the stand

development process without intervention, and late-successional habitat for old-growth dependent species would not be accelerated.

Over time, opportunities for thinning would be reduced or eliminated, and as a result the opportunity to hasten the development of late-successional characteristics in these stands could be lost. These stands would remain in the stem exclusion stage of stand development for another 100 years or more, providing little value for species dependent upon late-successional habitat. Left untreated, these stands would eventually move toward developing some late-successional habitat characteristics (such as large diameter trees) as natural agents reduce tree density at the scale of the single tree or small groups of trees, however the stands could stagnate, with tree growth virtually ceasing due to extreme inter-tree competition. Some desired characteristics such as large diameter trees with deep crowns and large diameter branches, a multi-layered canopy and a diversity of understory vegetation may not develop in the current stands without a moderate level of disturbance, or may not develop until after the next stand replacing disturbance.

Cumulative Effects

The high stand density and declining tree vigor in these stands, compounded by environmental stressors , could predispose them to stand replacing disturbances such as extensive windthrow or large scale insect or disease outbreaks before they develop the desired late-successional characteristics. Historically, wind disturbance in the late-successional stands in the project area removed individuals or groups of trees at small scales and enhanced or maintained a multi-layered stand structure across the landscape during the periods between large fires. In contrast, even-aged stand structures such as those found in the managed stands in the project area are much more susceptible to stand replacing windthrow events, especially if high stand density results in height-to-diameter ratios of 80 or larger. These conditions are likely to develop in the project stands by a stand age of 80 to 120 years. Left untreated, the project stands could be subject to successive windthrow events, perpetuating the unnatural spatial patterning and age distribution that was initiated by historic clearcut harvesting. Following a stand replacing disturbance, the stands would have many biological legacies in the form of standing trees, CWD and snags, but there would be a further delay the development of late-successional conditions by returning the stand to an early successional stage of stand development. In summary, if thinning or similar disturbance were not to occur, the resulting delay in the development of the desired late-successional characteristics in these young stands could produce or perpetuate changes in ecological functions and processes, both within the stands proposed for treatment and at a landscape scale.

The No Action Alternative would not violate any standards and guidelines, but would forego opportunities to use commercial thinning to meet habitat objectives. Since none of the proposed units would be treated, the No Action Alternative would not fulfill the purpose and need of increasing the structural and species diversity of forest stands.

Alternative B – Proposed Action

Direct Effects

The Proposed Action would enhance structural heterogeneity (both vertical and horizontal) through the inclusion of patches receiving different treatment intensities in the overall stand treatment. Observations from similar projects on the ONF indicate that 30 percent to 50 percent of the existing snags in the range of about 10 in to 16 in dbh would need to be felled for worker

safety during implementation of the project, but rarely would snags 20 in dbh or larger be felled for safety (see PDC Table 2-4) . Additionally, the percent cover of CWD (5 in diameter and larger) would increase by 4 percent to 7 percent within project stands following implementation due to unmerchantable material left within the stands. Most of the increased cover of CWD would be in pieces 5 in to about 12 in in diameter, and would persist in the stands for 2 to 3 decades. The proposed treatments would directly promote the development of late-successional characteristics identified as priorities by the South Fork Skokomish Watershed Analysis (USDA 1995) and the Hood Canal South Late Successional Reserve Assessment (USDA 1996) by:

- reducing the density of stands, increasing the growing space available to individual trees, and transferring part of the stands' growth potential from the upper canopy to the forest floor;
- emphasizing retention of minor species overlooked by past management practices (i.e., western redcedar, western white pine, and deciduous species) while thinning the dominant tree species, thereby, increasing the relative abundance of those minor species; and
- increasing the ground cover of CWD.

PDC and MMs detailed in Chapter 2 would adequately minimize risk of any adverse effects on late-successional habitat elements.

Indirect Effects

The Proposed Action would likely improve habitat conditions for some late-successional species by moving stands into the understory reinitiation stage of stand development. Thinning would increase structural and species diversity, and enhance the development of late-successional characteristics within the project stands. Structural and compositional diversity would be increased by thinning the overstory to allow the release or introduction and growth of understory vegetation and the development of relatively large tree diameters, crowns and limbs. Long-term studies have demonstrated that lower stand density results in increased diameter growth (Curtis et al. 1997), and increased tree growth has been observed for overstory trees (Harrington et al. 2005; Roberts and Harrington 2008) and midstory trees (Comfort et al. 2010) following variable density thinning treatments on the Olympic Peninsula. Variation in the thinning intensity within the project stands would produce differences in the growth of individual trees (Roberts and Harrington 2008, Comfort et al. 2010), promoting both vertical and horizontal structural heterogeneity. Thinning would increase cover of herbs, shrubs and understory trees (Bailey and Tappeiner 1998; Carey and Wilson 2001; He and Barclay 2000; Tappeiner and Zasada 1993), and promote understory species diversity (Ares et al. 2010). Flower and fruit production of understory shrubs would also be enhanced by thinning (Wender et al. 2004). Compared to an unthinned condition, the stands would have greater density, survival, and growth of conifer seedlings (Bailey and Tappeiner 1998, Brandeis et al. 2001; DeBell et al. 1997), moving the project stands toward developing a multi-layered canopy. Following the proposed treatment, the lower stand density would increase tree and stand vigor, providing for more resilience following future disturbance and resistance to environmental stressors such as climate change.

The removal of trees during the thinning operation and increased vigor of the stands following the thinning would reduce the number of snags and amount of CWD produced by density-dependent mortality in these stands compared to the No Action alternative; however other

sources of mortality would continue to produce snags and CWD. Mortality of trees damaged during the thinning operation or from wind events could be greater than the No Action alternative for about 5 years following the thinning treatment. Other sources of mortality such as root rots would continue in these stands following treatment. The Proposed Action would reduce the total number of snags within the stands for several decades following treatment, but average snag size would be greater than in the No Action alternative. The proposed treatment would leave sufficient trees in the project stands to attain the desired future condition for snags and CWD, and the artificial creation of large snags (20 in dbh or larger) would shorten the time needed to reach target levels for this habitat element within the project stands (Garman et al. 2003). Within the no-cut buffers adjacent to streams and within other skip areas in the project stands, density-dependent mortality would continue to created snags and CWD in quantities similar to the No Action alternative.

In summary, the indirect effects include:

- accelerating tree growth for the development of large trees, snags, and CWD;
- promoting the increase and diversification of understory vegetation and the development of multiple canopy layers;
- promoting the development of relatively large diameter branches and deep tree crowns;
- increased vigor and resilience of project stands and decreased density-dependent mortality;
- providing opportunities to create additional snags and ground coverage of CWD.

Cumulative Effects

As detailed in the descriptions of historic stand management activities and current stand conditions, past vegetation management activities have had a considerable impact on forest stand structure and landscape-level connectivity in the planning area. As a result of historic stand management activities, the current landscape has a larger proportion of dense young conifer stands, and less area of late-successional forest, than was historically present, and old-growth patches are fragmented and discontinuous. Roughly 68 percent of the project area is composed of managed stands that originated following clearcut harvest. Precommmercial thinning treatments in many of these stands, and previous commercial thinning on about 2,180 acres within the planning area have begun to move some stands toward the desired future condition. The Proposed Action would expand the acreage within the project area that has received silvicultural treatment to enhance habitat characteristics and promote development of late-successional structure, although the project would have only a slight effect at the landscape scale given the small scale of the project (about 15 percent of the project area). The project would expand the effective size of adjacent late-successional patches as the treated stands develop desired characteristics, but would not notably increase connectivity between late-successional patches across the landscape. When combined with past commercial thinning treatments, the current project would result in a maximum of about one-third of the acreage in managed stands within the project area receiving a commercial thinning treatment to accelerate the development of late-successional conditions. The remaining two-thirds of the acreage in managed stands would continue to develop as described for the No Action alternative. The cumulative effect of the project would be to accelerate the recovery of late-successional forest conditions in the treated portion of the project area.

To augment snags and CWD created through natural processes, the active creation of snags and CWD within the project stands would increase the functionality of the project stands and accelerate the attainment of desired levels of these habitat elements. Additionally a non-commercial thinning of understory trees (less than 8 in dbh) could be used to accelerate the recruitment of mid-canopy trees, promote minor tree species and to increase the diversity of understory vegetation.

Stands receiving a second commercial thinning under this project and stands currently 60 years or older located within LSR are not likely to have another commercial thinning treatment in the future, but could benefit from other habitat enhancement treatments. For stands located in AMA and those currently less than 60 years old within LSR, a second commercial thinning treatment in approximately 20 years would further promote the development of a multi-layered canopy, the retention of understory vegetation cover and diversity, provide for the continued growth of overstory trees, and allow for the introduction of a third cohort of trees. Future treatments of previously managed stands within the watershed not included within this project, including non-commercial and commercial thinning, snag and CWD creation and the planting of underrepresented species would aid in the restoration of landscape connectivity and the functionality of existing and future late-successional forest patches.

3.2 Soils and Slope Stability

Introduction

This section summarizes the potential effects to soil productivity and slope stability associated with the proposed and connected actions within the LSVMP area. The following is a discussion of the relevant information pertaining to past and predicted disturbances to the soil resource and slope stability.

The effects analysis section assumes that the PDC, mitigations, best management practices, and seasonal operating restrictions specified in Chapter 2 of this Environmental Analysis are applied to the project implementation. These measures were designed to minimize or mitigate potential impacts, and to ensure that the project would comply with all pertinent laws, regulations, and policies.

Proposed Actions and Alternatives Analyzed

For a detailed description of the alternatives considered for analysis, see Chapter 2 of this document. In summary, 2 alternatives are analyzed in this report: Alternative A (No action) and Alternative B (proposed action).

Methodology

Soil distribution is complex within the planning area. All soil mapping units delineated within the ONF Soil Ecological Unit Inventory (USDA 2000) and other mapped features have been assessed for several potential risks and hazards, and are summarized in this document. Assessments are supported through field verification and GIS analysis. These are most useful as an initial broad-scale planning tool to identify and display maps of possible soil concerns and sensitive areas. Interpretations are based on observations of soil characteristics at sites thought to best represent the entire soil mapping unit. Soil properties can vary within a mapping unit and on-site investigations are often required to refine or modify interpretations. The project Soil Scientist has adjusted the management interpretations to reflect on the existing and likely ground

conditions at the time of activities considering project design criteria (PDC), MMs, best management practices (BMP), and seasonal operating restrictions, as outlined in Chapter 2. These interpretations have also been adjusted based on the types of disturbances to the soils based on the proposed ground disturbing activities, and provide resolution to the soil map units at a site-specific scale.

Sources of Information Used for Analysis

This analysis utilized the surveys and information sources listed below to evaluate and interpret potential effects associated with the proposed action. In addition, previous field experience, personal observations, consultation with other local experts, and knowledge of how soils respond to the proposed types of management actions were used to predict impacts. Sources of information include:

- ONF EUI (USDA 2000), a certified National Cooperative Soil Survey for all soil mapping unit (SMU) delineations and interpretations of properties for use and management
- Olympic National Forest National Cooperative Soil Survey Data (NRCS Web Soil Survey) for some interpretations for use and management
- Natural Resource Conservation Service (NRCS) Web Soil Survey of the ONF (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm)
- Lower North Fork Skokomish Watershed Analysis (USDA 2014)
- Lower South Fork Skokomish Watershed Analysis (USDA 2013)
- Skokomish River Basin Ecosystem Restoration EIS (US Army Corps of Engineers 2014)
- Historic aerial photos
- Other resource information in ONF GIS data sets

Detailed Methodology

A three-step methodology was used to gather data needed for this effects analysis. Priority stands were chosen for field evaluation and validation of soil mapping units, slopes, hydrologic characteristics, and other features. Appropriate map changes were made to reflect field observations. With updated and validated soil mapping, pertinent management interpretations should be more accurate and therefore provide high confidence when determining levels of risk. Stands were also chosen based on logging method (with emphasis on ground based systems) for field estimates and study of existing soil disturbance conditions. Skyline and helicopter stands were included in the analysis, but stands where slopes averaged greater than 30 percent were not surveyed as intensively because of the relatively reduced soil impacts resulting from those logging methods compared to ground based logging activities. Soil disturbance condition was assessed using visual observations on the ground, and quantitative estimates were made using historic air photos and GIS mapping.

A total of 22 field days were spent in the planning area in the summer of 2014. Investigations were primarily focused on the activity areas of potential harvest units and haul routes, and examined landforms and soil types (physical properties, existing disturbance, hydrologic conditions, topography, landslide risk, road conditions and proposed development, stream

courses, wet areas, and restoration opportunities). Specific logging systems and road development concerns associated with the proposed action were examined, including:

- Soils with seasonal high water table
- Surface soil textures and bearing strength/rock fragments
- Surface erosion and delivery potential
- Existing and potentially unstable areas
- Unique features such as rock outcrops, wet areas, wetlands, seeps and springs
- Proximity to riparian areas
- Potential effects to soil productivity and hydrologic conditions

In general, the field investigations confirmed most of the EUI mapping and characterization of landforms and soils. The proposed actions for each unit (logging systems, road development, operating season) were considered, and used to inform site-specific recommendations, design criteria, mitigations, and best management practices that are included in this report.

Analysis Indicators

Detrimental Soil Conditions

- Ground Based Yarding Operations On Sensitive Soils
- Overall Detrimental Conditions

Some of the soils within the Lower Skokomish Vegetation Management project area are particularly susceptible to compaction, displacement, and rutting from ground disturbing management activities. Commercial thinning treatments associated with the proposed action that utilize conventional ground based yarding equipment, especially during winter months when soil moisture levels are higher, may result in unacceptable soil impacts. The extent and degree of these soil disturbances may not meet Forest and Regional standards for soil quality. The consequences of these effects are reduced soil productivity and increased potential for erosion, runoff and sedimentation.

Under the proposed action, many of the units identified for ground based yarding operations are located on landforms and soil map units (SMU) that are highly sensitive to heavy equipment. They are vulnerable to detrimental soil impacts due to the wet climate, silty soil textures, restrictive layers, low rock fragment content, high seasonal water tables, and other factors. These soils are particularly vulnerable to soil disturbances by conventional ground based equipment during the winter months when rainfall is highest. Seasonal operating restrictions because of wildlife concerns often require operations to occur during the winter months. Detrimental soil impacts that may result from operating during wetter times of the year include: compaction, displacement (topsoil removal), rutting, puddling, and shifting to a wetter soil moisture regime. Alteration and loss of soil organic matter and organisms, erosion and sedimentation, shifts in potential vegetation communities, alteration of hydrologic regimes, and overall loss of soil productivity may also result from these activities.

Elements of proposal that may cause loss of soil productivity

- Logging activities – impacts from ground based equipment on skid trails and landings, impacts from log drag in skyline corridors, helicopter landing development
- Road development – temporary road construction and reconstruction of existing road beds.

Measurement Indicators for Ground Based Equipment Operations on Sensitive Soils

- Acres of ground based yarding operations on sensitive soil types
- Qualitative description of degree and extent of expected detrimental soil impacts

Measurement Indicators for Overall Detrimental Soil Condition

- Percentage of ground within individual proposed treatment units (activity areas) in non-detrimental and detrimental soil condition classes
- Percentage of ground of the overall project area in non-detrimental and detrimental soil condition classes

Soil Stability

Road development and timber harvest activities associated with the proposed action may result in an increased potential for landslide risk.

Shallow rapid landsliding in the project area has been an active agent in the downslope movement of soil, rock and vegetation for at least the last one hundred years, and deep seated mass movement for thousands of years, as described in the three watershed analyses consulted for this report. Some of the proposed harvest units and road development are located on landforms that may pose a landslide risk.

Measurement Indicators

- Acres of harvest units planned within and adjacent to potentially unstable landforms
- Miles of road development planned within and adjacent to potentially unstable landforms

Spatial and Temporal Bounding of Analysis Area

There are three geographic scales for this soils analysis of this project. From largest to smallest, they are:

- **Planning Area** – The 31,034-acre LSVMP planning area.
- **Project Area** – The area in which project analysis occurs for proposed specific activities, including actions associated with designated treatment units as well as other connected actions outside of those units such as helicopter landing construction, rock pit development, log haul, and sale area improvement projects.
- **Activity Area** – The 4,484 acre area of direct ground impacting activity, consisting of the smaller, forest stand-scale units delineated in the proposed action, either individually or collectively. Also included are the proposed 18.7 miles of temporary road development, and 7 one acre helicopter landings. The analysis areas for soil resources for direct, indirect and cumulative effects are the outer boundaries of the stands (units) proposed for thinning. These are appropriate boundaries because actions not related to rock pits, temporary road development and landings outside the unit boundaries would have little or

no effect on soil productivity within the units, and actions within the unit boundaries would have little or no effect on soil productivity elsewhere.

Affected Environment

Geology

The bedrock geology of the planning area is almost entirely comprised of interbedded tholeiitic basalt flows and mudflow breccias (Tcbb) of the Crescent Formation (Tabor and Cady 1978). The basaltic lavas and breccias are hard to moderately hard, dark gray to black, coarse to fine textured and highly fractured. These rocks are moderately weathered along fracture surfaces and exposed outcrops. During the Pleistocene era, continental glaciation originating in British Columbia advanced southward and deposited till and outwash clay, silt, sand, gravels and boulders (Qc) within the valleys and lowland areas of the project area. Localized alluvium (Qa) is also expressed within floodplains and terraces directly associated with the South Fork Skokomish river.

Landforms

The combination of geology, glaciation, and natural weathering processes has created a topography ranging from steep, rugged mountain slopes on the western border of the project area, glaciated mountains and valleys within the central extent, and glacial outwash plains in the eastern part of the project area. Landforms are characterized by broad, basin-like glacial cirques at the very headwaters with steep downcut U-shaped valley sidewalls with a thick veneer of glacial till and drift dominating areas of lowest relief as you move eastward. Landforms were mapped as part of the ONF Ecological Unit Inventory (USDA Forest Service 2000). Below are descriptions of each of the landforms found within the project area.

- **Mountain slopes (D)** are moderately steep to steep, complex slopes up to 2500 feet in relief. Slopes range from 45 to greater than 60 percent. Drainage patterns are somewhat broad. Slopes are relatively smooth, with slope breaks or benches. Drainage spacings are from 1000 to 2500 feet and are first and second order. Sediment delivery efficiency of steep slopes is moderated by potential sediment storage on convex and complex slopes. Efficiency is rated moderately high, as once sediment enters first order streams it can be delivered efficiently to major order streams.
- **Glacial valleys (N)** have a parabolic or "U" shaped cross section, steep walls and generally a broad and flat floor. Formed by glacial erosion, a U-shaped valley results when a glacier widens and over steepens a V-shaped stream valley. Sediment delivery will increase with increase of slope. Stream densities are often high with substratum materials composed of glacial till with some inclusions of outwash and debris from adjacent valley walls. Glacial till often has a compacted layer which perches water, causing springs and overland flow when surface layers are compacted. Slope instability is common upon removing vegetation at slope breaks and near drainageways.
- **Ground moraines (M)** are gently rolling, undulating, or bench-like slopes that occupy the valley floor and sideslopes. Slope gradients are from 2 to 30 percent. Topography varies from knoll and pothole topography to nearly flat plains, to moderately steep "plastered" till on sideslopes. Stream patterns are irregular except on sideslopes where they are recessive. The substratum has a compacted layer that perches water tables and

can create zones of instability when dissected by a stream. Till is inherently high in silt which is highly transportable by erosion.

- **Glacial outwash plain (L)** is a plain formed of glacial sediments deposited by meltwater outwash at the terminus of a glacier. Material in the outwash plains is often size-sorted by associated water runoff of the melting glacier with the finest materials being the most distantly re-deposited, whereas larger boulders are the closest to the original terminus of the glacier. Can contain surficial braided stream complexes.

Soils

Soils within the Lower Skokomish Vegetation Management activity area have been divided into two general categories, based on geology, landform, slope, and proposed management activities: glacial valley and moraine/drift soils; and mountain slope soils (described below). Additional information can be found in the ONF Area, Washington (WA632) soil survey and the ONF EUI**.** Soil interpretations were evaluated for potential impacts associated with timber harvesting, temporary road construction, and slope stability.

Glacial valley and moraine/drift soils

Landscapes of the broad, U-shaped valleys and lowlands have been extensively altered by ice and water erosion consequent to continental glaciation that occurred during the Pleistocene epoch. The glacial deposits consist primarily of till, along with outwash and lacustrine sediments. The majority of the soil types found within this grouping are highly susceptible to compaction and displacement resulting from ground disturbing management activities. The surface soils generally have silt loam to sandy loam textures with low rock fragment contents, which result in low resistance (bearing strength) to heavy equipment. In the absence of disturbance, water will percolate freely through the surface soils but may be restricted by a compact till layer located in the subsoil. Depth to compact till layer varies, therefore the seasonal water table generally ranges from 2 to 5 feet in most glacial valley soil types during the months of November through April. Water perching above the compacted till layer in the subsoil, along with andic soil properties that retain large amounts of moisture, further reduce bearing strength. When heavy equipment is operated on these landforms, especially during winter months when soil moisture is high and a water table may be present, surface soil materials are easily displaced/removed or mixed with subsoil, resulting in deep rutting, puddling, and compaction. Alteration of soil structure, reduction of macropore space, and loss of organic matter and organisms may reduce overall soil productivity and impair hydrologic function.

Table Soil-1. Mapped Glacial Valley Soil Types and their sensitivity to Ground-Based Harvest.			
Map Unit Symbol	Map Unit Name	Sensitive to Ground base?	Rationale
505N7	Fircreek vgrsl, 5 to 30 percent north slopes	Potentially	Low Bearing Strength at Saturation
536M7	Nedhill-Fircreek complex, 5 to 30 percent slopes	Yes	Water table
537M7	Nedhill vgrsl, 5 to 30 percent slopes	Yes	Water Table
538M7	Nedhill vgrsl, 30 to 60 percent slopes	Yes	Water Table/Slope
563L8	Duskpoint vgrl, 2 to 15 percent slopes	No	N/A
661L7	Bogachiel-Ishmael complex, 1 to 5 percent slopes	Potentially	Low Bearing Strength at Saturation

Mountain slope soils

Mountain slope soils are grouped by both ridgetop and midslope/toeslope positions. Both soil types formed in basaltic residuum and colluvium, with bedrock structure that is steeply upturned and deeply weathered. Ridgetop soils are shallow to moderately deep and formed from basalt residuum. These soils are generally well drained and medium textured. Midlsope/toeslope soils are moderately deep to very deep and formed from basalt colluvium. Both soil types tend to have high gravel content within the upper profile which conveys some protection against puddling and rutting. The degree of stream dissection varies throughout the mountain soils, from broad, nearly straight to slightly concave slopes, to highly dissected mountain headwalls.

Overall soil productivity is high. Dissected sideslopes, headwalls, and escarpments with sustained slopes of over 70 percent show the most potential for slope instability. Slope instability caused through thinning treatments (cable and helicopter yarding) is of secondary concern compared to new temporary road construction, due to cut and fillslope stability, stream crossing locations, and road drainage issues.

Table Soil-2. Mapped soil types within the mountain slope landform.	
Map Unit Symbol	**Map Unit Name**
400D8	Lenacreek-Valletta complex, 60 to 90 percent south slopes
401D8	Lenacreek-Dosewallips-Valletta complex, 60 to 90 percent south slopes
416D8	Fricaba-Waketickeh-Duckabush complex, 60 to 90 percent south slopes
423D7	Sawpeak-Walkinshaw-McGravey complex, 60 to 90 percent north slopes
425D7	Sawpeak-McGravey complex, 60 to 90 percent north slopes
538M7	Nedhill vgrsl, 30 to 60 percent slopes

Unsuitable and Unmanageable Lands

All of the proposed harvest units within the Lower Skokomish Vegetation Management activity area are considered suitable for timber management as defined by the Forest Plan. Areas unsuitable for timber management would include areas with high slope instability, wetlands, and soils that are excessively shallow, rocky and very low productivity. There are however, small areas within several harvest units where acreage has been identified as having very shallow soils, rock outcroppings, or wet areas that were too small to delineate. These unsuitable areas would be excluded from harvest with PDC (primarily no-cut buffers), and are described in Chapter 2, Table 2-4. These would be identified and omitted during the timber unit layout process, or included as skips.

Landforms where very shallow soils were identified and mapped in the EUI as inclusions or minor component of the soil map units include mountain headwalls (K), mountain slopes (D), and escarpments (X). Soil map units with shallow inclusions and proposed harvest units where these units are mapped are presented in Table Soil-3 below.

Table Soil-3. Landforms with shallow inclusions by proposed harvest unit.

SMU	Description	Proposed Harvest Units
400D8	Lenacreek-Valletta complex, 60 to 90 percent south slopes	D1A-15, D1A-16, D1A-25, D1A-27, D1A-31, D1A-35, D1A-46, D1A-48, D1A-49, D9, D12, D21A, D21-04, D21-05, D21-11
401D8	Fricaba-Waketickeh-Duckabush complex, 60 to 90 percent south slopes	D22, D22A, D25,D29B, D29C, D29E, R7, R8, R23,V1, V4, V5, V8, V33
416D8	Snahopish-Solleks-Bunch complex, 60-100% south slopes	R5, R6, R9, R12, R18, V14, V22, V26
423D7	Sawpeak-Walkinshaw-McGravey complex, 60 to 90 percent north slopes	D15, D20, D30, S2, V8, V22, V26, V33
425D7	Sawpeak-McGravey complex, 60 to 90 percent north slopes	D21-11, D21-05, D12A, D24A, D22, D25,V14

Slope Stability

Road construction and timber harvest can potentially increase the rate of mass failures as well as the size and number of these events. Poorly located, poorly constructed, or poorly maintained roads can result in slope failures, sedimentation, and other soil resource damage. Soil stability factors not related to management activities include soil type, slope steepness, geology (rock composition and slope shape), and earthquakes.

Within the Project area, unstable terrains are primarily concentrated on escarpments and inner gorges (ONF EUI). Mapped historic failures were primarily shallow rapid landslides (debris slides, debris flows), and are associated with both natural and management related sources. Triggers of these landslides are generally: slopes greater than 70 percent, shallow soils, degree of stream dissection, and concave shape, with numerous seeps, springs, and headwater streams. Loss of root strength due to historical clearcutting and broadcast burning in these terrains combined with poorly located roads are primarily where management-related shallow landslides have occurred. The complete removal of all trees within a unit (historic clearcutting) has a

higher potential to increase slope instability than the current management practice of commercial thinning from below. Areas that remained stable after the original regeneration harvest would continue to stabilize after thinning. Thinning promotes tree growth of the residual trees, as crowns increase in size, root systems expand, and evapotranspiration rates increase. These factors all promote greater slope stability. Thinning should emphasize the retention of a well-distributed stand of larger trees, both conifers and hardwoods. These larger trees also provide the opportunity to better withstand the assaults of windstorms and floods over time.

The boundaries on several proposed thinning units were modified to exclude thinning those areas that were judged to be unstable or potentially unstable by the soil scientist using a combination of GIS review and field validation. Additional unstable or potentially unstable areas may be discovered during unit layout. If so, the Soil Scientist would consult with layout personnel to ensure these areas where excluded as per PDC Soil-01 in Chapter 2, Table 2-4 of this document**.**

Table Soil-4 below identifies potential unstable landforms and lists thinning units that will need landform buffering to minimize soil instability due to harvest treatments.

Table Soil-4. Harvest units within or adjacent to potentially unstable landforms under the proposed action, Alternative B.

Landform	Unit
Escarpments (X)	Cable: D9,D10,D10A,D10B,D15,D23,D29,D30,V1,V4,V5 Ground: D10C, D23, D29,D30
Inner gorges (J)	Cable: D29 Ground: D2-06, D3C, D7, D29

Table Soil-5 below identifies potential unstable landforms and lists road sections that will require minimized sidecast and strict adherence to road building PDCs listed in Chapter 2, Table 2-4.

Table Soil-5. Temporary road development located within or near potentially unstable landforms associated with proposed treatment units, Alternative B.

Landform	Route Number *(miles)*
Escarpments (X)	D2-1*(0.26)*, D3-4*(0.23)*,D9-3*(0.20)*, D9-4*(0.07)*
Inner Gorges (J)	D2-1*(0.26)*, D3-4*(0.23)*, D29-1*(0.46)*

Environmental Consequences

Alternative A – No Action

Under the No Action Alternative, no commercial thinning treatments or associated project activities would take place. This includes all new temporary road construction or reconstruction, fuels treatments, and potential road decommissioning. Alternative A serves as a baseline of the existing condition for comparison with the proposed action.

Direct Effects and Indirect Effects

Detrimental Soil Conditions

Effects of Ground Based Yarding Operations

Under Alternative A (No Action), soils within the activity areas would have no additional ground based activities or ground disturbing impacts that would result in a change in the current condition of detrimental soil conditions.

Overall Detrimental Soil Conditions

The No Action Alternative creates no adverse effects on the soil resources within the project area. Detrimental soil conditions would remain unchanged, averaging 5 percent. Approximately 245 acres (5 percent) of the proposed treatment area would remain in a detrimental soil condition class of greater than 20 percent. Another 1,011 acres (24 percent) of the proposed treatment area would remain in a detrimental condition class ranging from 15 to 20 percent, while 2,766 acres (65 percent) would remain in a detrimental condition class ranging from 10 to 15 percent.

Existing compacted skid trails, landings and unclassified temporary roads that are present from the previous entry within the activity areas would not be used or restored, and would remain in a long-term detrimental condition as an irretrievable commitment. Opportunities to alleviate detrimental soil compaction on existing landings and skid trails designated for reuse would not be implemented. Soil structure on impacted soils would likely continue to recover slowly in the upper 2 to 4 in, while deeper soil layers would likely remain compacted for many more decades. Some vegetation root penetration and mixing by soil organisms will occur, but these are generally slow processes. At higher elevation sites, freeze-thaw action might ameliorate some near-surface compaction, though this effect is diminished at depth. Some of the existing compacted soils on existing temporary roads, landings and some isolated skid trails are likely to persist for the long-term, since current detrimental impacts are 40 to greater than 70 years old. Detrimental soil conditions would essentially stay the same as described under the current conditions in the Affected Environment section.

The opportunity to improve soil quality by treating selected stands, including young plantations established in the 1960s and 1970s, would not be available. Without thinning, growth rates and soil productivity in the plantations would decline as competition for nutrients, light and growing space increased. The ability to enhance growth and soil productivity through active management could be lost. Inherent soil productivity could be overutilized and long-term carrying capacity exceeded. Soil function would be committed toward supporting a stagnant stand condition at risk of loss or reversion to poor forest health, rather than the development into a vigorous, structurally-complex stand.

Slope Stability

Under the No Action Alternative, there would be no change to the landslide risk within the Project Area, since no thinning activities and associated road building would occur in the identified stands. Existing landform stability provided by the root systems of the existing stands would remain intact and existing shallow landslide scars within the project area would slowly heal as vegetation becomes denser over time. The extent of landform instability (both rapid and deep seated landsliding) would likely continue when triggered by intense rainstorm events.

An indirect effect of this alternative is that no new temporary road development, specified road construction, or reconstruction of NFS roads would occur, so there would be no increased landslide risk from additional road development. Within the project area (activity areas and haul

routes), there would be no change in current maintenance of NFS roads. However, structural and drainage improvements to haul routes that would reduce the risk of landsliding would also be foregone. Culverts, cross drains, and general road conditions would continue to deteriorate due to declining road maintenance budgets and time. Intense rainstorms common to the area would continue, resulting in culvert washouts, diversions and mass wasting. It is likely that future landsliding on existing NFS roads and unclassified abandoned roads located on or near unstable landforms would continue, resulting in pulses of sedimentation and negatively affecting aquatic habitat conditions.

Sedimentation

Under the No Action Alternative, there would be no direct effects of sedimentation to aquatic habitats, since no roads would be used in association with logging activities in proposed stands. This alternative would not change water quality within the subwatersheds affected by the activity area. The present sediment recruitment rates into stream channels would continue. Current amounts of bedload and suspended sediment routed down river to channels associated with existing conditions and previous activities (timber harvest, road construction) would remain unchanged. There would be no additional direct effects of sedimentation to aquatic habitats, since no roads would be developed or used for timber haul, and no logging activities would occur in proposed units.

Indirect effects of the No Action Alternative would be that project associated road repairs and maintenance, upgrading, or decommissioning that targets sediment reduction would not be implemented. Deteriorating road conditions, especially on closed and abandoned roads, would continue. Road maintenance would still occur to the extent necessary to protect public safety and to address or mitigate potential resource damage. Sedimentation would continue to be generated primarily from under-maintained open NFS roads and drainage structure failures on unclassified, abandoned roads. The amount of sediment that would reach stream courses would likely remain at current levels.

Cumulative Effects

The affected area for cumulative soil effects under the No Action alternative includes the Lower Skokomish Vegetation Management planning area boundary. The watershed analyses referenced earlier identified and described the negative effects of erosion, sedimentation, loss of soil productivity, and impacts to aquatic habitat conditions from past timber harvesting and road development. The planning area is currently recovering from these past effects. Since 1994, the Forest Service has focused some restoration efforts on protecting and improving the watershed conditions by reducing road-related sedimentation through decommissioning and upgrading.

The analysis of detrimental soil condition cumulative effects considered the total area proposed for treatment within each alternative. The effects of the current project area and the effect of past, present, and reasonably foreseeable future projects were considered in the analysis and portray the extent and duration of detrimental soil conditions cumulative effects. For past projects, the detrimental soil analysis includes effects from railroad logging, tractor logging, high-lead cable and skyline cable yarding, current roads and landings, and broadcast burning within project activity areas. Forest roads have caused extensive erosion and landsliding, as described in the watershed analysis. Over the past decade, numerous miles of forest roads within

the planning area have been decommissioned, repaired, maintained and upgraded. Foreseeable activities include additional road repairs, upgrading and maintenance of the forest road network. Because impacts of the No Action alternative would be minor and due to the discountable effects of overlap of past, present and future actions within the watershed no cumulative impacts are anticipated in the Lower Skokomish watersheds associated with this alternative.

For Alternative A, it is estimated that approximately 5 percent of the total project treatment area is affected by detrimental soil conditions from the cumulative effects of past management activities.

Alternative B – Proposed Action

The Proposed Action, Alternative B is described in detail in Chapter 2 of this document. Under Alternative B, approximately 4,484 acres are proposed for commercial thinning treatments. Proposed logging systems include ground-based yarding (1,604 acres), skyline yarding (2,253 acres), and helicopter yarding (379 acres). An additional 246 acres have been designated as Skips, which would receive no thinning treatment.

Temporary, specified road development and helicopter landings

The Proposed Action includes a total of 18.7 miles of road development. Approximately 5.2 miles of new temporary roads would be constructed with an additional reconstruction of 13.5 miles of existing unclassified or decommissioned roads (See Table 2-3 and Appendix B). Alternative B includes up to 7 proposed helicopter landings to accommodate the units proposed for helicopter yarding. To allow for safe operations within the landing, each helicopter landing would require a clearing of roughly one acre. After thinning is complete, all newly constructed and reconstructed roads (excluding those designated specified roads put into storage for future entries) and landings would be decommissioned/rehabilitated, scarified and revegetated.

Direct and Indirect Effects

Detrimental Soil Conditions

Effects of ground Based Yarding Operations

Implementation of Alternative B would result in a net increase of both areal extent and degree of detrimental soil condition compared to Alternative A (No Action) within the project area. This increase is largely associated with ground-based yarding operations and units restricted to winter operations only, due to wildlife disturbance concerns (Section 2.4.4, Table 2-5).

Alternative B has 1,604 acres of harvest units designated for ground based yarding. Of this total, 70 acres of the ground-based units occur on potentially-sensitive soil types that would be harvested during winter. Units of primary concern include the following: D3C, D29, V4 and V5. Alternative B includes PDCs (see Chapter 2, Table 2-4) intended to limit the severity and extent of operational soil impacts during winter harvest.

The feasibility of Alternative B to conduct ground-based yarding with conventional equipment on sensitive soils during the wet winter season and meet the PDCs for soil productivity will rely heavily on operator ability and communication between the operators and the timber sale administrator. The ability of the operator to create and maintain adequate slash mats on skid

trails, minimize off-trail travel, and make effective movements that minimize disturbance will be crucial. This alternative would likely require different felling methods or a different felling sequence than have been used on most recent commercial thinning sales. Operating on sensitive soils in the winter period would also likely require additional attention to skid trail design and layout. This alternative would require the most oversight and monitoring by timber sale administrators. This alternative would also have the highest potential to require operational shutdowns during wet weather periods or require a change to different logging equipment and/or techniques to meet the PDCs.

Under Alternative B, ground-based yarding would create new Class 2 or low level Class 3 soil disturbance over most of the existing primary and secondary skid trails. The likely extent of these detrimental impacts is about 217 acres (assuming an average of 15 percent of the activity area is impacted by skid trails, landings and the permanent transportation system, and 90 percent of that area consists of this lower-level disturbance). Approximately 9 acres of impacts are likely to occur in units with sensitive soils to be harvested during winter months. Typical soil disturbance impacts on skid trails would be characterized by the one or more of the following: compacted duff and soil organic matter, removal or compaction of forest floor layers, wheel tracks or depressions that are evident in the mineral soil, compacted mineral soil down to more than12 in, change in soil structure from granular to platy, reduced macropore space and shifts in pore distribution, partial mixing of surface soil with subsoil. These impacts would likely be most severe on the primary skid trails that are subjected to numerous passes due to long yarding distances, especially during winter operations. Typical adverse soil effects resulting from these impacts may include: reduced infiltration and percolation through the upper soil profile (leading to increased runoff), reduced air exchange, degraded habitat for soil macro- and microfauna, reduced nutrient availability, altered nutrient cycles, and reduced resilience to future impacts. There may also be changes in vegetation composition and structure on these sites in response to these impacts. Some of these effects may be relatively short-term, though soil conditions and soil productivity throughout most of the skidding network may take decades to recover to near pre-existing conditions. The extent and depth of slash mats that would be needed on most skid trails to meet soil productivity PDCs on sensitive soils would likely impact soil nutrient cycling and inhibit reestablishment of vegetation if not decompacted after use.

High-level Class 3 soil disturbance such as rutting greater than 12 in, creating areas of standing water, deep puddling, severe compaction, or total removal of the topsoil layer would occur in some skid trail areas, but this degree of impact would be rare and would be limited to small, isolated areas. These locations would mostly be concentrated near landings on primary trails that are subject to a large number of equipment passes, on sloping terrain (15-30 percent), and concave depressions and swales. This level of soil impact could also occur along skid trail areas where inadequate slash was placed. The extent of these Class 3 detrimental impacts is about 25 acres (10 percent of total skid trails), of which less than 1 acre of impacts are likely to occur on skid trails in units with sensitive soils to be harvested during winter months. Typical soil disturbance impacts in these highly disturbed areas would be characterized by: highly-evident wheel tracks and depressions into mineral soil; missing forest floor duff layers; mixing and displacement of surface soil; displacement of the majority of the topsoil and exposure subsoil; change in soil structure from granular to massive or platy at depths greater than 12 in. Typical adverse soil effects where these rare high level Class 3 detrimental soil impacts occur would be

greatly reduced infiltration and percolation through the upper soil profile (leading to increased runoff), reduced air exchange, shifts to wetter moisture regimes (potential development of aquic conditions), large changes in soil temperature regimes/heat fluxes, degraded habitat for soil macro- and microfauna, reduced nutrient availability, severely altered nutrient cycles, and reduced resilience to future impacts. Vegetation recovery would be halted in the near term and there would be a substantial long-term reduction in overall soil productivity in these areas. Recent monitoring on similar soils types under similar topographic and climactic conditions has demonstrated long-term changes in soil structure, soil moisture, and vegetation composition/structure along highly disturbed skid trails. Soil conditions and soil productivity within the rare, heavily impacted portions of the skid trails would not be expected to recover for decades or even centuries. Heavily impacted portions of skid trails would be rehabilitated by minor ripping and filling in the deeper ruts, scarifying the skid trail, and adding slash and coarse wood. These MMs are considered moderately beneficial but would have limited effects if they were implemented during wet soil conditions. The skid trail MMs would not be sufficient to correct detrimental soil conditions, but would put the sites on a trajectory toward accelerated recovery. Because the areas of high-level Class 3 soil disturbance would be rare and isolated, there would be no long-term adverse impacts to soil productivity at the harvest unit scale.

The majority of detrimental impacts that would be expected as a result of the proposed activities would overlap the impact footprint from previous harvest entries, which is currently in a detrimental soil condition. Careful planning and reuse of skid trails and landings (where other resource concerns do not prevent this) will greatly aid the containment of additional impacts.

Overall Detrimental Soil Conditions

Under Alternative B, there are 12 ground based treatment units (203 acres or 4.5 percent of the total proposed treatment acreage) that are already in the greater than 20 percent detrimental soil condition class. Another 15 ground based units (328 acres, or 7.3 percent of the total proposed treatment acreage) currently fall within the 15to 20 percent detrimental soil condition class and will likely exceed 20 percent DSC following the proposed thinning treatments and associated activities. Ground based units of concern include: D2-02, D2-03, D2-04, D2-05, D2-06, D3A-01, D3A-02, D3A-03, D3B-02, D3B-04, D3B-05, and D3C (all currently in greater than 20 percent DSC class); and 9, 11, 33, 35, 36, 37, D1A-04, D1A-08, D1A-14, D1A-18, D1A-19, D1A-20, D1A-21, D1A-22, D1A-40, D1A-42, D1B-01, and D1B-04 (all currently in 15-20 percent DSC class and expected to exceed 20 percent DSC post-activity). These units are on glacial valley LTAs on gentler slopes, and have high levels of existing impacts from NFS roads that border the units, unclassified roads, and historic compacted skid trails and landings.

The remaining 48 ground based units (1,073 acres or 23.9 percent of the total proposed treatment acreage) fall within the 10-15 percent DSC class and are not expected to exceed the 20 percent threshold after treatment. Careful planning of the skidding network, adherence to PDCs, oversight by the timber sale administrator, caution and skill on the part of the operator, and appropriate MMs will be required to contain and treat impacts in order to meet the Regional soil quality standards for the ground based harvest areas. Table Soil-6 below summarizes post treatment existing detrimental soil condition classes for all proposed harvest units and logging systems under Alternative B in the LSVMP area. For all other logging systems (other than

ground based), an additional 2 units (40 acres, or greater than 1percent of the proposed treatment acreage) fall within the greater than 20 percent DSC class while an additional 50 units (683 acres, or 15.2 percent of the proposed treatment acreage) falls within the 15-20 percent DSC class. The remaining 40 treatment units (1,908 acres, or 42.5 percent of the proposed treatment acreage) would remain in the 0 to 10 or 10 to15 percent detrimental condition classes. Because these logging systems have a much lower ground-disturbing potential and will use existing landings and yarding corridors, it is not expected that detrimental soil conditions will increase as a result of harvest and yarding activities.

Table Soil-6. Alternative B - Acres in DSC class by proposed logging system.

	DSC Class				
Logging System	**5-10%**	**10-15%**	**15-20%**	**>20%**	**Totals**
G	0 ac (0%)	1,073 ac (66.8%)	328 ac (20.4%)	203 ac (12.6%)	1,604 ac (35.73%)
C	215 ac (10.3%)	1,379 ac (64.3%)	502 ac (24.1%)	25 ac (1%)	2,082 ac (46.4%)
DC	0 ac (0%)	0 ac (0%)	155 ac (90.1%)	17 ac (9.9%)	172 ac (3.8%)
H	0 ac (<0.1%)	353 ac (93.1%)	26 ac (6.7%)	0 ac (0.1%)	379 ac (8.4%)
SKIPS	247 ac (3.3%)				247 ac (5.5%)
Totals	**215ac (5.0%)**	**2,766 ac (65.2%)**	**1,011 (23.8%)**	**245 ac (5.7%)**	**4,484 ac (100%)**

Under Alternative B, ground based systems would utilize most of the existing impacted skid trails, and those trails would then rehabilitated. Ground based yarding would use existing skid trails and landings where feasible, but would create new soil detrimental condition in the form of up to 5 percent new skid trails and 2 percent new landings within each ground based harvest unit. Skyline cable yarding would be a minor impact (change of 1.8 percent) (Allen et al. 1999), with detrimental soil conditions occurring primarily at landings and cable yarding corridors. Helicopter yarding is also anticipated to result in low amounts of detrimental soil conditions (change of +0.5 percent) with most of the impact being associated with the landings. Fuel treatments (primarily lop and scatter branches and unmerchantable tops, and occasional small slash pile burns along NFS roads) are considered negligible, as they would not change the detrimental soil conditions as the methods proposed are not likely to detrimentally compact or displace soils.

This alternative would result in an estimated overall average of 14 percent of the activity areas being in a detrimental soil condition, an increase of approximately 9 percent compared with Alternative A – No Action. This 9 percent increase accounts for ground based units within the 15 -20 percent DSC that can be expected to cross into greater than 20 percent DSC after project completion, and both new cable/helicopter landings and corridors (2 percent). Some units already exceed the 20 percent allowable threshold for DSC, and some will cross that threshold as a result of the proposed activities. Those units currently in the 15 to 20 percent and greater than 20 percent DSC classes will require more oversight and emphasis on containment of impacts

(prevention) and strict adherence to PDCs (mitigation). Some units may require active rehabilitation to bring levels below 20 percent or to prevent a net increase in DSC percentage (for those units already exceeding 20 percent). All new and existing unclassified temporary roads (excluding the miles of existing unclassified to be reconstructed as specified), Class 3 skid trails, and landings used would be rehabilitated by ripping the compacted and disturbed soils to a depth of 14 in, and have vegetation and erosion control treatments applied to them. These treatments are meant to set a trajectory toward recovery by beginning to restore soil structure, increasing root penetration and soil organism activity, improving hydrologic function, and reducing erosion and runoff, but are not expected to return the soil to its original condition and productivity for many decades. However, other compacted temporary roads, landings, and skid trails not used for the project within activity areas under Alternative B would remain in a compacted and displaced irretrievable condition. These may be treated as part of sale area improvement following implementation if funds are available.

New detrimental soil conditions associated with skyline cable and helicopter yarding systems would be minimal due to one-end or full suspension of logs that would result in minor short term displacement. Application of the several soil PDCs (Table 2-5), BMPs, and other rehabilitation mitigations would also help to minimize these soil disturbance impacts.

Soil Stability

Alternative A will harvest about 655 acres and develop 1.96 miles of temporary roads that are located within or near potentially unstable landforms of concern. Refer to Appendix B for specific harvest units and road development located within or adjacent to these features. Logging systems associated with harvest vary, but are primarily skyline cable and helicopter systems in these terrains.

Riparian no-cut buffer distances for potentially unstable landforms incorporated as PDCs under Alternative A provide a minimum 50-foot stream buffer exclusion for tree removal and equipment operation (non-fish-bearing streams) with 100- to 200-foot buffers required on certain fish-bearing streams.

All of the proposed thinning units under Alternative A were primarily clearcut harvested between 44 and 78 years ago. No considerations were made to protect potentially unstable areas located within riparian zones and other potentially unstable landforms. Cable and tractor logging equipment traveled on steeper slopes, dragging logs and causing substantial amount soil damage. Road construction techniques and logging practices did not meet the standards that they do today. Therefore, the level of stability of all proposed thinning stands have been "tested" by past activities that were considerably more impactful than the current proposal. Areas that remained stable after the original clearcut harvest would likely continue to be stable after the proposed thinning.

Thinning of the proposed units, road development, and associated activities are not expected to contribute to any new landslides within or adjacent to the activity areas. There is a potential for increased blowdown within potentially unstable landforms as a result of thinning activities, thereby reducing root strength and increasing potential for erosion and sedimentation that could lead to increased landslide risk. Road development may also result in landslide risk if water is concentrated and redirected onto unstable slopes. During the layout process, a Forest Service

soil scientist will assess on the ground proposed activities (timber harvest, road development) that are located within or near these potentially unstable landforms. Unstable areas identified during layout would be evaluated and determined whether additional "skips" or other exclusions are needed. Thinning would not have a serious effect on hillslope stability in the short term because the roots of the remaining trees already intermingle with those trees that would be cut, and new root growth would result before the roots of cut trees decay and lose their strength. Over the long term, the thinning would enhance tree growth and tree root development, restoring hillslope stability to original levels. Existing shallow landslide and small rotational failures within the activity area would be protected and would continue to slowly stabilize and revegetate.

Existing NFS roads that would be used for haul would be maintained, repaired, and improved as needed. These actions would reduce risk associated with the proposed action, as well as some of the risk of future resource damage from road-related landsliding.

Sedimentation

While limited overall effects on ground cover would occur, modification of natural processes such as surface erosion and nutrient cycling would be the highest under this alternative. Under Alternative A, all thinning units would have some temporary reductions in effective ground cover, but the remaining ground cover would be sufficient to minimize erosion. Ground disturbing activities associated with timber harvest and road development have been designed to maintain effective ground cover and to minimize the risk of erosion and the potential for sediment to be transported to streams. These concerns are primarily addressed through riparian no-cut buffers, road drainage improvements, and road development restrictions that provide adequate vegetation with effective ground cover/tree canopy between streamcourses and areas where activities would occur. Project design criteria and BMPs that confine road development and ground based yarding activities to the dry season, restrict activities during wet weather, and/or implement erosion control plans will reduce the potential for erosion and sedimentation. All new temporary roads, unclassified roads used as temporary roads, and primary skid trails would be decompacted and have slash and mulch placed on them following completion of harvest operations to reduce compaction, increase infiltration rates, and provide for effective ground cover to reduce surface erosion. Implementation of the erosion and sediment control management practices described in this report and in Chapter 2 of the Environmental Assessment, as well as the numerous standard timber sale contract clauses that address erosion, should minimize sedimentation from these activities. These effects are considered minor and short in duration.

Cumulative Effects

The affected area for cumulative soil effects under Alternative B includes the Lower Skokomish Vegetation Management activity area and the three subwatersheds that are partially covered by the planning area. The positive and negative effects include a combination of management actions that occur on private, tribal, State, and National Forest lands, along with natural occurrences. The major impacts to soil and water resources across all watersheds from past actions have come from timber harvest, broadcast burning, and road development.

The watershed analyses covering the area identified and described the negative effects of erosion, sedimentation, loss of soil productivity, and impacts to aquatic habitat conditions from

past timber harvesting and roading. The planning area is currently recovering from these past effects. Since 1994, the Forest Service has focused some restoration efforts on protecting and improving the watershed conditions by reducing road-related sedimentation through decommissioning and upgrading.

The analysis of detrimental soil condition cumulative effects considered the total area proposed for treatment in each alternative. The effects of the current project and the effects of past, present, and reasonably foreseeable future projects were considered in the analysis and portray the extent and duration of detrimental soil conditions cumulative effects. For past projects, the detrimental soil analysis includes effects from railroad logging, tractor logging, high-lead cable and skyline cable yarding, construction and use of roads and landings, and broadcast burning within project activity areas. Forest roads have caused extensive erosion and numerous landslides, as described in the watershed analyses. Over the past decade, many miles of forest roads within the planning area have been decommissioned, repaired, maintained and upgraded. The current proposal would result in more miles of road being maintained and upgraded, thereby reducing risk to aquatic resources. Foreseeable future activities include additional road repairs, road upgrades, and maintenance of the NFS road network and those activities listed at the beginning of Chapter 3 as considered for Cumulative Effects. Some stands within the planning area would likely be entered again in the future to achieve long-term restoration objectives. Existing roads, landings and skidding networks would be used for future treatments, and additional impacts to soil quality and increases in detrimental soil condition would be expected to be negligible.

Because of these minor impacts and the discountable overlap of effects of past, present and future actions within the watersheds, negligible cumulative impacts are anticipated for the LSVMP planning area under Alternative B.

3.3 Fisheries and Water Quality

Affected Environment

The LSVMP planning area falls within the South Fork Skokomish River and Skokomish River – Frontal Hood Canal watersheds (5th field HUC). These watersheds are on the east-side of the Olympic Peninsula and drain into the Hood Canal. All of the proposed sale area units and timber haul routes are within the Lower South Fork Skokomish River, Lower North Fork Skokomish River and Middle North Fork Skokomish River subwatersheds (6th field HUC); subwatersheds are further divided into drainages (7th field HUC). The following 9 drainages comprise the planning area: Lower South Fork Skokomish River, Flat Creek, Fir Creek, Vance Creek, Lower North Fork Skokomish River, McTaggert Creek, Frigid Creek, Lake Cushman Frontal, and Big Creek. Primary streams (which include the tributaries that flow into them) that have the potential to be affected are the South Fork Skokomish River, Harp Creek, Rock Creek, Flat Creek, Dalby Creek, Vincent Creek, Fir Creek, Vance Creek, Nicklund Creek and Cabin Creek. Tributaries to the North Fork Skokomish River that have the potential to be affected are McTaggert Creek, Gibbons Creek, and Frigid Creek.

Table Fisheries-1. Watersheds within the project area and proportion of acres proposed for treatment.			
Subwatershed Name (6th Field)	**Total Subwatershed Acres**	**Unit Acres**	**% Subwatershed Treated**
Lower South Fork Skokomish River	27,700	2,564	9.3%
Lower North Fork Skokomish River	15,753	1,629	10.3%
Middle North Fork Skokomish River	27,514	329	1.2%
Total	70,976	4,522	6.4%

Lower South Fork Skokomish River subwatershed

Potential affected reaches of the South Fork Skokomish River are approximately from River Mile (RM) 7.6 (downstream of High Steel Bridge) to 14.2 (confluence with Brown Creek). This is an anadromous reach– salmon and steelhead habitat. Other potential affected tributary reaches to the South Fork Skokomish are as follows: Harp Creek RM 0-1.4, Rock Creek RM 0-4.8, Flat Creek RM 0-0.7, Dalby Creek RM 0-1.1, Vincent Creek RM 0-1.8, Fir Creek RM 0-2.9, Vance Creek RM 0-10.5, Nicklund Creek RM 0-1.9 and Cabin Creek RM 0-1.7. Extents of anadromous habitat within the tributaries to the Lower South Fork Skokomish are as follows: Harp Creek RM 0.1, Rock Creek RM 0.5, Fir Creek RM 0.4, and Vance Creek RM 7.6.

Fish present in the planning area, within the Lower South Fork Skokomish are coho salmon (*Oncorhynchus kisutch*), steelhead (*O. mykiss*), bull trout (*Salvelinus confluentus*), sea-run cutthroat trout (O. *clarkia*), Pacific lamprey (*Entosphenus tridentate*) and sculpin (*Cottid* spp.). Above anadromous barrier resident rainbow (*O. mykiss*) and cutthroat trout (O. *clarkia*) are present.

Lower North Fork Skokomish River subwatershed

Potential affected streams would be McTaggert Creek RM 3.1-5.9, Gibbons Creek RM 0-2.4, and Frigid Creek RM 1.5-3.6. Extents of anadromous habitat within the tributaries to the Lower North Fork Skokomish are as follows: McTaggert Creek RM 5.5, Gibbons Creek RM 2.0, and Frigid Creek RM 1.5.

Fish present in the planning area, within the Lower North Fork Skokomish are coho salmon (*Oncorhynchus kisutch*), steelhead (*O. mykiss*), sea-run cutthroat trout (O. *clarkia*), Pacific lamprey (*Entosphenus tridentate*) and sculpin (cottid spp.). Above anadromous barrier resident rainbow (*O. mykiss*) and cutthroat trout (O. *clarkia*) are present.

Middle North Fork Skokomish River subwatershed

Potential affected streams would be unnamed tributaries to Lake Cushman RM 0-2.0 and Big Creek. Potential fish present in the planning area, within the Middle North Fork Skokomish are River lamprey (*Lampetra ayresii*), rainbow trout (*O. mykiss*) and cutthroat trout (*O. clarkia*) and sculpin (*Cottid* spp.). See Table Fisheries-2 for fish present in the Lower South Fork Skokomish River, Lower North Fork Skokomish River and Middle North Fork Skokomish River subwatersheds, their stock status, and their potential presence within the project area.

Table Fisheries-2. Fish presence in potentially affected watersheds.

Species and status information				**Potential presence in watershed** (X = species does or may occur within the named watershed)			
Fish Species	**ESU**	**Status***	**Sensitive Species**	**Within Project Area**	**Lower South Fork Skokomish River**	**Lower North Fork Skokomish River**	**Middle North Fork Skokomish River**
Chinook salmon	Puget Sound	Threatened[1]	No	No	X	X	X
Summer chum salmon	Hood Canal summer-run	Threatened[2]	No	No	Extirpated	Extirpated	
Coho salmon	Puget Sound/Strait of Georgia	Healthy[3] (Skokomish stock)	No	Yes	X	X	
Steelhead trout	Puget Sound	Threatened[4]	No	Yes	X	X	
Cutthroat trout	Puget Sound	Unknown[5]	No	Yes	X	X	X
Bull trout	Coastal Puget Sound	Threatened[6]	No	Yes	X	X	X
Lamprey	Not Applicable	Unknown	Yes	Yes	X	X	X
Sculpin	Not Applicable	Unknown	No	Yes	X	X	X

** Sources for status information:*

1 *NMFS 1999a*
2 *NMFS 1999b*
3 *WDFW Salmonid Stock Inventory (SaSI) 2002*
4 *NMFS 2007*
5 *WDFW SaSI 2000*
6 *USFWS 1999*

Threatened Fish Species and Critical Habitat

Hood Canal summer chum salmon, Puget Sound Chinook salmon, and Puget Sound steelhead have been listed as threatened by the National Marine Fisheries Service (NMFS) under the Endangered Species Act and are present in the South Fork and North Fork Skokomish River watersheds. Critical Habitat for Hood Canal summer chum salmon and Puget Sound Chinook salmon have also been designated by NMFS. Coastal Puget Sound bull trout has been listed as threatened and critical habitat has been designated by the U.S Fish and Wildlife Service (USFWS).

Hood Canal summer chum salmon are considered to be recently extinct in the Skokomish basin (PNPTT & WDFW 2000). The historic upper extent of summer chum in the South Fork Skokomish would have been at approximately RM 6. Critical habitat for Hood Canal summer chum does not extend into the South Fork Skokomish River.

Puget Sound Chinook (summer/fall) extend up to approximately RM 6 in the SF Skokomish and do not pass beyond the gorge to the upper SF Skokomish River. Distance to the closest harvest unit in the planning are is about 1.9 miles. However critical habitat for Puget Sound Chinook in the SF Skokomish River extends up to RM 14.2 (confluence with Brown Creek).
Puget Sound steelhead are present in the Lower South Fork Skokomish and Lower North Fork Skokomish subwatersheds. In the South Fork Skokomish, steelhead are primarily in the mainstem up to RM 26.5 (anadromous barrier) and also within the anadromous reaches of the Lower SF Skokomish tributaries: Harp Creek, Rock Creek, Fir Creek, and Vance Creek. In the Lower North Fork Skokomish steelhead are found in McTaggert Creek, Gibbons Creek, and Frigid Creek. Critical habitat for Puget Sound steelhead has not yet been designated.
Coastal Puget Sound bull trout are present in the Lower South Fork Skokomish subwatershed primarily in the mainstem of the South Fork Skokomish River up to RM 26.5 (anadromous barrier) and also within the anadromous reaches of the Lower South Fork Skokomish tributaries: Harp Creek, Rock Creek, Fir Creek, and Vance Creek. Critical habitat for bull trout follows their distribution in the upper South Fork Skokomish River as described above.

Essential Fish Habitat

Under the Magnuson-Stevens Fishery Conservation and Management Act, federal agencies are required to consult with the NMFS on activities that may adversely affect Essential Fish Habitat (EFH). EFH includes spawning and rearing habitat for Chinook, coho, and pink salmon. There is not a sustained pink salmon population in the Skokomish basin. All anadromous reaches within the Lower South Fork Skokomish River, Lower North Fork Skokomish, and Middle North Fork Skokomish River subwatersheds are considered EFH. This project will have No Adverse Effect on EFH.

Sensitive Fish Species

River lamprey, a fish species on the Regional Forester's (Region 6) Sensitive Species List has the potential to be present within the planning area. This sensitive fish species may occur within the Middle North Fork Skokomish subwatershed.

Environmental Consequences

Method of analysis

Selected indicators from the "Matrix of Pathway and Indicators" taken from the 1996 NMFS document, "Making Endangered Species Act Determinations of Effects for Individual or Grouped Actions at the Watershed Scale" were used to analyze the proposed action. There are three Project Elements (PE) – 1) thinning within Riparian Reserves; 2) temporary road construction, reconstruction, and road decommissioning; and 3) log haul – that have the potential to affect the following nine matrix indicators: temperature, sediment, substrate embeddedness, streambank condition, drainage network increase, road density and location, and function of riparian reserve (Table Fisheries-3). The proposed action was analyzed using these selected indicators to assess potential environmental effects based on existing conditions at the project and watershed scales. The ratings of these indicators show relative change to the baseline, and display if the action would have a beneficial, neutral or negative impact on the habitat indicator. A detailed discussion of all the habitat indicators that are included in the NMFS matrix for salmon will be included in a Biological Assessment (BA) for this timber sale proposal prior to

implementation of work. This BA will include the entire list of indicators and accompanying narratives.

Table Fisheries-3 shows a summary of the indicators used for this analysis. Indicators were evaluated for long-term impacts, and are relative to desired conditions unless otherwise specified.

Table Fisheries-3. Potential project effects to indicators from the "Matrix of Pathway and Indicators".

	Baseline (Watershed Scale – 5th field HUC) South Fork Skokomish River			Effects of Proposed Alternatives (Project Scale)		Effects of Proposed Alternatives (Watershed Scale)	
Indicator [1]	**Properly Functioning**	**At Risk**	**Not Properly Functioning**	**Alt A – No Action**	**Alt. B – Proposed Action**	**Alt A – No Action**	**Alt. B – Proposed Action**
Temperature		SFS, NFS		M	M	M	M
Sediment		SFS, NFS		M	D	M	M
Substrate Embeddedness		SFS, NFS		M	D	M	M
Streambank Condition		NFS	SFS	M	D	M	M
Drainage Network Increase		NFS	SFS	M	M	M	M
Road Density & Location		NFS	SFS	M	D	M	M
Riparian Reserve		NFS	SFS	M	R	M	M

1 Source: NMFS 1996

The "Baseline" columns in Table Fisheries-3 represent the current condition of the overall South Fork Skokomish River and North Fork Skokomish River watersheds. The two "Effects" columns present the effects the proposed action would be likely to have on the indicators:

- R (restore) = project is likely to have a beneficial impact on habitat indicator
- M (Maintain) = project may affect indicator, but impact would be neutral
- D (Degrade) = project is likely to have a negative impact on the habitat indicator.
- SFS = South Fork Skokomish
- NFS = North Fork Skokomish

Alternative A - No Action

Direct and Indirect Effects

This alternative represents no change to the existing baseline, and would have no direct or indirect effects on instream or wetland aquatic habitat, or water quality within the Lower South Fork, Lower North Fork, and Middle North Fork Skokomish River subwatersheds. All indicators – temperature, sediment, substrate embeddedness, streambank condition, drainage network increase, road density and location, and function of riparian reserve – would be maintained (M). The present sediment recruitment rates into stream channels would continue. The current amounts of bedload and suspended sediment routed down river channels associated with natural conditions and previous activities (timber harvest, road building) would be slowly reduced over time, through regrowth of the cutover areas within the drainage.

Riparian vegetation would continue to grow at current rates, creating some mature conifers that would eventually be recruited into channels as large woody material. The species diversity of riparian vegetation would be similar to current conditions over the next few decades, but hardwoods would then begin to be slowly displaced by conifers. In the absence of any large flood events, instream aquatic habitat would continue to be similar to current conditions. The possible impacts of large flood events are variable, and are dependent on reach specific channel conditions.

Cumulative Effects

No cumulative effects would occur within the Lower South Fork Skokomish River, Lower North Fork Skokomish, and Middle North Fork Skokomish subwatersheds because there would be no management action taken that would add to existing effects of past, present, and foreseeable actions.

Alternative B – Proposed Action

The following discussion of potential environmental consequences of the proposed action draws on and expands the information presented in the "Effects" columns of Table Fisheries-3. Each indicator is assessed as it corresponds to the three Project Elements (PE): thinning within Riparian Reserves; temporary road construction and reconstruction; and log haul. This discussion frequently refers to the riparian no-cut buffers prescribed for the proposed action (Table 2-4). For reference, the no-cut stream buffer width information from Table 2-4 is repeated in Table Fisheries-4. Implementation of these minimum buffer widths is assumed in this analysis.

Table Fisheries-4. Riparian no-cut buffer widths by stream type.

Stream type	Minimum no-cut buffer width
South Fork Skokomish River mainstem	200 feet, measured from outer edge of the channel migration zone on either side of channel.
All other fish bearing streams (includes intermittent fish-bearing streams).	100 feet, measured from the outer edge of the streambank, or to the top of the slope break, whichever distance is greater.
Non-fish-bearing intermittent and ephemeral streams	50 feet, measured from the outer edge of the streambank, or to the top of the slope break, whichever distance is greater.

Direct and Indirect Effects

Temperature

PE – Thinning within Riparian Reserve

Proximity: Refer to Table Fisheries-5 for types of fish habitat adjacent to harvest units across the planning area.

Table Fisheries-5. Units adjacent to fish habitat.

Stream	Unit	Logging System	Fish Habitat
SF Skokomish R.	D30	Ground	Steelhead, bull trout, coho
SF Skokomish R.	D30	Cable	Steelhead, bull trout, coho
SF Skokomish R.	D15	Helicopter	Steelhead, bull trout, coho
Harp Ck.	D15	Cable	Rainbow and cutthroat trout

Table Fisheries-5. Units adjacent to fish habitat.

Stream	Unit	Logging System	Fish Habitat
Harp Ck.	D10A	Cable	Rainbow and cutthroat trout
Harp Ck.	D10A	Ground	Rainbow and cutthroat trout
Harp Ck.	D10B	Cable	Rainbow and cutthroat trout
Rock Ck.	D29C	Downhill Cable	Rainbow trout
Rock Ck.	R23	Cable	Rainbow trout
Rock Ck.	R8	Cable	Rainbow trout
Rock Ck.	R5	Helicopter	Rainbow trout
Dalby Ck.	D23	Ground	Cutthroat trout
Vincent Ck.	D3B-04	Ground	Rainbow and cutthroat trout
Vincent Ck.	D3B-02	Ground	Rainbow and cutthroat trout
Vincent Ck.	D3B-01	Cable	Rainbow and cutthroat trout
Vincent Ck.	D3A-01	Ground	Rainbow and cutthroat trout
Vincent Ck.	D3A-02	Ground	Rainbow and cutthroat trout
Vincent Ck.	D3A-03	Ground	Rainbow and cutthroat trout
Tributary to Fir Ck.	D1B-01	Ground	Cutthroat trout
Tributary to Fir Ck.	D1B-04	Ground	Cutthroat trout
Tributary to Fir Ck.	D1A-13	Cable	Cutthroat trout
Tributary to Fir Ck.	D1A-22	Ground	Cutthroat trout
Tributary to Fir Ck.	D1A-15	Cable	Rainbow trout
Tributary to Fir Ck.	D1A-16	Cable	Rainbow trout
Tributary to Fir Ck.	D1A-17	Cable	Rainbow trout
Tributary to Fir Ck.	D1A-24	Cable	Rainbow trout
Tributary to Fir Ck.	D1A-25	Cable	Rainbow trout
Tributary to Fir Ck.	D1A-48	Cable	Rainbow trout
Tributary to Fir Ck.	D1A-49	Cable	Rainbow trout
Tributary to Fir Ck.	D21A	Cable	Rainbow trout
Tributary to Fir Ck.	D21-11	Cable	Rainbow trout
Fir Ck.	D20	Helicopter	Rainbow trout
Tributary to Vance Ck.	V26	Cable	Sculpin
Tributary to Frigid Ck.	D9	Cable	Rainbow and cutthroat trout
Tributary to Frigid Ck.	D9	Ground	Rainbow and cutthroat trout
Frigid Ck.	D28	Ground	Rainbow and cutthroat trout
Frigid Ck.	D23B	Ground	Rainbow and cutthroat trout
Frigid Ck.	D23A	Ground	Rainbow and cutthroat trout
Gibbons Ck.	D25	Cable	Cutthroat trout
Gibbons Ck.	D24	Cable	Cutthroat trout
Gibbons Ck.	D24A	Cable	Cutthroat trout
McTaggert Ck.	D11	Cable	Cutthroat trout
Tributary to Cushman	36	Ground	Cutthroat trout
Big Ck.	9	Ground	Cutthroat trout
Big Ck.	11	Ground	Cutthroat trout

Probability: Commercial thinning would occur within the Riparian Reserve; however no thinning would occur in close proximity to streams. No cut buffers would be implemented on all streams in part to protect existing shade-producing trees from being cut (see Table Fisheries-4). The width of the no-cut buffers would expand on steep and unstable slopes. The thinning would be removing the less dominant and co-dominant trees within the stand; the dominant shade-producing trees would remain. Given the riparian no-cut buffers and silvicultural prescriptions, changes in stream shading or stream temperature would be unlikely.

Magnitude: None

Element Summary: No change in stream shade would be anticipated from the proposed timber sale activities. No increase in water temperature would be anticipated as a result of any activities under this alternative, which would have a neutral effect to water temperature.

303(d) Listed Waterbody:

The 2008 federal CWA 303(d) list included the segment of the mainstem South Fork Skokomish River (identified as List ID 35267) within T22N R05W Section 15 (WDOE 2009) for temperature, see Figure 1. Units identified in Table Fisheries – 5a have the greatest potential to affect water temperatures in the South Fork Skokomish. However, harvest units are far enough away from the mainstem channel, at least 200 feet, that shade would not be affected, thus not affecting water temperatures in the South Fork Skokomish River.

Currently no TMDL is in place to address the 2008 303(d) listed water bodies within the South Fork Skokomish watershed. However, a cooperative effort initiated in 2006 between the Forest Service, Ecology, and EPA is underway with development of the Western Washington Total Maximum Daily Load for temperature. This effort adheres to Forest Service protocol for addressing CWA Section 303(d) listed waters on federal lands (USDA and USDI, 1999). It will link implementation of management standards and guides set forth in the Northwest Forest Plan Aquatic Conservation Strategy to factors affecting stream temperatures, thereby satisfying federal regulations associated with a TMDL. It will formally validate the maintenance or restoration of stream temperatures with implementation of the ACS. This TMDL will apply to all current and future stream temperature impairments for water bodies on NFS lands within the Gifford Pinchot, Mt. Baker Snoqualmie and Olympic National Forests.

Figure Fisheries-1. Units upstream and adjacent to 303d listed temperature segment of the South Fork Skokomish River.

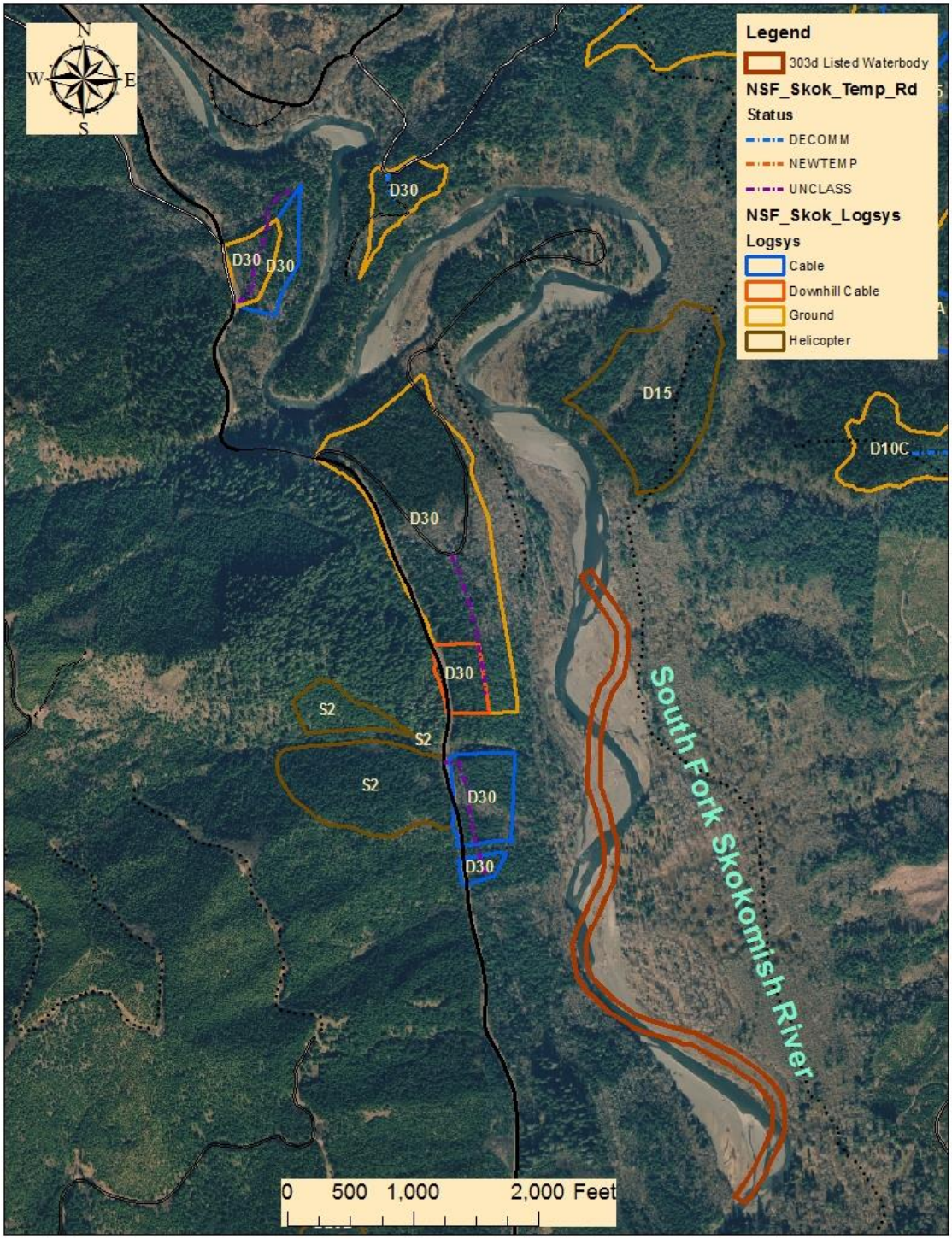


Table Fisheries-5a. Units upstream and adjacent to 303d listed temperature segment of South Fork Skokomish River.			
Unit	**Logging System**	**Acres**	**No Cut Buffer to SF Skokomish (ft)**
D15	Helicopter	24.2	200
D30	Ground	5.4	200
D30	Ground	4.2	200
D30	Cable	3.7	200
D30	Ground	40.1	200
D30	Downhill Cable	4.6	200
D30	Cable	9.2	200

Sediment/turbidity and Substrate embeddedness

These two indicators, sediment/turbidity and substrate embeddedness, are grouped because they are affected similarly by project elements. Turbidity is used as an indicator of fine sediment suspended in the water, and substrate embeddedness is an indicator of fine sediment that settles onto the streambed.

PE – Thinning within Riparian Reserves

Proximity: Refer to Table Fisheries-5 for proximity of harvest units to fish habitat across the planning area.
Probability: Table Fisheries-6 summarizes the type of logging systems that would be used within the Riparian Reserve. Ground-based and downhill cable logging have the highest potential to disturb soils of the different logging systems because of its potential to displace the organic and surface soil layers, increasing the potential for overland flow and erosion. Approximately 188 acres within the Riparian Reserve would be logged using ground-based equipment, and 35 acres using downhill cable. The project design criteria (described in Chapter 2, Table 2-4), including the no-cut buffers, would all but eliminate the potential for sedimentation associated with ground-based logging. Rashin et al. (2006) reported that restricting ground disturbance in 10 meter (30 foot) buffer along streams channels prevented sediment delivery to streams from about 95 percent of harvest-related erosion features. This project's minimum buffers are all wider than 10 meters. Numbers of acres treated within the Riparian Reserve in the table below, Table Fisheries-6, differ and are less than the table in Chapter 2, Table 2-2. The smaller numbers for Riparian Reserve treatments, in Table Fisheries-6 are due to subtracting out the acres within the riparian no-cut buffers for streams and wetlands. Numbers in Table Fisheries-6 are also likely overestimations of treated acres within the Riparian Reserve, because during the layout process of the timber sale new intermittent streams or wetlands would be identified and associated buffers established. Additionally no-cut buffers identified by defined slope breaks maybe larger than the minimum widths outlined in Table Fisheries-4, thus reducing acres treated in the Riparian Reserve.

Table Fisheries-6. Acres in Riparian Reserve (RR) by logging system.	
Logging System	**Acres in RR**
Ground-based yarding - G	178
Cable yarding – C	657
Downhill Cable yarding - DC	35
Helicopter yarding - H	109
Total	**979**

Magnitude: None
Element Summary: Buffers on all streams in the sale area would provide a sufficient distance from water sources to protect them from sediment related to felling, yarding, skidding, and slash disposal activities from entering streams. This also includes locations of helicopter landings.

PE – Temporary Road Construction, Reconstruction, and Road Decommissioning
Proximity: Refer to Table Fisheries-7 for temporary road construction that would entail new culvert installations. All new culvert installations are on intermittent and non-fish-bearing stream. The closest a new culvert installation to anadromous fish habitat is approximately 0.2 miles, and 0.1 miles to resident fish habitat.

Table Fisheries-7. Temporary Road with stream crossings				
Temp. Road Number	**Unit**	**Type of Temp. Road**	**Type of Stream Flow at Crossing**	**Distance to closest fish habitat (mile)**
D30-1	D30	Unclassified	Intermittent	0.2
D23-4	D23A	Unclassified	Intermittent	0.5
D24-1	D25	New Temp.	Intermittent	0.3
35-1	33	Unclassified	Intermittent	0.5
36-2	36	Reopening of Decommissioned	Intermittent	0.1

Probability: Culvert installations and removals at stream crossings have the potential for generating sediment and turbidity that could impact aquatic habitat. Only one new stream crossing culvert would be installed in conjunction with the reconstruction of unclassified roads. All newly installed stream crossing culverts that would be in place during the wet-season would be sized to accommodate 100-year flow events.

Magnitude: Installation and removal of culverts has the potential to cause sediment input and turbidity during project activities. Stream channels, however, would likely be dry or have minor amounts of flow during low summer flows when culverts would be installed and removed. Dewatering the stream channel within the project area prior to culvert installation would further minimize any short-term impacts.

Since the culvert installations would occur during summer low flow conditions, the amount of sediment mobilized during actual project activities would be small and transport would be very limited. Duncan et al. (1987) demonstrated that even fine sediments produced from road surfaces settled out rapidly and were stored in small mountain stream channels. Less than 50 percent of sediments traveled further than approximately 310 to 410 ft. The closest new stream crossing

culvert installation to anadromous fish habitat is along temporary road D30-1 off of FSR 2300 and is approximately 0.2 miles (1056 feet) downstream to the mainstem South Fork Skokomish. The closest new stream crossing to resident fish habitat is on temporary road 2400038 off of FSR 2400 and is approximately 0.1 mile (528 feet) downstream on a tributary to Lake Cushman.

There would be a potential for some additional sediment to be mobilized from the disturbed fill slopes at culvert installation and removal sites during the first winter before they become fully revegetated. Grass seeding and soil stability treatments applied during and immediately after excavation would limit short-term sediment production. Any sediment that erodes from the disturbed fill slopes could be carried into the South Fork Skokomish River during high flows. Given that erosion control measures would be implemented at the stream crossings sites, erosion and sediment production from stream crossing sites is expected to be minimal. Table Fisheries-8 contains a summary of proposed construction and reconstruction of roads in Riparian Reserve.

Table Fisheries-8. Summary of proposed temporary road development by road type.

Type of temporary road construction	Miles proposed	Miles in RR
Reconstruction of existing unclassified road	10.4	1.6
Reopening of existing decommissioned road	3.1	0.5
New road construction	5.2	0.6
Total temporary road mileage	**18.7**	**2.7**

Element Summary: Impacts to fish and fish habitat from temporary road construction, reconstruction, and decommissioning would be negligible. The relatively small total length of proposed road development (including 2.7 miles in Riparian Reserve), with only five new culverts stream crossings, would generate only limited sediment and turbidity. Road construction activities would occur during the summer low-flow season, which would limit transport of any introduced sediment in small tributary channels.

PE – Log Haul

Proximity: Fish-bearing streams that intersect the timber haul routes and potentially may be affected by sediment generated from log haul are: Harp Creek, Rock Creek, Flat Creek, Dalby Creek, Vincent Creek, Fir Creek, Vance Creek, Nicklund Creek, Cabin Creek, McTaggert Creek, Gibbons Creek, Frigid Creek, Big Creek and the SF Skokomish River. Anadromous stream crossings are the SF Skokomish River, McTaggert Creek, and Gibbons Creek.

Probability: Sediment would be likely to be generated by log haul during wet weather. Some sediment may enter streams, especially after major rain storms and during heavy levels of timber haul. Sediment delivery generally occurs where roads are either close to or cross streams. Sediment derived from road surfaces would be delivered either directly or via ditches during higher flows (storm events). Fine sediments would probably remain in suspension and move rapidly through the system to settle in low gradient reaches.

Best management practices would be implemented to minimize the potential for sediment delivery to streams. If standard mitigation erosion-control methods such as sediment traps and spot rocking at stream crossings are inadequate to prevent sediment delivery to streams log haul would be suspended. This is intended to reduce the frequency and magnitude of potential sediment delivery to stream channels.

Magnitude: Approximately 60 percent of the total proposed treatment acres in the planning area would be hauled on the FSR 2340 road system, while approximately 35 percent would be hauled on FSR 2300, and about 5 percent would be hauled on FSR 2400. On average approximately four truckloads per day is the anticipated traffic volume generated from ground based and cable harvested units. Sediment delivery to streams can increase 7.5 times baseline conditions from more than four loaded trucks per day (Reid and Dunne 1984). Truck traffic and road maintenance procedures such as grading or resurfacing have a major influence on the amount of sediment transported by the road ditch during the subsequent precipitation event (Reid 1981). The amount of sediment that is delivered to stream channels is also influenced by the frequency of ditch-relief culverts that spread accumulated ditch water out onto the forest floor, and by erosion control techniques such as check dams and settling basins. FSR 2340, 2300, and 2400 are mainline roads that receive regular maintenance. The combination of these factors and implementation of the prescribed MMs would result in a small potential magnitude of sediment delivery to streams.

Some sediment that reaches stream channels would be trapped and stored in tributary streams before reaching anadromous reaches of the South Fork and North Fork Skokomish River; however, finer particles may reach downstream reaches in the form of suspended sediment. The magnitude of material transported downstream to fish-bearing stream reaches and the potential effects to substrate composition is expected to be small. During rain events, when there is the potential for sediment to be routed through smaller tributaries, sediment effects would be diluted as the smaller tributaries enter the mainstem of both the South Fork and North Fork of the Skokomish River. Just below the confluences of these smaller tributaries, the sediment associated with log haul from the project would probably be indistinguishable from the natural higher background sediment loads during storm events.

Distribution: Log haul would occur on approximately 18.7 miles of proposed temporary roads, approximately 68.8 miles of existing authorized NFS roads, and approximately 5.2 miles of private roads. Main arterial roads on which log haul potentially may occur are the 2300, 2340, 2340-200, 2340-230, 2350, 2351, 2352, and 2400. Table Fisheries-9 contains a summary of haul routes by subwatershed.

Table Fisheries-9. Haul routes by subwatershed.

Subwatershed	Miles of Paved Road	Miles of Gravel Road	Number of stream crossings
Lower South Fork Skokomish	6.5	43.8	42
Lower North Fork Skokomish	0	17.1	15
Middle North Fork Skokomish	5.7	0.9	6

Frequency: On average, for ground based and cable operations, approximately four truckloads per day is the anticipated traffic volume generated from the proposed thinning. Traffic volume would be higher for helicopter harvested units. Most of the ground-based and cable units would be harvested in the summer, early fall season, while the helicopter would be harvested in the late fall, winter, or spring seasons.

Duration: Sedimentation due to log haul is considered short-term in duration. The duration of sedimentation due to log haul is expected to last only while hauling activities occur. This planning area would likely be broken into at least two timber sales, and timber sales have the potential to last up to 5 years. Thus, temporary roads for each timber sale have the potential to be open for up to 5 years, with timber haul occurring intermittently over that same time. Timber sales would likely be sold one to two years apart, thus effects across the planning area could be dispersed over 5 to7 years.

Timing: Approximately 82 percent of the roads that would be used have gravel surfacing. Approximately 85 percent of the units are scheduled to be harvested in the dry season (June 1 to October 31).

Nature: Negative effects to aquatic habitat from sediment inputs from log haul would likely occur, however, adverse impacts would be limited. The relatively low magnitude and frequency of haul, and the MMs that would be implemented to control erosion and sediment delivery to stream channels would all minimize potential effects. Pulses of sediment during storm events are anticipated to occur. Haul would be shut down until road conditions improve. No long-term adverse impacts to fish populations are anticipated.

Element Summary: Increased sediment delivery and turbidity in streams from timber haul would occur only during periods when timber haul was actually occurring. Because timber sale activity is typically intermittent, adverse sediment and turbidity impacts would also be intermittent, however they would extend for several years as various sales were prepared and logged. Because the operating season for the majority (about 85 percent) of harvest units would occur from June 1 to October 31 (the drier season), sediment delivery to streams in these units would be reduced compared to unit harvested during the wetter season.

Actual adverse impacts to the aquatic system from increased sediment delivery or turbidity would be small, localized, intermittent, and temporary. No adverse impacts would be discernable at the watershed scale.

There would be a negative, short-term effect to the sediment/turbidity and substrate embeddedness indicators due to log haul activities at the site scale. Effects to fish or fish habitats are expected to be minor.

Streambank Condition

PE – Temporary Road Construction, Reconstruction, and Road Decommissioning
Proximity: Refer to Table Fisheries-7 for temporary road construction that would entail new culvert installations. All new culvert installations are on intermittent and non-fish-bearing streams. The closest distance a new culvert installation to anadromous fish habitat is approximately 0.2 miles (1056 ft.), and 0.1 mile to resident fish habitat.

Probability: Some disturbance would occur on streambanks at new stream crossings that would be part of new temporary road construction in Units D30, D23A, D25, 33 and 36 which have the potential to affect the South Fork Skokomish River, Frigid Creek, Gibbons Creek, and a tributary to Lake Cushman respectively. Short term disturbance would occur when the culvert is installed and then again when the culvert is removed as the temporary road is decommissioned/rehabilitated. In the long term, streambank condition at new crossing sites

would recover as re-vegetation takes place. Road construction and decommissioning would likely extend over more than one year at the sites.

Magnitude: Actual adverse impacts to the aquatic system from disturbed streambank conditions at new culvert sites would be minimal. The new culvert sites are on a temporary road that would be decommissioned/rehabilitated after the timber sale. The new crossings do not present any unusual long-term slope stability or erosion concerns. The new crossings are on non-fish-bearing stream above anadromous and resident fish habitat. No adverse impacts to streambank condition would be discernable at the watershed scale.

Element Summary: At the project scale, temporary road construction would have a short-term, localized negative impact to this indicator. Effects to fish species or fish habitats would be negligible.

Drainage Network Increase

PE – Temporary Road Construction, Reconstruction, and Road Decommissioning
Proximity: Refer to Table Fisheries-7 for temporary road construction that would entail new culvert installations. All new culvert installations are on intermittent and non-fish-bearing streams. The closest distance a new culvert installation to anadromous fish habitat is approximately 0.2 miles (1056 ft.), and 0.1 mile to resident fish habitat. Table Fisheries -10 shows the type of temporary roads, which are planned to be constructed and decommissioned/rehabilitated within the planning area.

Table Fisheries-10. Temporary Roads in Riparian Reserve across planning area.

Type of Temp. Road	Temp. Road Number	Miles in RR
DECOMMISSIONED RD - FOR USE	D10C-1	0.14
DECOMMISSIONED RD - FOR USE	D30-4	0.03
DECOMMISSIONED RD - FOR USE	D23-10	0.06
DECOMMISSIONED RD - FOR USE	V4-1	0.14
DECOMMISSIONED RD - FOR USE	36-2	0.11
NEW TEMP ROAD	D12-5	0.04
NEW TEMP ROAD	D23-6	0.11
NEW TEMP ROAD	D1-3	0.01
NEW TEMP ROAD	D25-9	<0.01
NEW TEMP ROAD	D24-1	0.09
NEW TEMP ROAD	D1-1	0.01
NEW TEMP ROAD	D1-7	0.01
NEW TEMP ROAD	D23-7	0.06
NEW TEMP ROAD	D1-6	0.03
NEW TEMP ROAD	D25-2	0.02
NEW TEMP ROAD	35-3	0.01
NEW TEMP ROAD	D24-1	0.06

Table Fisheries-10. Temporary Roads in Riparian Reserve across planning area.		
Type of Temp. Road	**Temp. Road Number**	**Miles in RR**
NEW TEMP ROAD	D24-4	0.02
NEW TEMP ROAD	D25-7	0.08
UNCLASSIFIED RD FOR USE	D11-2	0.10
UNCLASSIFIED RD FOR USE	D25-7	0.02
UNCLASSIFIED RD FOR USE	V1-1	0.01
UNCLASSIFIED RD FOR USE	D29-3	0.00
UNCLASSIFIED RD FOR USE	D24-8	0.08
UNCLASSIFIED RD FOR USE	D10-2	0.01
UNCLASSIFIED RD FOR USE	D25-8	0.04
UNCLASSIFIED RD FOR USE	D29-1	0.23
UNCLASSIFIED RD FOR USE	D25-12	0.01
UNCLASSIFIED RD FOR USE	D24-1	0.01
UNCLASSIFIED RD FOR USE	V33-1	0.07
UNCLASSIFIED RD FOR USE	D25-11	0.04
UNCLASSIFIED RD FOR USE	D10-1	0.14
UNCLASSIFIED RD FOR USE	D29-2	0.03
UNCLASSIFIED RD FOR USE	V5-1	0.03
UNCLASSIFIED RD FOR USE	35-2	0.06
UNCLASSIFIED RD FOR USE	V22-1	0.17
UNCLASSIFIED RD FOR USE	D23-3	0.06
UNCLASSIFIED RD FOR USE	D25-10	0.03
UNCLASSIFIED RD FOR USE	D3-1	0.03
UNCLASSIFIED RD FOR USE	D12-6	0.01
UNCLASSIFIED RD FOR USE	D30-1	0.12
UNCLASSIFIED RD FOR USE	D25-6	0.13
UNCLASSIFIED RD FOR USE	35-1	0.08
UNCLASSIFIED RD FOR USE	D23-4	0.11
Total		**2.64**

Probability: New temporary road construction in the RR has the highest probability of increasing the drainage network. The proposed action plans to construct approximately 5.2 miles of new temporary road. Of that 5.2 mile of new temporary road, only 0.6 mile is within the RR.

Magnitude: Because the amount of new temporary road construction is small – 5.2 miles – and roads would be on relatively flat ground, there would be no increase to the drainage network.

Element Summary: Due to the relatively low amount of new temporary road building, especially in the RR, effects to this indicator would be neutral. Temporary road construction will include frequent installation of ditch-relief culverts which will act to disconnect ditchlines from streams

and prevent creation and scouring of first order streams at the outlets of ditch-relief culverts. Effects to fish species or fish habitats would be negligible.

Road Density and Location

Roads and road density are often used as a coarse level descriptor of watershed characteristics and conditions. Road density is defined as a ratio of the length of roads per unit area. Usually reported in mi/mi^2, road density is one measure used to assess the relative potential impacts of roads on water quality and quantity and is typically calculated using GIS layers of mapped roads and analysis areas.

PE – Temporary Road Construction, Reconstruction, and Road Decommissioning

Proximity: The closest temporary road building to anadromous fish habitat is approximately 0.2 mile, and 0.1 mile to resident fish habitat.

Probability: A total of 18.7 miles of new temporary, unclassified, and decommissioned roads would be constructed and reconstructed, see Table Fisheries-8. Approximately 5.2 miles of new temporary roads would be constructed, and 13.4 miles of existing unclassified and previously decommissioned road would be reopened under the proposed action. Only 0.6 miles of new temp road would be constructed in Riparian Reserve; and 2.1 miles of existing unclassified and previously decommissioned road within Riparian Reserve would be reopened. All new temporary roads and all reopened unclassified and previously decommissioned roads would be decommissioned/rehabilitated after timber harvest.

Magnitude: There would be moderate and temporary increases in road densities in the Lower South Fork and Lower North Fork Skokomish subwatersheds. Drainages with the greatest increase in road densities would be McTaggert Creek, Frigid Creek and the Lower South Fork Skokomish. Decommissioning of temporary roads at the completion of the timber sales (which may last 5 to 7 years) would return road densities to pre-harvest conditions. Refer to Table Fisheries-11 for road densities of the drainages (7th field HUC) within the planning area. Road densities are expected to increase while temporary roads are open, and then return to pre-project levels.

Table Fisheries-11. Road Densities per drainage 7HUC

Drainage (7 HUC)	Area (mi^2)	FS NFS roads (mi)	Temporary Roads (mi)	Current FS Road Densities (mi/mi^2)	Road Densities with Temporary Roads (mi/mi^2)
Lower South Fork Skokomish River	12.49	22.7	5.5	1.8	2.3
Flat Creek	6.84	17.8	0.6	2.6	2.7
Fir Creek	2.70	12.1	0.6	4.5	4.7
Vance Creek	21.25	56.9	1.3	2.7	2.7
Lower North Fork Skokomish River	6.31	3.3	0	0.5	0.5
McTaggert Creek	5.23	7.7	5.6	1.5	2.5
Frigid Creek	3.92	8.8	3.3	2.2	3.1
Lake Cushman Frontal	18.10	9.1	1.6	0.5	0.6
Big Creek	5.85	15.0	0.4	2.6	2.6

Element Summary: There would be a temporary negative effect to road densities primarily in the McTaggert, Frigid, and Lower South Fork Skokomish drainages. However after timber harvest activities road densities would return to pre-project levels.

Riparian Reserve

PE – Thinning within Riparian Reserves

Proximity: Approximately 979 acres of Riparian Reserve would be thinned. Thinning prescriptions within the Riparian Reserve are expected to result in variable canopy densities. Nearest the stream, canopy cover would remain as it is currently because there would be no thinning within the no-cut buffers (see table Fisheries-4 for minimum buffer widths).

Probability: As reported in Rashin et al. (2006), a 10 meter (approximately 33 feet) buffer is expected to prevent about 95 percent of harvest-related erosion features from delivering sediment to streams. All no-cut buffers for this project are wider than 10 meters. These untreated buffers along all streams would protect the immediate area along streams from a number of potential effects, including direct and indirect impacts to channel functions or instream habitat, water temperature, sediment filtering, large wood, nutrient and detritus inputs, soil and ground cover, and microclimates. The no-cut stream buffers would also maintain the habitat connectivity within these core areas of the Riparian Reserve.

Magnitude: Treated portions of the Riparian Reserve outside the no-cut buffers would be thinned to a 60 percent to 90 percent canopy cover. It is expected that over time the thinning conducted in the outer Riparian Reserves would produce larger trees sooner than they may otherwise have developed. The thinning treatments within the Riparian Reserve are also expected to increase structural and species diversity within these stands.

Thinning in Riparian Reserve could reduce the number of trees that would naturally fall into the stream and contribute to instream large wood; however this impact is expected not to be substantial. The 100 to 200 ft and 50 ft no-cut buffers along fish streams and non-fish streams, respectively, would maintain the vast majority of potential instream large wood sources. Because the thinning would generally remove the smaller trees, most of the trees that would be cut in the RR outside the no-cut buffers are currently too short to reach the stream channel and contribute to instream large wood. The remaining trees within the Riparian Reserve would increase in growth rate, both in height and diameter, in response to the thinning. An increase in stand complexity within the treated portion of the RR is also anticipated.

Element Summary: By implementing riparian reserve stand treatments, positive changes would be expected in the structure and composition of the large wood within riparian reserves as late-successional conditions develop over time. Immediate effects to fish species or fish habitats would be negligible.

Rock Pit Expansion

Due to the road building and road maintenance associated with timber harvest, three rock pits are proposed for expansion: Big Creek Rock Pit, Brown Creek Rock Pit, and V-1043 Pit. The Big Creek Rock Pit is within the Middle North Fork Skokomish River subwatershed, and both the Brown Creek and V-1043 pits are within the Upper South Fork Skokomish subwatershed. All pit

expansions are estimated to be approximately 2 acres at each pit, and all expansion boundaries fall outside of Riparian Reserves. Direct expansion activities are not expected to deliver sediment into nearby streams. Increased haul during the wet season may cause sedimentation to streams; effects would be similar to log haul sedimentation effects, see PE Log Haul section.

Cumulative Effects

Cumulative effects are the impacts on the environment which result from the incremental impact of the project when added to other past, present, and reasonable foreseeable future actions. Cumulative impacts can result from individually minor but collectively substantial actions that overlap through space and time.

The major impacts to aquatic resources across all three subwatersheds from past actions have come from fire, timber harvest, and roads. Generally, on the east side of the Olympic Mountains, large stand replacement fires occur approximately every 200 years. All three subwatersheds have had extensive timber harvest starting from the early 1900s. Additionally, logging roads have caused numerous landslides.

In the past few years there have also been several positive efforts made to improve salmonid habitat within all of the South Fork Skokomish subwatersheds by local environmental groups, tribal, federal, state and county governments. Projects such as road decommissioning, levee removal, instream placement of LWD, and conservation easements to protect high value floodplain and riparian areas have been accomplished, and others are underway within the South Fork Skokomish and North Fork Skokomish River watersheds. On National Forest lands, approximately 97.8 miles of road have recently been decommissioned within the South Fork Skokomish watershed, and approximately 25.5 additional miles of existing roads are planned to be decommissioned in within the next several years. Other ongoing or foreseeable activities across all subwatersheds are listed in Section 3.0. Repair and maintenance of the road network is also included.

Existing and foreseeable activities on non-federal across the Lower South Fork, Lower North Fork, and Middle North Fork Skokomish subwatersheds include timber sales, road construction, and bank hardening. These future private and state actions are likely to continue, potentially exacerbating the existing adverse effects on salmonid habitat within the lower subwatersheds. Timber harvest on private lands is expected to continue into the near future, and it is possible that there will be some harvest activities occurring simultaneously on federal lands in the Lower South Fork Skokomish subwatershed and on private lands in Lower North Fork Skokomish subwatershed. In the upper watershed riparian conifers will develop into older large diameter trees, providing habitat-forming woody debris in small streams and rivers. Some of this large wood may transport downstream to private lands. Abandoned roads on private lands may be reopened and new roads constructed to access timber on private lands. Intensive (clearcut) logging, mainly on private lands, would increase surface erosion from log haul and road construction, and some quantity of fine sediment is likely to continue to reach the stream channel network. The long term disposition of unclassified (non-system) roads on National Forest lands is unknown, but changes in the Washington State forest practice regulations require that private and state land managers develop management plans for their road systems aimed at meeting Clean Water Act requirements.

The proposed action would not contribute to downstream cumulative effects, because the incremental increase of sediment to stream channels from log haul, road building, and road decommissioning would last only during implementation of timber sales. Cumulative effects may occur within lower gradient response reaches (stream gradient less than 3 percent) where project-related sediment would deposit and may remain, in which case the following indicators would be degraded at the project level: sediment, substrate embeddedness, and streambank condition. However, this effect would be small, and would not cause any of the indicators to be degraded at the subwatershed (6th field) and watershed scale (5th field).

Threatened Fish Species

The effects determinations for the proposed action are: "No Effect" to Hood Canal summer chum and its critical habitat; "Not Likely to Adversely Affect" Puget Sound Chinook, Coastal Puget Sound bull trout, and Puget Sound steelhead; and "Not Likely to Adversely Affect" critical habitat for Puget Sound Chinook, Coastal Puget Sound bull trout, and Puget Sound steelhead. See sediment section for effects to fish that are considered in making these determinations.

Essential Fish Habitat

This project would not adversely affect essential fish habitat for Chinook, coho, or pink salmon. While road construction and reconstruction, decommissioning and log haul may generate some sporadic pulses of fine and coarse sediment, measurable impacts to fish habitat are not expected to occur due to the application of project PDCs and the temporal and spatial variability of project activities. Generally sediment pulses are of limited duration and within the range of natural variability. The project would improve road drainage, reduce overall road densities through road decommissioning of unclassified roads and may generate funds for restoration projects such as decommissioning high risk roads.

Sensitive Fish Species

The proposed action may impact individuals or habitat for river lamprey, but it will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

Northwest Forest Plan Aquatic Conservation Strategy

The Northwest Forest Plan requires consistency with Aquatic Conservation Strategy (ACS) with specific reference to nine ACS Objectives. Below is a summation of the environmental analysis regarding consistency with the elements and components of the objectives. Specific rationale may be found in analysis documented under other reports contained in this chapter of the EA: Soils and Slope Stability, Fisheries, Water Quality, and Wildlife.

ACS Objective 1. *Maintain and restore the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.*

The project contributes to a restorative effect for Objective 1 by promoting the development of late-successional forest characteristics in second growth stands in portions of the watershed, and helping to meet the desired future condition for Late Successional Reserves, Adaptive Management Areas, and Riparian Reserves described in the Forest Plan.

The LSVMP would accelerate development of late successional habitat features and promote increased vegetative diversity, both within and outside of Riparian Reserves in the Lower South

Fork Skokomish, Lower North Fork Skokomish, and Middle North Fork Skokomish subwatersheds. The project meets NWFP ROD standards and guidelines for management of Riparian Reserves (ROD p.C-32) with the application of silvicultural practices to control stocking, reestablish and manage stands, and to acquire vegetation characteristics needed to attain the ACS Objectives.

Thinning treatments would increase structural and compositional diversity by releasing understory vegetation, and promoting development of residual trees with relatively large diameters, crowns, and limbs. Skips within the treatment areas would insure that not all young stands are treated in the project area, providing forest complexity at project and landscape scales. Where vegetative complexity is high, no-cut riparian buffers along all streamcourses would maintain the high level of vegetative complexity associated with these areas. Riparian buffer widths would be variable depending on fish presence, stream size, slope stability, sediment delivery potential, and water quality considerations. PDCs and mitigation measures were developed to retain desirable habitat components in the treated stands.

ACS Objective 2. *Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.*

The project contributes to a restorative effect for Objective 2 through restoring spatial and temporal connectivity within and between watersheds.
The vegetation treatments and associated activities proposed in this project are spread across three subwatersheds - Lower South Fork Skokomish, Lower North Fork Skokomish, and Middle North Fork Skokomish. Vegetation treatments within the Lower Skokomish planning area are designed to develop a landscape scale pattern of more complex and diverse forest stands. No-cut riparian buffers along all streamcourses would maintain a high level of connectivity along streamcourses.

ACS Objective 3. *Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.*

The project would contribute to maintaining physical integrity of aquatic systems addressed in Objective 3. No-cut buffers along all streamcourses would protect riparian areas from disturbance and maintain the physical integrity of stream channels and streambanks. Stand treatments and road construction, reconstruction, and decommissioning activities are designed to minimize impacts at the project sites.
The use of unclassified and NFS roads for harvest unit access may require re-constructing existing failed crossings on small, non-fish bearing streams, which are intermittent. New temporary road construction would not require crossing any fish bearing streams. After project completion all unclassified and temporary roads being used in the planning area would be decommissioned/rehabilitated. Decommissioning would require removal of all culverts, and blocking road access to motor vehicle use. This would start the process of streambank and streambed restoration to more natural conditions.

ACS Objective 4. *Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

The project would contribute to maintaining water quality conditions addressed in Objective 4 in the project area by designating no-cut buffers along all streamcourses and by implementing BMPs and required MMs. Stream buffer designations consider slope stability, sediment delivery potential, and water quality considerations.

Riparian no-cut buffers would also prevent sediment generated from timber harvesting operations from reaching stream channels. New temporary road construction would be limited. There is the potential that increased surface erosion from road haul and equipment operation on disturbed soils during periods of wet weather may reach the stream channel network. Through the application of best management practices (BMPs), any water quality impacts would be minor and of limited duration along the stream channel continuum.

Project design criteria (BMPs, management requirements, and MMs) were developed to address potential impacts at the project scale and to retain desirable habitat components in the treated stands. These criteria outline specific requirements for roads, landings, and skid trails to minimize and mitigate potential impacts to soil and water. These measures would be employed to limit and restrict sediment from reaching flowing waters during project implementation, especially during log haul in wet weather.

At the project scale, the project would have a minor impact on water quality from newly exposed stream banks and streambeds when failed culverts are replaced or removed. Any short-term increases in sediment production or turbidity are expected to be well within the range of what would typically occur during high winter flows or as a result of natural streambank erosion. At the watershed scale, changes in the overall sediment rates would not be detectable. After the completion of the proposed project, numerous existing unclassified roads and all new temporary roads would be decommissioned/rehabilitated. These actions would contribute to the health of the riparian, aquatic, and upland ecosystems.

ACS Objective 5. *Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.*

The project contributes to maintaining Objective 5 at the project scale and the watershed scale. Based on observations of past ONF thinning sales with similar prescriptions, riparian buffers, soils, and landforms, there is no evidence that the project will increase failure risk or cause additional shallow or deep-seated landslides. Over the long term, the thinned stands are expected to produce healthier stand conditions that will promote slope stability.

At the project scale, all stream courses are protected with no-cut riparian buffers, minimal impact logging systems, and MMs. The project includes activities at individual sites that would result in short term increases in sediment production, but have long-term benefits. For example, culvert

installations or upgrades, and road decommissioning work all have the potential to create short term sediment movement. Sediment inputs to streams from culvert work would be likely to create turbidity pulses that last for only a few hours, at most, before water clarity returns to background levels, based on past observations from implementation of large culvert removals and replacements on ONF drainages. Disturbance at reconstructed and/or decommissioned stream crossings may continue to produce small amounts of sediment throughout the first winter until the sites are fully revegetated and stable. Any short-term increases in sediment production or turbidity are expected to be well within the range of what would typically occur during high winter flows or as a result of natural streambank erosion.

A short-term increase in surface erosion from road haul would be expected in the planning area from log haul associated with the commercial thinning. Surface erosion from log haul would be mainly expected to occur during winter storm events. With the application of BMPs, proper road drainage and maintenance, and MMs such as curtailing log haul during storm events, any impacts would be short term. In the long term, the decommissioning of unclassified roads would restore the sediment regime in the planning area watersheds to more natural conditions. At the watershed scale, changes in the overall sediment rates would not be detectable given the high variability in natural rates of sediment input.

ACS Objective 6. *Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.*

The proposed action would be expected to maintain in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing (Objective 6) at both the project and the watershed scales due to the hydrologic maturity of the vegetation, and the small portions of the watersheds that would be affected. Hydrologic maturity is important due to the vegetative canopy's ability to intercept snow, reducing the amount on the hillside that would be available for runoff during large rainfall events. This project will treat, at the most, ten percent of the 6th field watershed area. Of that area treated only about one-third of the standing green trees will be removed. At the 6th field watershed scale, this project would result in a negligible change in vegetation in the Lower Skokomish planning area.

This project would not substantially affect instream flows. While tree removal may result in reduced evapotranspiration rates, allowing more water in the soils for runoff, this would be a temporary effect lasting between three and five years, until crown expansion and ground vegetation response offsets the short-term reduction. The initial reduction in vegetation represents only a small overall change that would not be measurable at the project or watershed scale. Small increases in stream flow could occur within some of the individual tributaries adjacent to harvest units, but given the very small drainage areas affected, these changes would not be detectable at the project or watershed scale. There is high natural variability in discharge that is related directly to annual or seasonal precipitation. Over time, the accelerated growth response of the residual trees as well as the development of understory vegetation would increase evapotranspiration rates.

ACS Objective 7. *Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.*

The project would maintain the current floodplain inundation and water table conditions (as related to Objective 7) at both the project and the watershed scales due to the protection measures that would be implemented along all stream channels and waterbodies, and the small portions of the watersheds that would be affected by thinning activities.

The project would not affect the timing, variability, or duration of floodplain inundation or water table elevation in meadows and wetlands within the project area. At the project scale, floodplains are protected with no-cut riparian buffers, exclusion of road construction, minimal impact logging systems, and MMs. The proposed removal of vegetation with the stand treatments would not affect the floodplain or water table elevations in the project area watershed.

ACS Objective 8. *Maintain and restore the species composition and structural diversity of plant communities in Riparian Reserves and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.*

The LSVMP would contribute to the restoration of Objective 8 at the project and watershed scale by restoring the composition and structural diversity of riparian vegetation by promoting the development of late-successional forest characteristics in second growth stands both outside and within Riparian Reserves.
The project requires no-cut buffers along all riparian corridors and wetlands. These buffers encompass diverse plant communities, protect current shading levels for thermal regulation, protect stream banks from operational disturbances, and ensure that soil disturbance does not get routed to streams or wetlands. Designated no-cut buffers along units in the planning area will also protect channel migration processes. All temporary roads would be decommissioned/rehabilitated after project completion and culverts would be removed. The decommissioning of unclassified roads used for the project would initiate restoration along riparian corridors at existing road crossings.
The size and number of new helicopter landings within Riparian Reserves would be minimized by utilizing existing openings and landings as much as possible and by incorporating new helicopter landing sites into designed gaps within timber harvest units where feasible. All landings would be outside of designated riparian no-cut buffers.

The proposed thinning treatments are designed to accelerate the development of late-successional characteristics in second-growth stands, and to increase structural heterogeneity and plant species diversity in the landscape. The proposed thinning treatments would increase plant species diversity by providing resources for the development of understory plants, and would retain hardwoods and less abundant conifer species. Structural heterogeneity would be increased through the retention of larger diameter trees, variation in thinning intensity, and no-cut buffers. Skips would also protect snags and CWD. Coarse woody material of all sizes would remain on site in treated areas. Any large pieces of wood moved during temporary road construction would be replaced on scarified roads after the stand treatment and road decommissioning is completed.

ACS Objective 9. *Maintain and restore habitat to support well distributed populations of native plant, invertebrate, and vertebrate riparian dependent species.*

This project contributes to restoration by restoring habitat for riparian-dependent species by promoting the development of late-successional forest characteristics in second growth stands within Riparian Reserves. No-cut buffers (Table Fisheries-5) along all streamcourses would protect riparian areas from disturbance and maintain the existing riparian conditions. The proposed decommissioning of unclassified roads used for the project would initiate restoration along riparian corridors at existing road crossings.

At the site specific scale, the project requires no-cut buffers along riparian areas. This would help maintain the existing microclimates that are especially important for species sensitive to changes in temperature and humidity, such as amphibians and certain types of vegetation, as well as for those animals that use the riparian areas as travel corridors. These riparian areas contribute to the landscape heterogeneity of both untreated and treated stands. The retention of less abundant conifers (such as cedars), minor hardwood species, and untreated areas or "skips" provides for different stocking levels and species composition. This variety of stand conditions would create a diverse range of habitats that would support a variety of species within the riparian areas and across the landscape.

There are a number of roads with existing weed infestations that are proposed for reconstruction or decommissioning. If there is no treatment of these invasive plant species, these infestations would continue to spread and new infestations would be likely, including in riparian areas. The project proposes weed spread prevention and eradication activities to be implemented before, during, and after project activities. Native plant species are supported through the proposed noxious weed treatments associated with the project, and the project's MMs to minimize introduction and spread of invasive plant species.
The proposed action provides for the development of habitat conditions within the riparian areas and across the landscape to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species at the project and watershed scales.

Conclusion: *The impacts associated with the proposed action, either directly, indirectly, individually, or cumulatively, would not prevent attainment of Aquatic Conservation Strategy nor the nine ACS Objectives, at the site, watershed or landscape scales.*

3.4 Botanical Resources

This evaluation addresses the potential effects of the proposed Lower Skokomish Commercial Thin on threatened, endangered, proposed and sensitive vascular and non-vascular plants, fungi and lichen species in accordance with the National Environmental Policy Act (42 USC 4321 et seq.), the federal Endangered Species Act (16 USC 1531 et seq.), and the National Forest Management Act (16 USC 1604 et seq.). In addition, Forest Service Manual 2600, Chapter 2670 provides direction designed to ensure that Forest Service actions (1) do not contribute to the loss of viability of any native or desired non-native species or cause a trend toward Federal listing for any species; (2) comply with the requirements of the Endangered Species Act; and (3) provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision making process.

This report also includes a discussion of the potential effects of the proposed action upon invasive plant spread, and measures prescribed to mitigate these effects.

Affected Environment

The proposed project area lies entirely within the *Tsuga heterophylla* (western hemlock) zone. This vegetation zone is characterized as warm temperate to maritime, with moderate winter and summer temperatures. Dominant tree species are Douglas-fir and western hemlock, with Sitka spruce, Pacific silver fir, red alder and bigleaf maple occurring in lesser quantities (USDA 1989).

Methodology

Pre-Field Analysis

In order to determine whether the activities proposed in this project pose a potential threat to Regional Forester's Threatened, Endangered, Proposed or Sensitive species, a pre-field review was performed. The Region 6 Regional Forester Special Status Species List (USDA Forest Service 2011), the ONF Rare Plant Occurrence GIS cover, the Forest Service Natural Resource Information System (NRIS), Interagency Species Management System (ISMS), BLM Geographic Biotic Observations (GeoBOB), Washington State Natural Heritage program, aerial photographs, and district files were reviewed for documented occurrences of these species.

Field Survey Methodology

Intuitive-controlled field surveys for Region 6 sensitive and invasive plant species were conducted June – October, 2014. All units proposed for treatment within the Project Area received some level of botanical analysis to assess potential habitat for sensitive vascular plants and mosses (there are currently no known or suspected occurrences of any R6 sensitive lichens or fungi on the ONF). A number of units were surveyed that have since been dropped from consideration for treatment under this proposal. Surveyors targeted microhabitats such as forest openings, rocky outcrops, road cuts and ditches, seeps, springs, moist meadows and stream edges.

Federally Listed Species

There are no Endangered or Federally listed, Candidate, or Proposed bryophytes, fungi or lichens documented or suspected on the Hood Canal Ranger District of the ONF. There is one Federally listed Endangered vascular plant, *Arenaria paludicola* (Marsh sandwort), that was suspected to occur on the ONF, but is now considered potentially extirpated from the state of Washington (USDA Forest Service, Pacific Northwest Region, Federally Listed, Proposed and Candidate Species, and Proposed or Designated Critical Habitat, January 2008). This species was removed from the most recent Region 6 Regional Forester Special Status Species List, dated December 1, 2011.

Whitebark pine (*Pinus albicaulis*), an R6 Sensitive Species and a Federal Candidate species under the Endangered Species Act, occurs in subalpine habitats above 5,000 feet in the Buckhorn Wilderness on the Hood Canal Ranger District of the ONF. The US Fish and Wildlife Service issued their twelve (12) month finding on a petition to list whitebark pine as a threatened or endangered species on July 19, 2011, in Federal Register Volume 76, Number 138. The finding was that of "warranted but precluded" with a Listing Priority Number (LPN) of 2. The Listing Priority Number of 2 indicates that the species has a very high priority for listing as threatened or endangered because of eminent threats to the species.

Whitebark pine is long-lived, cold-tolerant, five-needle pine of high elevations. It is a keystone species, important to numerous species of wildlife, including Clark's nutcracker (*Nucifraga*

columbiana) its seed dispersal agent. Major threats to the persistence of whitebark pine are an exotic fungus, white pine blister rust (*Croartium ribicola*), mountain pine beetle (*Dendroctonous ponderosae*) infestations, succession, fire and fire suppression, and climate change (Aubry et al, 2008).

Environmental Consequences

Effects Common to All Action Alternatives

Direct, Indirect, and Cumulative Effects

There are no known current or historical sites of *Pinus albicaulis* within the proposed project area, and due to lack of suitable habitat it is not likely to occur there. *Arenaria paludicola* is thought to have been extirpated from Washington State, and is also very unlikely to occur in the project area. Therefore, under all alternatives there would be no direct, indirect or cumulative effects to either species, nor would implementation of this project affect the viability of either species.

Regional Foresters Sensitive Species

Vascular Plants

Sensitive vascular plant species were assessed for the LSVMP planning area in May, 2014. Of the 31 documented or suspected sensitive vascular plant species for the ONF, appropriate habitat for seven sensitive species - *Botrychium ascendens* (upward-lobed moonwort), *Chrysolepis chrysophylla* var. *chrysophylla* (golden chinquapin), *Montia diffusa* (branching montia), *Ophioglossum pusillum* (adder's tongue), *Parnassia palustris* var. *tenuis* (northern grass of Parnassus), *Polemonium carneum* (great polemonium), and *Utricularia intermedia* (flat-leaved bladderwort) - exists in the proposed project area (Table Botany-1). Of these species, only one - *Parnassia palustris* var. *tenuis* - is known to occur in and adjacent to the 5th field watershed in which the planning area is located, and one site has been documented adjacent to a unit. *Ophioglossum pusillum* was documented in the watershed historically, but it has not been seen there since 1925. *Botrychium ascendens* and *Chrysolepis chrysophylla* var. *chrysophylla* occur in adjacent 5th field watersheds, and appropriate habitat for these species occurs in the planning area. For all other species listed here, appropriate habitat exists in the planning area, but they are not known from the Skokomish or adjacent watersheds and are only suspected to occur there.

Table Botany-1. Sensitive vascular plant species with appropriate habitat in the planning area (Camp and Gamon, 2011).

Scientific name	Status	Common name	Habitat
Botrychium ascendens	Sensitive	upward-lobed moonwort	Coniferous forests, wet and dry meadows, stream banks, and roadsides.
Chrysolepis chrysophylla var. chrysophylla	Sensitive	golden chinquapin	Dry open sites to woodlands; infertile and droughty sites.
Montia diffusa	Sensitive	branching montia	Moist forests and open fir woodlands in lowland and montane zones.
Ophioglossum pusillum	Sensitive	adder's tongue	Seasonally wet areas, from forested sites to meadows to roadside ditches.

Table Botany-1. Sensitive vascular plant species with appropriate habitat in the planning area (Camp and Gamon, 2011).			
Scientific name	**Status**	**Common name**	**Habitat**
Parnassia palustris var. *tenuis* (aka *P. p.* var. *neogaea*)	Sensitive	Northern grass of Parnassus	Seepy road cuts and rock faces, wet meadows and along streams.
Polemonium carneum	Sensitive	Great polemonium	Woody thickets, open and moist forests, prairie edges, and roadsides.
Utricularia intermedia	Sensitive	flat-leaved bladderwort	Shallow ponds, slow moving streams, and wet meadows.

Field surveys were conducted for these species June – October, 2014, with a particular emphasis on potential *Parnassia palustris* var. *tenuis* habitat (Walker 2003). No new populations of this species were found, despite the presence of appropriate habitat in the planning area. In addition to this, attempts to relocate a known population adjacent to unit D30 were unsuccessful. This particular population was last documented over two decades ago, and at that time it was described as occurring on exposed rock on a riverbank, and having only 4 individuals covering 1 m^2. In the time since it was last documented, there have been several small landslides in the area, which may have extirpated this small population from this location.

Although appropriate habitat was present in the planning area for the other species described above, no new populations were found.

Bryophytes (mosses and liverworts)

Sensitive bryophyte species were assessed for the Lower Skokomish Commercial Thin planning area in May, 2014. Of the two species documented or suspected to occur on the ONF, one species – *Bartramiopsis lescurii* - was identified as having potential habitat in the proposed planning area (Table Botany-2).

Table Botany-2. Sensitive bryophytes with potential habitat in the project area (Camp and Gamon, 2011).			
Scientific name	**Status**	**Common name**	**Habitat**
Bartramiopsis lescurii	Sensitive	False apple moss	On humus, soil over rock, cliffs and in rock crevices; usually on rock substrates and vertical surfaces. Occurs in cool, humid canyons and stream terraces at low to moderate elevations.

Field surveys were conducted for this species June – October, 2014. Although appropriate habitat was present in the planning area, no new populations were found.

Fungi

There are no fungal species documented or suspected to occur on the ONF that are designated as Forest Service Sensitive in Washington State.

Lichens

There are no lichen species documented or suspected to occur on the ONF that are designated as Forest Service Sensitive in Washington State.

Environmental Effects: Regional Forester's Sensitive Species

Direct, Indirect and Cumulative Effects Under Alternative B

Vascular plants and bryophytes

There are no known sites of any of the botanical sensitive species described above within the proposed project area. Therefore, under all alternatives there would be no direct, indirect or cumulative effects to these species, nor would implementation of this project affect the viability of these species.

Survey and Manage Species

The Lower Skokomish Commercial Thin planning area applies one of the Pechman exemptions from a stipulation entered by the court on October 11, 2006 in litigation regarding Survey and Manage species and the 2004 Record of Decision related to Survey and Manage Mitigation Measure in *Northwest Ecosystem Alliance v. Rey,* No. 04-844-MJP (W.D. Wash., Oct. 10, 2006), as discussed in Chapter 1 of this document. Please refer to that section for details of that decision and how it applies to this proposal.

As it applies directly to botanical resources in the project area, all proposed units are in stands that are less than 80 years old, which exempts this project from protocols outlined in the most recent Survey and Manage Record of Decision. The result is that any Survey and Manage species on the 2003 list that may occur in the project area are excluded from protection through implementation of MMs. However, surveys were conducted for category A or C Survey and Manage species known to occur in the Skokomish watershed, which include the moss *Tetraphis geniculata* and the lichen *Platismatia lacunosa*. These surveys occurred concurrently with the sensitive species and invasive plant surveys discussed in this document; no new occurrences were found. There are no documented occurrences of any category B, D or E Survey and Manage botanical species in the project area. One category F Survey and Manage species, *Usnea longissima*, is abundant at a few sites within the planning area (but outside of units) including in older forest along the Skokomish River gorge at the High Steel Bridge, and between Brown Creek and the 2340 road northeast of Brown Creek Campground. However, it was only seen in a few units adjacent to these locations, and then only as litterfall, or in the crowns of individual trees, which suggests that this lichen may be in the process of colonizing these stands.

Invasive Plants

Noxious weeds and other invasive plants pose a serious threat to the health of National Forests. Executive Order 13112, Invasive Species (Feb. 1999), provides direction that "Federal agencies shall: (1) prevent the introduction of invasive species; (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (3) monitor invasive species populations accurately and reliably; (4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded." Prevention of invasive plant spread or new infestations, along with timely treatment and monitoring of infestations, are key objectives for the ONF. The 2008 ROD authorized the treatments included in the ONF Invasive Plant EIS "Beyond Prevention: Site Specific Invasive Plant Treatment Project" (USDA Forest Service 2008).

Invasive plant surveys were conducted concurrently with the sensitive plant surveys. In addition to this, the ONF Invasive Plant GIS cover and treatment records from the last five years were reviewed in May 2014 prior to the surveys to determine if there were additional known infestations that needed to be assessed in relation to this project. Below is the resulting list of invasive plants known to occur in the project area that are very likely to have an adverse ecological effect if infestations are left unchecked (Table Botany-3). Of particular concern are species that are shade tolerant which can persist, and potentially thrive if introduced in to harvested units, even if a relatively dense canopy remains, or develops over time. These species are bolded in the table below.

Table Botany-3. Invasive plant species documented in the Project Area.

Scientific name	Common name	Location
Arctium minus	lesser burdock	Along the 2340 road, less than 500 ft. from the edge of unit D30.
Cirsium arvense	Canada thistle	Scattered infestations throughout project area; most are restricted to road edges.
Cirsium vulgare	bull thistle	Scattered infestations throughout project area; most are restricted to road edges.
Cytisus scoparius	Scotch broom	Scattered infestations throughout project area; most are restricted to road edges, but some found on old roadbeds leading into interior of units, especially in units adjacent to the 24 road.
Geranium robertianum	herb Robert	Found in several units, both along road edges and in interior of unit. Units (and associated roads) include D10A (2340230); 33, 35, 36 and 37 (24 road); D29, D29B, D29C, D29E, R23 (2300200, 2351, and 2352). Also found along the southwestern edge of the Brown Creek rock pit and on an old landing associated with unit R23.
Hieracium caespitosum	meadow hawkweed	Scattered infestations throughout project area; most are restricted to road edges.
Ilex aquifolium	English holly	A few scattered individual fruiting trees, and smaller vegetative saplings throughout project area; most are restricted to road edges, but a few in interior of units, especially in D1, D2, and D3 units in the Dennie Ahl checkerboard area.
Lamiastrum galeobdolon	yellow archangel	A single, small infestation is located at the junction of the 23 and 2350 road, near unit D20.
Prunus laurocerasus	English laurel	A single large fruiting tree is located along the 2350 road near unit V1.
Senecio jacobaea	tansy ragwort	Scattered infestations throughout project area; most are restricted to road edges.

Alternative A (No Action)

Direct and Indirect Effects

Implementation of the No Action Alternative would result in no increase in suitable habitat for noxious weeds from project related activities. Suitable habitat for many weeds decreases with full canopy closure. Lack of disturbance and maintenance of the canopy would continue to

discourage the establishment of some of the weeds on the preceding list, allowing native species to occupy the majority of the habitat in the project area. Other factors that contribute to the introduction and establishment of weeds, such as transport on vehicles travelling through the project area, livestock spread of weeds, and spread of existing roadside noxious weeds would continue.

There is an overall low risk of noxious weed introduction and spread from this alternative.

Cumulative Effects

Because there would be no active management, there would be no cumulative effects with past, current, and foreseeable management actions.

Action Alternative B

Direct and Indirect Effects

The Alternative Action B would result in newly exposed ground associated with road construction, landings, and skid roads. These areas would be susceptible to noxious weed and invasive plant colonization, particularly because there are already invasive species documented in the area that could provide a ready seed source. Under all of the action alternatives, without mitigation, invasive species would continue to spread along existing road corridors, and could colonize disturbed areas within harvested units and along temporary roads constructed to access the units. In order to control invasive plant colonization and spread under the proposed action, prevention and weed eradication activities will be implemented before, during and after project activities as described in the PDCs and MMs section of Chapter 2. Forest Service and County personnel will continue to focus invasive plant treatments on infestations associated with this project. Project related activities will not occur within 25 feet of herb Robert infestations until they are brought under control. Gravel, straw mulch, and other material used for road construction and maintenance would come only from sources certified by Forest Service botanists or other qualified officials to be weed-free. Implementation of this action alternative with these mitigations would provide positive results in the treatment of current infestations and prevention of invasive plant spread.

Cumulative Effects

Past activities that have likely contributed to the introduction and spread of invasive plant species include but are not limited to the following:

- Construction of gravel and paved roads providing ease of access to the watershed;
- Timber harvest activities using machinery imported from other geographic areas containing different invasive species propagules;
- Erosion control measures and forage seeding projects introducing non-native invasive plant species in seed mixes and straw sediment barriers;
- Riding horses or use of livestock for packing introducing weed propagules through grain (feed) or manure.

On-going road maintenance in the form of blading, ditch pulling, and hauling away of associated debris to waste sites is currently spreading some invasive species, as is the use of material from infested rock sources for resurfacing.

Foreseeable future activities that may impact the spread of invasive plant species either positively or negatively include:

- Weed treatment projects under the ONF 2008 Invasive Plant Treatment EIS: "Beyond Prevention: Site Specific Invasive Plant Treatment Project" (USDA Forest Service 2008)
- Timber harvest on adjacent land that could potentially introduce additional unwanted plants to National Forest lands;
- Forest Service road decommissioning and culvert replacement projects;
- Proposed forage enhancement projects; and
- Potential post-thinning weed treatment projects.

The management requirements described in Chapter 2, and similar requirements that would be imposed by the 2008 Olympic National Forest Invasive Plant EIS (USDA Forest Service 2008) on future projects on National Forest System Lands in the project area, should serve to minimize the risk of invasive plant establishment and spread due to active management. Pre- and post-activity weed treatments would be likely to reduce or eliminate existing infestations, thereby improving conditions and reducing the potential for future spread. No cumulative adverse effects to invasive plant conditions in the project area would be anticipated under the action alternative proposed for the LSVMP planning area.

3.5 Wildlife Resources

Methodology

Wildlife specialists reviewed pertinent databases for species and habitat information, conducted field review of priority stands, and surveyed for potential nest trees. For all terrestrial federally-listed, Forest Service Sensitive Species, Survey and Manage, and Management Indicator Species (MIS) from the Forest Plan, and forest landbirds, analysis indicators include the effects to habitat quantified by acres affected, or to individuals if known. A display of habitat conditions for species of special status in the project area is provided in Table Wildlife-1. Species may be federally-listed as endangered, threatened, or proposed for listing; effects to these species are disclosed in this section of the environmental assessment and in the Terrestrial Wildlife Biological Assessment. Analysis indicators for federally-listed species will be acres of nesting, roosting, foraging, and dispersal habitat maintained or improved, degraded, downgraded, and removed, and acres of disturbance during the breeding season. Effects to critical habitat federally listed species will also be indicated as acres of habitat (aka primary constituent elements) affected. Pacific fisher is proposed for federal listing as a threatened species (estimated final ruling April 2016). Analysis indicators for Forest Service Sensitive Species will be acres of habitat maintained or improved, degraded, and removed or lost. Analysis indicators for Management Indicator Species will be acres of habitat maintained or improved and acres lost. For Survey and Manage species, analysis indicators will be acres of habitat maintained or improved and acres disturbed. Analysis indicators on migratory birds will be acres of habitat maintained, improved or disturbed.

Spatial and Temporal Context

The analysis area for effects on wildlife varies by species and reflects the area within which the

species could be directly and indirectly be affected by the proposed action and alternatives. For species with larger home ranges such as northern spotted owl, Roosevelt elk, fisher, or goshawk, the analysis area consists of the project area plus a distance representing a median home range in the Olympic Peninsula. For other species, the analysis area consists of the area of potential treatment. The time period for analysis is 30 to 40 years with affected stands, and over 100 years in context of the landscape.

For the northern spotted owl, the project area is defined by the area that contains all the proposed actions within the Lower South Fork Skokomish, Lower North Fork Skokomish, and Middle North Fork Skokomish 6th field watersheds. The analysis area was established by a 1.4 mile radius nest core buffer around treatment units plus all northern spotted owl home ranges (2.7 mile radius) that intersects the treatment unit buffers. Average fisher home ranges on the Olympic Peninsula are 15,700 acres for females and 31,700 acres for males (Lewis 2014). For fisher, the project area is defined by the area that contains all the proposed actions that will occur within the Lower South Fork Skokomish, Lower North Fork Skokomish, and Middle North Fork Skokomish 6th field watersheds.

Roosevelt elk mean home range sizes of up to 7,240 acres (Hutchins 2006) or 12,108 acres (Storlie 2006) have been reported for elk within managed forests. Home range size is generally smaller where habitat quality is higher. Concentrated use or "core" areas where the elk spend the majority of their time are generally much smaller than the home range size. In the analysis area, radio-collared elk as part of a Skokomish Indian Tribe study have been located in the checkerboard ownership in the southeast area of the Lower South Fork Skokomish and in the Lake Cushman area, but are predominately found on private land in the lower sections of the watersheds (Tropp-Ackerman, pers. comm., 2014). This is likely due to limited forage higher in the watershed as compared to agricultural lands.

Home range sizes for deer on the Olympic Peninsula are much smaller, with a recent study showing an average of 373 acres (range 168 to 1,583 acres; McCoy and Gallie 2005). The study area had a greater amount of early seral habitat than what is typically found on the ONF which has less open forested habitats. Therefore, home ranges on National Forest System lands may be larger. As with elk, there is generally a much smaller concentrated use area for deer.

DecAID Analysis

DecAID is an advisory tool developed to assist land managers inevaluating forest conditions and proposed forest management activities on organisms (bats, marten, pileated woodpecker and other primary cavity excavators, and mollusks) that use snags and downed wood (Mellen-MacLean et al. 2009). DecAID represents a statistical summary of the current knowledge and best available data on dead wood in PacificNorthwest ecosystems. An examination of historical conditions for snags and down wood levels on the landscape was compared to those with current conditions. In the South Fork and North Fork Skokomish watersheds there were two vegetative types that were analyzed, "Westside Lowland Conifer-Hardwood (WLCH) Forest, Washington Coast" and "Montane (higher elevation) Mixed Conifer (MMC) Forest" (See project record for DecAID Analysis) (Maggiulli 2010a, Maggiulli 2010b - See project record for complete DecAid Analyses). The WLCH vegetative type comprises the vast majority of the proposed thinning units within this project area. The DecAID analyses found a trend toward fewer medium (10-19 inches dbh) and large (>20 inches dbh) snags per acre under current conditions compared to historic conditions in the WLCH vegetative type. This disparity was especially pronounced for

the large snags. Historically, a larger proportion of the vegetative type had higher coverage of coarse woody debris than under current conditions. This difference was larger with respect to woody material in the larger (>20inches diameter) size category. These differences in snag and coarse woody debris levels between historic and current conditions were less pronounced in the MMC vegetative type, which is only minimally present in proposed thinning units. In addition, the information presented in the DecAID analyses represents conditions across the entire North Fork and South Fork Skokomish watersheds. This includes areas of the upper watersheds which were less impacted by harvest activities compared to the lower watersheds. Therefore, current snag and coarse woody debris conditions in the lower North Fork and South Fork Skokomish watersheds may be even more distinct from historic conditions than represented by these DecAID analyses. Information collected during field review found variability in snag and coarse woody debris levels between the stands proposed for thinning. In general, there were only low to moderate number of medium sized snags and few large snags. Coarse woody debris levels averaged of 6-8 percent cover across stands proposed for thinning (See Silviculture report and Table C-4 in Appendix C)..

In addition to structural conditions, DecAID describes the functional values of what each species needs in terms of snags and down wood values by determining and displaying "tolerance levels" (typically, 30%, 50%, or 80%) for size and density or percent cover for snags and down wood used by wildlife species. Tolerance levels are estimates of the percent of all individuals in the populations of a given species that are within some specified range of values for snags or down woody debris. In simplified terms, the higher the tolerance level, the higher the proportion of individuals in the populations that are being provided for in terms of the snag and coarse wood components of their habitat. A wildlife tolerance analysis was conducted for the Olympic National Forest (Maggiulli 2010c) and is referenced herein. Additional discussion on the methods, results assumptions and limitations of the DecAID tool are presented in the reports in the project record (Maggiulli 2010 a,b,c).

Affected Environment

The following table provides information on the species in the analysis area, their status, and general habitat description.

Table Wildlife-1. Federally listed wildlife species, Regional Forester's Sensitive Species, Olympic National Forest Management Indicator Species, Survey and Manage Species, and Landbirds with known occurrences or habitat in or adjacent to the project area.

Species	Status	Known to Occur in Analysis Area?	General Habitat Description
Northern spotted owl and Designated Critical Habitat	Federally listed, Threatened	One spotted owl nest core in project area. Designated Critical Habitat is within project area.	Nests in complex forested habitats with multi-layered canopies, large overstory trees, snags, and downed wood. Roosting and foraging similar to nesting but with lesser habitat components. Utilize younger, denser stands for dispersing.
Marbled murrelet and Designated Critical Habitat	Federally listed, Threatened	Seven historical occupied sites in the project area. Designated Critical Habitat is within project area.	Seasonal forest inhabitant for nesting only. Nests in older forested stands which may include remnant trees with one or more platforms on branches >4" diameter in large diameter live conifers.
[a]Taylor's checkerspot butterfly and	Federally listed,	No habitat is present in analysis area.	Open habitats (balds, created openings) with patches of vegetation of native forbs and grasses

Table Wildlife-1. Federally listed wildlife species, Regional Forester's Sensitive Species, Olympic National Forest Management Indicator Species, Survey and Manage Species, and Landbirds with known occurrences or habitat in or adjacent to the project area.

Species	Status	Known to Occur in Analysis Area?	General Habitat Description
Designated Critical Habitat	Endangered		that contain variety of host plant for feeding and overwintering.
Pacific fisher	Proposed for Federal listing, Threatened	No known den location in analysis area, but suitable habitat is present.	Same habitat as for northern spotted owl. Requires multiple rest sites that are often tree cavities, downed trees or snags.
Northern goshawk	Forest Service Sensitive	No historic territories within the analysis area. Documented within watershed. Habitat is present in analysis area.	Nests in dense, mature and late successional conifer forests.
Peregrine falcon	Forest Service Sensitive	No known locations, habitat is not present in analysis area.	Nests on cliff or rock outcrops. Primary forage along large bodies of water.
[a]Common loon	Forest Service Sensitive	Habitat not present in analysis area.	Inhabits salt and fresh water bodies, nesting in inland lakes and ponds.
Bald eagle	Forest Service Sensitive, Olympic NF Management Indicator Species	No known nest sites in project area, but have been observed roosting and foraging along the North and South Fork Skokomish Rivers.	Nests in conifer forests containing old-growth components typically within one mile of water.
Harlequin duck	Forest Service Sensitive	No known locations, but species utilizes South Fork Skokomish River.	Seasonal forest inhabitant. Nests along fast-flowing streams with loafing sites nearby.
Van Dyke's salamander	Forest Service Sensitive	No known locations, but suitable habitat is present.	Associated with streams, seeps and springs, wet talus and forest litter from sea level to 3,600 feet.
Olympic torrent salamander	Forest Service Sensitive	No known locations, but suitable habitat is present.	Found around the splash zone of cold, clear streams, seeps or waterfalls. Seeps running through talus slopes also provide habitat.
Townsend's big-eared bat	Forest Service Sensitive	No known locations but suitable habitat is present. No caves or mines in watershed.	Uses areas beneath sloughing bark, most often found in old-growth trees and snags. Commonly roosts in caves, large trees, mines, buildings and bridges for roosting.
[a]Olympic marmot	Forest Service Sensitive	Habitat not present in analysis area	Alpine and subalpine habitats; talus slopes.
Olympic pocket gopher	Forest Service Sensitive	Habitat not present in analysis area	Glacial outwash prairies.
Keen's myotis	Forest Service Sensitive	No known locations, but potential habitat is available in analysis area.	Utilizes a variety of moist coastal forests of lower elevations dominated by western hemlock, Sitka spruce, and other conifers. Day roosts in forested stands with increase in tree diameter, presence of defect, decreasing bark, and increasing proportion of old-growth in landscape or increasing proportion of trees in the early to late stages of decay.
Little brown myotis	Forest Service Sensitive	No known locations, but potential habitat is available in analysis area.	Habitat generalist and found in buildings and other structures, in conifer and hardwood forests (crevices and cavities of live trees, snags and stumps). Also found in open forests and forest margins associated with riparian areas and sites with open water.
Puget Oregonian	Forest Service Sensitive	No known locations, but potential habitat is available in analysis area.	Associated with hardwood shrubs and trees.

Table Wildlife-1. Federally listed wildlife species, Regional Forester's Sensitive Species, Olympic National Forest Management Indicator Species, Survey and Manage Species, and Landbirds with known occurrences or habitat in or adjacent to the project area.

Species	Status	Known to Occur in Analysis Area?	General Habitat Description
Malone's jumping slug	Forest Service Sensitive	No known locations, but potential habitat is available in analysis area.	Found in moist forested habitats, generally over 50 years old with greater than 50% canopy cover; dense sword fern, coarse wood, exfoliated bark piles.
Broadwhorl tightcoil	Forest Service Sensitive	No known locations, but potential habitat is available in analysis area.	Associated with exceptionally moist and very diverse forest sites at lower elevations. Typically in abundant ground cover (*Gaultheria*, *Oxalis*, sword fern, grasses), conifer or hardwood overstory, and moderate to deep litter.
Keeled Jumping Slug	Forest Service Sensitive	No known locations, but locally common and abundant on Olympic National Forest. Potential habitat is available in analysis area.	Associated with moist conifer forests.
Western bumble bee	Forest Service Sensitive	No known locations, but potential habitat is available in analysis area.	Associated with meadows and openings in forested areas. Habitat including flowering plants for foraging and rodent burrows for nesting.
Johnson's hairstreak	Forest Service Sensitive	No known locations in southeast portion of Peninsula, but suitable habitat is present.	Depends on old-growth hemlock that contains mistletoe.
[a]Golden hairstreak	Forest Service Sensitive	Habitat not present in analysis area.	Associated with golden chinquapin.
[a]Makah copper	Forest Service Sensitive	Habitat not present in analysis area.	Associated with meadow and prairie habitats.
[a]Olympic artic	Forest Service Sensitive	Habitat not present in analysis area.	Associated with higher elevation meadows and along shale ridges and summits with sparse grasses.
[a]Puget blue or Blackmore's blue	Forest Service Sensitive	Habitat not present in analysis area.	Associated with dry alpine meadows. Host on lupine. May occur on roadside and forest openings.
[a]Lupine blue	Forest Service Sensitive	Habitat not present in analysis area.	Alpine and subalpine dry meadows. Host plant Cushion buckwheat.
[a]Valley silverspot	Forest Service Sensitive	Habitat not present in analysis area.	Occupies subalpine habitat.
American marten	Olympic NF Management Indicator Species	No known locations but suitable habitat is present in analysis area.	Coniferous forest, normally older stands; use large logs, snags and live trees for denning/resting.
Primary cavity excavators (various species)	Olympic NF Management Indicator Species	Species and habitat present in analysis area.	Standing dead and dying trees of various sizes for feeding, resting and nesting in conifer and hardwood forests.
Pileated woodpecker	Olympic NF Management Indicator Species	Species and habitat present in analysis area.	Nests in decadent live trees and in snags (primarily broken top). Pacific silver fir favored species, but will nest in older western hemlock. Roosts in larger diameter western hemlock snags or live western redcedar. Forage in closed-canopy habitat with large, relatively hard snags.
Roosevelt elk	Olympic NF Management	Species and habitat present in lower portions of the South Fork	Species uses wide variety of successional conditions for life stages (farmland, riparian,

Table Wildlife-1. Federally listed wildlife species, Regional Forester's Sensitive Species, Olympic National Forest Management Indicator Species, Survey and Manage Species, and Landbirds with known occurrences or habitat in or adjacent to the project area.

Species	Status	Known to Occur in Analysis Area?	General Habitat Description
	Indicator Species	Skokomish and North Fork Skokomish watersheds.	openings, older forests). Higher quality habitat found in younger aged habitats.
Columbia black-tailed deer	Olympic NF Management Indicator Species	Species and habitat present in analysis area.	Occupy a range of habitats, often with dense vegetation. Consume variety of browse including woody shrubs, forbs, lichens and some grasses. Food source more abundance in recently disturbed areas with less canopy cover then denser, mid-age to older forests.
Neotropical migratory birds	Migratory Landbirds	Species and habitat present in analysis area.	Focus in coniferous forests; depending on species may have close association with understory shrubs or early successional habitats; hardwoods; snags and conifers.
[a]Survey and Manage species (mollusk)	Survey and Manage	Project activities for thinning in stands <80 years of age exempt survey requirements. Rock pit development is not exempt from survey requirements.	Survey efforts would focus on habitat favored by mollusk species (downed wood, deciduous overstory and high level of leaf litter. Habitat is not present in rock pit expansion areas; therefore surveys are not required. .

[a]Species will not be analyzed further due to absence of habitat in analysis area.

Federally Listed and Proposed Species

The project area provides habitat for two wildlife species currently listed as threatened under the Endangered Species Act: the marbled murrelet and the northern spotted owl. "Threatened" status means that the species is likely to become endangered within the foreseeable future. A third federally listed species, the Taylor's checkerspot butterfly, is not found in the project area. Habitat is not present for this species in the project area.

Northern Spotted Owl

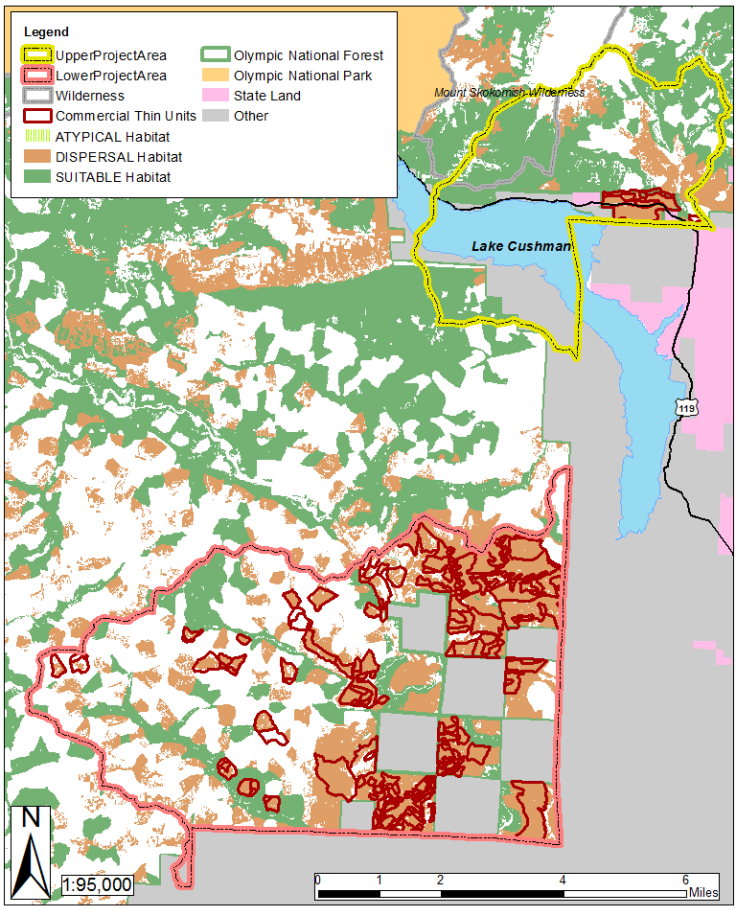
The northern spotted owl (*Strix occidentalis caurina*) was federally listed "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USDI 1990). Designated critical habitat was federally designated in 1992 and revised in 2012 (USDI 1992, 2012). Northern spotted owl critical habitat subunit NCO-2 (North Coast Range Region) is approximately 213,633 acres in size (USDI 2012). Of that, 17,421 (GIS) acres (about 8 percent) is located in the analysis area, with the bulk of it occurring in blocks in the southwest corner and northern tip of the analysis area. Only 28 acres of critical habitat subunit NCO-1 occurs in the analysis area, and may simply represent mapping error along the boundary of the analysis area.

Designated critical habitat for the northern spotted owl is comprised of primary constituent elements with specific characteristics that make areas suitable for nesting, roosting, foraging and dispersal habitat. To be essential to the conservation of the northern spotted owl, these features need to be distributed in a spatial configuration that is conducive to persistence of populations, survival and reproductive success of resident pairs, and survival of dispersing individuals until they can recruit into a breeding population (USDI 2012). The designated critical habitat for

northern spotted owl within the project analysis area contains approximately 4,523 acres of older forest (nesting and roosting habitat) and mid-seral forest (foraging habitat); 3,364 acres of less structurally complex mid-seral forest (dispersal habitat); and 2,219 acres non-habitat (young forest stand, natural openings, water, etc.). In general, nesting and roosting habitat is in forested stands with moderate to high canopy closure (60 to 80 percent); multi-layered, and multi-species with large diameter (greater than 30 inches dbh) overstory trees; a high amount of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of deformity/decay); large diameter dead trees; and a large accumulation of fallen trees and other woody debris on the ground (USDI 2012). In the coast range of Washington, the characteristics of roosting habitat differ from those of nesting habitat only in that roosting habitat need not contain the specific structural features used for nesting. Foraging habitat is associated with high tree height, canopy cover, number of snags, density of large diameter snags (greater than 20 inches dbh), number of trees greater than 31 in dbh, and high volume of downed wood (USDI 2012). Dispersal habitat at a minimum consists of stands with adequate tree size and canopy cover to provide protection from avian predators (goshawk, great horned owl, barred owl) and minimal foraging opportunities. It is normally defined as stands on average of 11inches dbh, with canopy cover between 40 and 60 percent (Thomas et al. 1990).There is a total of approximately 6,045 acres of suitable nesting, roosting, and foraging habitat and approximately 9,144 acres of dispersal habitat for the spotted owl within the overall project area (approximately 26 percent and 39 percent of the project area respectively). The remaining balance of the analysis area (approximately 35 percent) would be considered non-habitat for the northern spotted owl.

A qualitative assessment of how nesting, roosting, and foraging habitat is currently distributed on the landscape shows a difference in the distribution patterns between the North Fork Skokomish and South Fork Skokomish portions of the project area. Within the South Fork Skokomish portion, suitable habitat occurs primarily in small (<100 acres), or elongated and narrow (generally less than 1,000 feet wide) parcels along riparian areas. The most contiguous pieces of suitable habitat in the project area exist in the headwaters of Vance Creek and Rock Creek. Outside of this suitable habitat, dispersal habitat is fragmented by younger stands of non-habitat. The adjacent portion of the Lower North Fork Skokokmish River watershed had a very minimal amount of suitable habitat, but more contiguous blocks of dispersal habitat. The Lower South Fork and Lower North Fork Skokomish River watersheds have incurred extensive fragmentation, especially at lower elevations. Forest Service ownership adjacent to non-federal ownership is primarily dispersal habitat with scattering of older, legacy remnants. While the Middle North Fork Skokomish portion of the project area has also incurred habitat fragmentation as a result of past harvest activities on and outside of federal lands, there still remains a moderately large (>1,500 acres) and relatively contiguous block of suitable habitat to the west. In addition, a more contiguous patchwork of suitable habitat and dispersal habitat exists to the north of proposed units in this portion as well. Figure Wildlife-1 shows the distribution of spotted owl habitat across the project area.

Figure Wildlife-1. Suitable (green) nesting habitat for marbled murrelets and spotted owls and Dispersal (light brown) habitat for spotted owls within the project area.



On the Olympic Peninsula, the mean nest core and median home range areas for the northern spotted owl is approximated by circles (1.4 mile radius for nest core; 2.7 mile radius for home range). The nest patch is defined as the 300 meter (about 0.19 mile) radius area around a known or likely nest site (USDI 2012). The home range is 14,271 acres in size (USDA/USDI 1994a), and a minimum of 40 percent of the home range (5,708 acres) should consist of nesting, roosting, and foraging habitat to stay above the "take" threshold for suitable habitat. The nest core should contain a minimum of 1,971 acres (50 percent) of nesting, roosting, and foraging habitat in order to stay above the "take" threshold (USDI 2012).

There are three northern spotted owl home ranges within the analysis area. One activity center has its nest core within the analysis area, but no proposed units are within the core area. Three northern spotted owl home ranges contain the rock pits that would be proposed for use. One core area contains one proposed rock pit. Status of threshold levels within each home range and nest core are found in Table Wildlife-2. Project activities would not remove suitable habitat, and as such would not contribute to further deficits of suitable habitats below thresholds

Table Wildlife-2. Northern Spotted Owl Status and Information on sites within 2.7 miles of Proposed Activities within Lower South Fork and North Fork Skokomish Watersheds.

Site Name/WDFW Number	Occupancy Status	History	Acres of Suitable and Dispersal Habitat in Nest Core (1.4 mile radius)	Acres of Suitable and Dispersal Habitat in Home Range (2.7 mile radius
Skinwood Creek/#17	Occupied	2006-2016: No surveys. 2005: Female, non-nesting. 2004: Adult banded (unknown sex). 2003: No detections. 2002: No detections. 1999-2001: No surveys.	Suitable – 2,115 Dispersal – 310 Non-Habitat – 1,514	Suitable – 5,110 **(Below Threshold)** Dispersal – 2,191 Non-Habitat – 5,410
Mt. Tebo/Upper Lebar/#885	Occupied	2006-2016: No surveys 2005: No detections. 2004: No detections. 2003: Male, undetermined status. 2002: No detections. 2001: No detections. 2000: No detections. 1999: No surveys	Suitable—1,306 **(Below threshold)** Dispersal—962 Non-Habitat—1,673	Suitable—7,204 Dispersal—2,177 Non-Habitat—4,687
Lebar Creek/#709	Occupied	2006-2016: No surveys 2005: Pair, one young. 2004: Pair, two young. 2003: No detections. 2002: Pair, nesting status undetermined; male subadult. 2001: Pair, nesting status undetermined; two fledglings found and banded. 2000: Single male response on one night; nesting status undetermined. 1999: No detections.	Suitable—2,272 Dispersal—115 Non-Habitat—1,052	Suitable—6,325 Dispersal—1,663 Non-Habitat—3,579

Previous work by Anthony et al. (2004), showed that the northern spotted owl population in Washington has been performing poorly despite the protection of a substantial amount of habitat on federal lands. The 2004 Status Review (Courtney et al. 2004) looked at spotted owls across their range and determined that a number of factors are responsible for the decline of the species, most notably the threat posed by the barred owl (*Strix varia*) which has shown to have a negative effect on displacing spotted owls and outcompeting them for nesting and prey. The second status review (Davis et al. 2011), showed that the northern spotted owl population on the Olympic Peninsula, in particular, is declining. It again showed that the barred owl, along with the amount of suitable nesting and roosting habitat, were the two factors most associated with the decline in

the vital reproductive rates for the northern spotted owl (Davis et al. 2011). Surveys in the South Fork Skokomish and North Fork Skokomish watersheds have not been conducted since 2005. None of the activity centers have incurred removal of suitable habitat since the last survey efforts. Therefore each of the activity centers with home ranges in the planning area is considered occupied for purposes of this analysis (USDA and USDI 2015).

On the eastern slope of the Olympic Peninsula, the northern flying squirrel (*Glaucomys sabrinus*) makes up 45 percent of prey consumed, followed by other small to medium-sized mammals including the southern red-backed vole (*Clethrionomys gapperi*), bushy-tailed woodrat (*Neotoma cinerea*), snowshoe hare (*Lepus americanus*), and deer mouse (*Peromyscus* spp.) (Forsman et al. 2001). Habitat for each of these species varies, but common attributes include higher density of downed material and overstory canopy cover, as well as snags. Dec AID analysis suggests that as much as one-third or more of the landscape may not even meet the 30 percent Tolerance Level for medium snags (10-19 inches dbh range) for northern flying squirrels and bushy-tailed woodrats. Field data for stands proposed for thinning suggest slightly better outcomes for proposed thinning stands for medium snags, but even fewer proposed stands that would meet even the lower tolerance levels for larger snags.

Despite the seeming lack of barred owl presence in the watershed during previous survey efforts (B.Biswell, personal communication, 2010), it is likely that the species has moved into the area since. In general, barred owls tend to prefer lower elevations and river bottoms, but they have been found in higher country as well. Courtney et al. (2004) devote an entire chapter of the Northern Spotted Owl Status Review to the interactions and potential threats to northern spotted owl populations posed by barred owls. Drawing from a number of studies and other observations, they describe the general agreement that barred owls have undergone range expansion and population increases throughout the range of the northern spotted owl. Barred owls use similar habitats in addition to some habitats not used by spotted owls, including second-growth dominated or more fragmented landscapes. There is overlap in the diet of the two species, but barred owls generally consume a wider variety of prey items. In addition to the potentially competitive elements of habitat and diet overlap, observations indicate that barred owls are more aggressive in interactions between the two species. Throughout the range of spotted owls, barred owls now occupy many territories once occupied by northern spotted owls. Given the above, there is the presumption that barred owls have had a role in displacing spotted owls (Courtney et al. 2004). Additionally, Olson et al. (2005) found that barred owls had a substantial negative effect on the probability of site occupancy by spotted owls, and can lead to declines in spotted owl occupancy. Overall, an examination of patterns of coexistence between owl species shows the great potential for these two species to be strong competitors, with the larger barred owl likely being competitively superior to the slightly smaller spotted owl (Gutierrez et al. 2007).

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) was federally listed as threatened due to extensive harvest of late-successional and old-growth forest, which provides nesting habitat for the species (USDI 1992). Critical habitat was federally designated in 1996 and revised in 2011 (USDI 1996, 2011). There are a total of approximately 15,151 acres of designated critical habitat in the analysis area. Marbled murrelet critical habitat block WA-03-b is approximately 64,993 acres in size (USDI 1992, 2013). Of that, 11,479 acres is located in the analysis area, primarily in the southern block. Critical Habitat Block WA-06-b is approximately 44,195 acres

in size (USDI 1992, 2013). Of that, approximately 3,672 acres is located within the analysis area, in the North Fork Skokomish portion. Designated critical habitat for the murrelet is comprised of two primary constituent elements (PCE) that are essential for marbled murrelet nesting: trees with potential nesting platforms (PCE 1), and forest areas within 0.5 miles of trees with potential nesting platforms that have canopy heights of at least one-half the site-potential tree height (PCE 2) (USDI 1997). The analysis area for marbled murrelet contains 6,045 acres of older forested stands that could be deemed suitable as nesting habitat (PCE 1). Nesting habitat can generally be approximated by northern spotted owl nesting habitat, but in older stands with specific tree attributes serving as nesting platforms (large diameter branches with a flat surface (over four in), deformities, forked branches, moss or mistletoe) with adequate cover to reduce exposure to microclimate and predators. The USFWS has defined a suitable nest tree (SNT) as a live conifer of at least 18 inches dbh that contains one or more platforms located in the live crown of a tree 33 feet or more above ground and within 55 miles of marine waters (USDI 2013).

On the Olympic Peninsula, murrelet populations are divided into two geographic zones: Conservation Zone 1 (Puget Sound, Hood Canal, and the Strait of Juan de Fuca), and Conservation Zone 2 (along the Pacific Coast). The analysis area is within Marbled Murrelet Conservation Zone 1 (USDI 1997). Based on estimates of terrestrial habitat loss and ongoing threats in the marine environment where the bird feeds, the USFWS concluded that the listed marbled murrelet population has declined considerably since 2002; citing multiple factors including: nest-site predation, human-induced mortality in the marine environment, and reduction in prey availability (USDI 2009). The most recent documentation of murrelet activity in the analysis area was in 2000. Seven murrelet sites (unknown nesting, but circling behavior in canopy suggests a nest nearby) are within the analysis area (all are within the lower South Fork area). Six of these sites are within designated critical habitat for the murrelet in the Rock and Vance Creek drainages. Murrelets demonstrate high nest site fidelity and the sites are considered occupied. The larger contiguous blocks of suitable nesting habitat and majority of marbled murrelet detections are outside the analysis area in the upper reaches of the South Fork Skokomish watershed and Lake Cushman, in addition to the aforementioned block of habitat in the Middle North Fork Skokomish. Figure Wildlife-1 shows the distribution of marbled murrelet nesting habitat across the project area. Only 4 sites sites are within 0.5 mile of proposed thinning units or other project activities such as proposed temporary roads. The other two murrelet sites are farther than 0.5 miles from any of the proposed project activities and therefore are not presented in the tables or analyses below. None of the sites are within 0.5 mile of proposed helicopter landings, or proposed rock pits(Table Wildlife-3).

Table Wildlife-3. Marbled Murrelet Site Status and Information for sites within 0.5 mile of Proposed Activities in the Lower South Fork and North Fork Skokomish Watersheds.

Site Number	Status	History	Acres of Suitable Habitat within 0.5 mile Area
2351	Historic Occupied	1994 – visual of one bird landing in stand	Locations considered same 93 acres
2352	Historic Occupied	1996 – visual of one bird in tree (nest status undetermined)	
2355	Historic Occupied	2000- visual of two birds circling above stand	155 acres

Table Wildlife-3. Marbled Murrelet Site Status and Information for sites within 0.5 mile of Proposed Activities in the Lower South Fork and North Fork Skokomish Watersheds.

Site Number	Status	History	Acres of Suitable Habitat within 0.5 mile Area
2356	Historic Occupied	2000- visual of two birds circling above stand	133 acres

The Recovery Plan for the Marbled Murrelet (USDI 1997) cites the central reason for listing the species as loss of nesting habitat. To fulfill the objective of stabilizing the population, the plan focuses on protecting occupied habitat, minimizing the loss of unoccupied but suitable habitat within designated critical habitat, and protecting marine habitats. Relative to the LSVMP, specific recovery actions outlined in the plan include using silvicultural techniques to encourage development of new habitat, focusing on trees that will provide nesting platforms.

Pacific Fisher

The Pacific fisher (*Martes pennanti*) is proposed for federally listing by USFWS due to the loss of old-growth habitat and other factors (USFWS 2014); the final rule to determine if the species is warranted to be listed is expected in the spring of 2016. The species commonly occurs in landscapes dominated by mature forest cover and have been categorized by some researchers as "closely-associated" with late-successional forests (Thomas et al. 1993). Fishers have been found selecting for stands with higher overhead canopy cover due to the increased security and snow-interception that it provides, as well as in those areas with high structural complexity on the forest floor (Weir and Harestad 2003). Seasonally, fishers are known to use both young and mature forest types depending on the shift in prey availability. Additionally, female fishers utilize two distinct sites as dens. Natal dens are comprised of living and dead standing trees with cavities. Maternal dens have been documented as occurring in downed wood, or logs (USDA 1994). Trees used as resting structures are often the largest trees, snags, or down logs available (Weir and Harestad 2003, Zielinski et al. 2004). Northern spotted owl suitable (nesting, roosting, foraging) habitat can be used as a proxy for determining fisher habitat. Approximately 6,045 acres of suitable habitat for fisher can be found in the analysis area. The fragmented distribution of that habitat has been previously discussed. Beginning in 2008, 90 fisher were reintroduced in the Olympic National Park. The animals have spread out across the Peninsula, including the ONF and industrial forest lands. Fishers have been detected in the Upper South Fork Skokomish watershed and North Fork Skokomish watershed. The nearest detection locations within analysis area were about 1.2 miles from the nearest proposed thinning unit.

Forest Service Sensitive Species (Forest Service Region 6)

Designation as a "sensitive" species means that these species are given special management consideration to ensure their continued viability on National Forest lands. Species such as the American peregrine falcon and Pacific bald eagle were placed on the Sensitive Species list concurrent with their federal de-listings, in 1999 and 2007, respectively. The Biological Evaluation for Region 6 Sensitive Species reflects the most recent updates to the Regional Forester's Sensitive Species list and the species are shown in Table Wildlife-1 (USDA 2015). One salamander species (Cope's giant salamander) and one butterfly (Dog Star Skipper) were

removed from the list in 2011. At the same time, several new butterflies and one mollusk were added. Most recently, the Northern goshawk and Western bumblebee were added to the list. Sensitive mollusk species are discussed in the subsequent section which also includes Survey and Manage species. Except for previous and unrelated surveys for bats and salamanders in the watersheds, there have been no surveys conducted for sensitive species in the analysis area.

Northern Goshawk

The northern goshawk (*Accipiter gentalis*) uses mid- to large-diameter trees for nesting and perching, and requires an open flight corridor beneath the canopy to be successful in searching for food and capturing prey. Suitable nesting habitat for the northern goshawk includes mature or old coniferous forest, with relatively closed canopies and multiple canopy layers, and a high density of larger trees (greater than 23 inches). Northern spotted owl habitat is used as a proxy for goshawk habitat; approximately 6,045 acres of suitable habitat is present in the analysis area. At the nest stand level, Finn et al. (2002) found a higher occupancy rate on the Olympic Peninsula when shrub cover was relatively low in the stand and when there was a greater depth of the overstory canopy. At the landscape level, Finn et al. (2002) found lands surrounding occupied historical goshawk nest sites to be dominated by late-seral forest and to a lesser degree by mid-seral forest. Bloxton (2002) found the dominant avian prey on the Olympic Peninsula included grouse, pigeons and Steller's jay, and the important mammalian prey included snowshoe hare, Douglas squirrel, and northern flying squirrel which are found in the analysis area. The species has been documented in both watersheds, with the closest detection approximately 1.5 miles from the nearest proposed unit. There are no documented territories within the project area.

American Peregrine Falcon

The American peregrine falcon (*Falco peregrinus anatum*), a formerly listed endangered species, was removed from federal listing status in August 1999 after the USFWS determined that it was no longer endangered or threatened. Peregrine falcon need cliffs or rock outcrops for suitable nesting habitat. While there are such cliffs in the upper part of the South Fork Skokomish watershed there have not been any documented sightings of the species. Peregrines feed on a variety of smaller birds (Hays and Milner 2004), many of which could be present in the project area.

Pacific Bald Eagle

The bald eagle *(Haliaeetus leucocephalus*) is discussed herein in the context of a Management Indicator Species as well as a Sensitive Species. The Pacific bald eagle was listed as a threatened species in 1978 (USDI 1978) in Washington, Oregon, Minnesota, Wisconsin, and Michigan (in the rest of conterminous United States the species was listed as endangered). The factors in listing the bald eagle included: 1) destruction or modification of habitat from such activities as logging, housing developments, and recreation; 2) direct mortality of adult and immature eagles as a result of shooting; 3) inadequacy of existing regulatory mechanisms (i.e. the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act); and 4) human pollutants causing reproductive failure (USDI 1978). The stepdown outline to achieve recovery included: 1) providing secure habitat; 2) inventorying and monitoring habitat and populations; 3) developing and maintaining public awareness and law enforcement programs; and 4) augmenting bald eagle population levels through management and protection.

As a result of nearly three decades worth of work by numerous individuals and agencies, the bald eagle in the Pacific states has made a dramatic recovery. In 2007, the final rule to delist the species was published in the Federal Register on July 9th and became effective on August 8th (USDI 2007a). Despite the delisting, the bald eagle will continue to be federally protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, and in Washington remains a state listed sensitive species. Section 4(g)(1) of the Endangered Species Act requires that species that have been recovered and delisted should be monitored for not less than 5 years after their removal from the ESA (USDI 2007a). The final post-delisting monitoring plan for the bald eagle came out in May 2010 (USDI 2010) and describes a 20-year monitoring program beginning in 2009. The idea behind this post-delisting monitoring is to make sure that any failures of the species to sustain itself are detected and that, if warranted, listing procedures are initiated, including emergency listing if needed (USDI 2010). This monitoring includes nest check monitoring.

Eagle nests are more common near marine shorelines, but also can be found at inland lakes, rivers, and reservoirs. The winter distribution of birds is similar to the breeding distribution, with heavier concentrations at salmon spawning streams and waterfowl wintering areas. Washington's breeding adults typically leave their territories in late summer to migrate northward to British Columbia and southeast Alaska in search of seasonally available foods (spawning salmon runs). Juveniles and fledglings will also head north, but juvenile movements can be more nomadic and random, and fledglings may stay several months away from Washington. The two most critical habitat features necessary for breeding bald eagles are the presence of large, dominant trees, capable of supporting their weight and their massive nests, and adequate food supplies. The trees must be located near water with a low level of human activity and replacement nest trees are critical, given the eagles' average relatively long life expectancy of 5-20 years. Perch trees scattered throughout a territory are also necessary.

The interior of the Olympic Peninsula is almost entirely federally owned (National Forest and National Park), however, the prime eagle habitat, along the three shorelines, including the Pacific Coast, Strait of Juan de Fuca, and Hood Canal, is primarily in private or state ownership (and these areas are where most bald eagle nests on the Peninsula are located). In terms of management of eagles on the National Forest, the Olympic Land and Resource Management Plan (USDA 1990A) describes 16 bald eagle existing and potential nesting areas. These were originally identified in the Pacific States Bald Eagle Recovery Plan (USDI 1986) as the Forest's share of sites determined necessary for recovery (USDA 1990b, pg. III-69). The FEIS (USDA 1990b, pg. IV-55) also states that the primary limiting factor for bald eagle populations on the Forest is the amount of feeding habitat, and that, "Nesting habitat is not currently nor is it expected to be a limiting factor for bald eagle populations on the Olympic National Forest if the standards and guidelines are followed."

There are 17 historic sites listed for the Olympic National Forest, including 16 nests and one communal roost. All the nest sites have had some level of monitoring by Washington Department of Fish & Wildlife, including occupancy and productivity surveys being collected as early as the late 1970s. Most WDFW survey work was done each year during the early eagle breeding (occupancy) period (April 7-25), and included documenting activity at historic nests, as well as searching for new nests. Likewise, mid-winter surveys were done throughout the Olympic Peninsula from 1982-1989.

Beginning in 2008, ONF began conducting its own eagle surveys, which has included monitoring of specific nest sites, as well as inventories of planning areas for new nests and other

eagle activity. Bald eagle surveys in the South Fork Skokomish watershed, from the forest boundary up to where Steel Creek enters the river (west of the analysis area), were conducted in April of 2009 and 2010. No nests or birds were observed during either flight. The surveyor observed that the lower and upper stretches of the survey area (Skokomish watershed) had smaller trees that may be less suitable for eagles (Olympic National Forest Bald Eagle Survey, 2009). The surveyor in 2010 remarked on the low flow rate of the river and that it would "not [be] likely to have a substantial fishery capable of supporting an eagle population," and that "few waterfowl were seen on the river" (Olympic National Forest Bald Eagle Survey, 2010).

Most of the prime bald eagle habitat, and therefore productive nests, on the Olympic Peninsula is adjacent to marine waters and therefore are not on the Olympic National Forest. Nonetheless, the Forest generally does have some nesting activity each year in other watersheds. The South Fork Skokomish River has adequate nesting habitat, but may not provide enough forage for breeding eagles (M. Stalmaster, pers. comm. 2010). Large trees suitable for nesting eagles are protected during all Forest project activities and would not be cut unless they posed a human safety hazard. The bigger impact to eagles from Forest activities would include any work (timber harvesting, road decommissioning or building, etc.) that might cause disturbance and/or adverse effects to water quality and the fisheries resources. There are no documented eagle nests within the analysis area or within 1 mile of proposed thinning units or other project activities. Historic nests are located outside of the project area, on non-federal lands.

Common Loon

Common loons (*Gavia immer*) inhabit both saltwater and freshwater bodies. They nest in inland lakes and ponds and forage in both types of water systems (Erhlich et al. 1988). While Lake Cushman and Lake West are both within the boundaries of the analysis area, they are not immediately adjacent to proposed thinning units or related activities such as proposed road building, rock pit development, or helicopter landings. There were no recorded observations of common loon within the analysis area within our available databases.

Harlequin Duck

The Harlequin duck (*Histrionicus histrionicus*) is a sea duck which winters along rocky Pacific coasts and moves inland to breed in the Olympic Mountains. During the nesting season from April to June, the adults require fast flowing streams with loafing sites nearby (Lewis and Kraege 1999). Harlequin ducks appear to be sensitive to human disturbance, which can discourage use at traditional nesting sites and thereby lower productivity. In addition, aquatic insect larvae make up the bulk of the diet during the breeding season and low levels of benthic invertebrates can also impact their productivity (Lewis and Kraege 1999). There have been no documented observations of this species in the USFS watershed, however given the ample supply of streams the species is assumed to be present.

Van Dyke's Salamander

The Van Dyke's salamander (*Plethodon vandykei*) is generally considered the most "aquatic" of the woodland salamanders, is usually associated with seepages and streams but can also be observed far from water (Leonard et al. 1993). Overall, it requires moist, shady environments with cool temperatures and high humidity, which often involves a sufficient overstory in order to maintain microclimate stability (Nordstrom and Milner 1997). It can be found in the splash zones of creeks or waterfalls under debris, or under logs, bark and bark on logs near water. It is also found in wet talus and forest litter from sea level to 3,600 feet (Nordstrom and Milner 1997).

Surveys conducted in late 1987 and 1991 documented Van Dyke's salamander along the South Fork Skokomish River at Brown Creek Campground, and further up in the watershed. Habitat also exists along many of the numerous streams within the project area, and therefore, the species is assumed to be present throughout the North Fork and South Fork Skokomish.

Olympic Torrent Salamander

The Olympic torrent salamander (*Rhyacotriton olympicus*) is the only species of torrent salamanders found on the Olympic Peninsula. The species is nearly always found around the splash zone of cold, clear streams, seepages, or waterfalls. Seepages running through talus slopes also provide habitat. The streams and riparian forest in the project area provide habitat for this species. Surveys conducted in 1991 documented Olympic torrent salamander along a tributary to the South Fork of the Skokomish River near Steel Creek in the upper watershed. The species is assumed to be present throughout the North Fork and South Fork Skokomish watersheds.

Townsend's Big-Eared Bat

The Townsend's big-eared bat (*Corynorhinus townsendii*) is a cave-dwelling species that will also utilize human structures, such as buildings, if they provide a "cavern" component. They will night roost in more open settings, including under bridges (I-beam or cast-in-place bridges, as opposed to wooden or cement flat bottom bridges) because of the heat-capturing properties of the former (Perlmeter 1995). Suitable roosts are critical components for the survival of the Townsend's big-eared bat (Woodruff and Ferguson 2005). Many species of bat also utilize the areas beneath sloughing bark, most often found on old-growth trees and snags. There are no caves in the Lower South Fork Skokomish or North Fork Skokomish watersheds that would serve as likely roosts. In 2005, day and night surveys for Townsend's big-eared bat were conducted under bridges across the forest. The species was documented under a bridge over the South Fork Skokomish at the 23/2353/2354 road junction**.** The remnant late-successional forest in the analysis area contains large trees and snags that could be suitable for bat roosting. The species is assumed to be present.

Keen's Myotis

Keen's myotis (*Myotis keenii*) is a bat species that has a very limited distribution ranging from Southeast Alaska down the coast of British Columbia and to the Puget Sound area in Washington. Keen's Myotis and western long-eared bats (*Myotis evotis*) are virtually indistinguishable in hand and where the two overlap, most studies lump data regarding the two species together (Grindal 1998). As with other bats, they primarily consume invertebrates and more specifically have been documented consuming those in the Diptera, Lepidoptera, Neuroptera, Arachnida, and Trichoptera groups (Kellner and Harestad 2005).

Keen's are more likely to use a tree for roosting with increase in diameter, presence of defect, decreasing bark, and increasing proportion of old-growth on the landscape or increasing proportion of trees in the early to late stages of decay in the surrounding area (Boland et al. 2009). During the active season, the species is largely restricted to moist coastal forests of lower elevations dominated by western hemlock, Sitka spruces, and other conifers. Reproductive females have been found roosting in old-growth forests (WDFW 2013). Day roosts commonly occur in structurally complex forests with abundant older and larger diameter living trees and snags (WDFW 2013). Surveys for Keen's myotis were conducted in the Upper South Fork Skokomish watershed in 2011 and none were found. However, given the presence of habitat,

this species is assumed to be present. While this species is likely foraging over the project area, the likelihood of proposed thinning stands containing suitable roost trees is low compared to that of surrounding late-successional forest.

Olympic Marmot

Olympic marmots *(Marmota olympus)* are endemic to the Olympic Peninsula, meaning that the species is not found anywhere else. They are found in sub-alpine and alpine meadows and talus slopes (Linzey and Hammerson 2008), and as such the majority are found in Olympic National Park. Marmots are present in habitat along Mt Ellinor, which is along the periphery of the analysis area. However, there are no meadows or talus slopes that would be suitable for marmot within the 1 mile of proposed project activities.

Olympic Pocket Gopher

There are 15 recognized subspecies of pocket gophers, eight of which occur in Washington. In western Washington, the Olympic Mazama pocket gopher *(Thomomys mazama melanops)*is associated with glacial outwash prairies, although their distribution seems patchy as some high quality prairies within the species' range lack gophers (Steinberg and Heller 1997). The species is seriously imperiled in Washington, primarily due to habitat destruction and degradation from agricultural expansion, livestock grazing, fire suppression, exotic plant invasion, and urban sprawl, and many of the historic populations have disappeared or diminished to such a degree that their presence was not obvious (Steinberg 1995). It is also threatened by pesticide and herbicide spraying. The Olympic pocket gopher subspecies is found in the Olympic National Park in Clallam County where it is restricted to subalpine habitat of the higher Olympic Mountains. There are not any glacial outwash prairie systems in the analysis area so it is unlikely that pocket gophers inhabit the area.

Little Brown Bat

The little brown bat (*Myotis lucifugus*) is one of the most common and widespread bat species in the Pacific Northwest. The species is a habitat generalist and is common in both conifer and hardwood forests, but also found in along forest margins (WDFW 2013). Day roosts include a variety of sites such as buildings, tree cavities and beneath bark, rock crevices, caves and mines. Tree-roosting reproductive females commonly use older patches of forest and select for taller, larger-diameter trees often in early stages of decay with deep cavities (WDFW 2013). Habitat for little brown bat is found in the analysis area. The species has not been formally documented in the project area but is assumed to be present.

Western Bumblebee

The western bumblebee (*Bombus occidentalis*) was once common in the western United States and has been declining (Hatfield et al. 2012). Bumblebees are important pollinators of wild flowering plants and crops. As generalist foragers, they do not depend on any one flower type. Bumblebees are threatened by many kinds of habitat alterations which may destroy, alter, fragment, degrade or reduce their food supply (flowers that produce the nectar and pollen they require), nest sites (e.g. abandoned rodent burrows and bird nests), and hibernation sites for over-wintering queens. The species can fly a half mile or more to reach foraging patches. Major threats that alter landscapes and habitat required by bumblebees include agricultural and urban development (Hatfield et al. 2012). Surveys for the western bumblebee have not been conducted in the analysis area or elsewhere on the Olympic National Forest, although the species has been

documented in Olympic National Park (Rhoades et al. 2016). The species prefers more open habitat than in a forested landscape, but there could be use of forest stands and adjacent non-forested landscapes in the analysis area that bumblebees use.

Johnson's Hairstreak

The Johnson's hairstreak (*Callophrys johnsoni*) is considered the only old-growth obligate butterfly in this region (Pyle 2002). All sightings in both Washington and Oregon have been in coniferous forests. Conifer forests containing the mistletoe of the genus *Arceuthobium* (commonly referred to as dwarf mistletoe) are necessary for this species (WDFW 1995) as that is what emerging larvae feed upon (Pyle 2002). Larsen et al. (1995) states that old-growth and late successional second growth forests provide the best habitat for this butterfly, although younger forests where dwarf mistletoe is present also supports Johnson's hairstreak populations. Perhaps one reason for infrequent sightings of this butterfly could be due to the species spending a majority of its time in the top of the forest canopy (Scott 1986; Pyle 2002).

One survey visit was conducted for larval Johnson's hairstreak in the South Fork Skokomish watershed with no results. Given the presence of late-successional old-growth in portions of the project area, this species is likely to be present, but is not expected in proposed thinning units. It could however be found in individual legacy trees or suitable nest trees within units, which will be protected with conservation measures.

Region 6 Sensitive and Survey and Manage Mollusk Species

Mollusk species that are listed on the Regional Forester's Sensitive Species list (USDA 2015) and/or species that fall under the 2001 Record of Decision (Survey and Manage) and were identified as having potential habitat in the proposed project area are disclosed below. Chapter 1 discusses policy regarding Survey and Manage Species. In cases where Survey and Manage species are also on the Regional Forester's Sensitive Species list (USDA 2015), the more stringent survey and manage requirements apply. As it applies directly to wildlife resources in the project area, all proposed units are in stands that are less than 80 years old, which exempts this project from protocols outlined in the most recent Survey and Manage Record of Decision (See Chapter 1). Surveys are not required for Category E species, such as the Keeled Jumping slug. In addition, mollusk surveys are not required when habitat is not present or for projects "which affect suitable habitat elements but are dispersed through a project area so that less than 5% of those habitat components in the project area are negatively affected" (Duncan et al. 2003; p.10). Habitat for these species is not present in proposed rockpit expansion areas or less that 5% of habitat components would be affected, therefore surveys are not required.

Puget Oregonian

The Puget Oregonian snail (*Cryptomastix devia)* (R6 Sensitive Species, Survey and Manage Category A) is associated with hardwood shrubs and trees. It is only known from the ONF from one shell found on the Hood Canal Ranger District. Despite extensive surveys across the Forest, no other shells or live animals have been discovered (J. Ziegltrum, personal communication, 2006). Regardless, habitat for the Puget Oregonian does occur within the project area in the form of hardwood trees, particularly big leaf maple and vine maple. It is assumed the Puget Oregonian could occur in the project area.

Malone's Jumping Slug

The Malone's jumping slug (*Hemphillia malonei*) (R6 Sensitive, Survey and Manage Category C) occurs in moist forested habitats, generally over 50-years-old with greater than 50 percent canopy cover especially where dense sword fern, conifer logs, CWD, exfoliated bark piles, and large decaying stumps are present. It can also be found in marshy open sites with dense skunk cabbage, fallen logs and other low vegetative cover (Duncan et al. 2003). This species has not been found on the ONF despite extensive surveys in similar habitats (J. Ziegltrum, personal communication, 2006). Additionally, while the project area is technically within the range of this species, the only area with documented suitable habitat on the ONF is a small portion of the Wynoochee River watershed.

Keeled Jumping Slug

The Keeled jumping slug (*Hemphillia burringtoni*) (R6 Sensitive Species, Survey & Manage Category E) is locally common and abundant on the Olympic National Forest (Ziegltrum 2001 and Ziegltrum 2004), and occurs in moist conifer forest. This species formerly included the species complex (Wilke 2004) of both warty jumping slug (*Hemphillia glandulosa*) and Burrington's jumping slug (H. burringtoni). There are no pre-disturbance survey requirements for Category E species. There is likely presence of the species due to available habitat and documentation elsewhere on the Forest.

Broadwhorl Tightcoil

The broadwhorl tightcoil (*Pristiloma johnsoni*) is a terrestrial land snail and is primarily associated with exceptionally moist and very diverse forest sites (Frest and Johannes 1999). Typical site descriptions include abundant ground cover (Gaultheria, Oxalis, sword fern, grasses), conifer or hardwood overstory, and moderate to deep litter. The species is confined to lower elevation sites or to the lowest available point at a site, for example the base of a slope (Xerces Society 2010). The species has not been documented on the ONF, but habitat is present. Activities that compact soils or snow, disturb ground vegetation and/or litter, remove woody debris, alter temperature and/or humidity of the microsite, reduce canopy cover, or alter the water table can impact the species.

Blue-Gray Tail-dropper

The blue-gray tail-dropper slug (*Prophysaon coeruleum*) (Survey and Manage Category A) occurs in moist conifer and mixed conifer-hardwood forests, usually located in sites with relatively higher shade and moisture levels than those of general forest habitat. It is usually associated with partially decayed logs, leaf and needle litter (especially hardwood leaf litter), mosses and moist plant communities, including big leaf maple, and sword fern plant associations (Duncan et al. 2003). The project area is within the reported range of these species. However, this species has not been found on the ONF despite extensive surveys in similar habitats (J. Ziegltrum, personal communication, 2006), making its presence in the project area highly unlikely.

Hoko Vertigo

The project area is outside of the documented range of occurrence of the Hoko Vertigo snail (*Vertigo n.* spp.)(Survey & Manage Category A). The Hoko Vertigo snail is arboreal and occurs in moist forest conditions within 200 meters of water where deciduous shrubs and small hardwood trees are present (Duncan et al. 2003), but has only been documented in the Hoko

River drainage on the northwestern Olympic Peninsula, in Clallam County. Field surveys were not required for this species due to a lack of occurrence, lack of habitat, or lack of potential impacts (Duncan et al. 2003).

Management Indicator Species

American Marten

The current geographic distribution of American marten (*Martes americana*) in the Pacific Northwest has been dramatically reduced, and is likely attributable to the loss of late-successional forests (Buskirk and Ruggiero 1994). It appears that the subspecies has been extirpated in the coast range in southwest Washington and that it is rare on the Olympic Peninsula (Sheets 1993). In terms of field surveys, there has been little evidence of the species on the Peninsula despite years of remote camera surveys going back in from the late 1990s to present. Recent remote camera surveys were done during the summer of 2010 and the fall/winter of 2011 on ONF in The Brothers Wilderness, Mount Skokomish Wilderness, the Church Creek drainage, and the Mount Rose area (where the 2008 animal was found). No photos of martens were taken at any of these stations. However, two reliable observations of marten (one in Olympic National Park, one in a wilderness area of the Olympic National Forest) were recorded in 2015, which continue to suggest that the species is still present on the Olympic Peninsula. An additional factor potentially affecting any marten populations that remain on the Peninsula is the recent reintroduction of fisher into Olympic National Park. Martens and fishers have evolved sympatrically (overlapping and competing with each other in the same range, as separate species) in the late-successional forests of the Pacific Northwest, though in the West martens generally occur at higher elevations than fishers (Ruggiero et al. 1994). Martens are also more arboreal, exhibit more subnivean (under snow) activity, and eat smaller prey than fisher (Buskirk and Ruggiero 1994). In areas where fishers and martens coexist, they may do so via niche partitioning with martens eating smaller prey (eg. voles) under the snow (Martin 1994). Competitive interactions between martens and other mustelids (a specific family of carnivorous mammals) have not been reported (Buskirk and Ruggiero 1994).

There have not been any studies conducted on habitat utilization for American marten on the Olympic Peninsula; all information on habitat use for Washington is derived from work done in the Cascade Range. Jones and Raphael (1991) found that martens used old-growth forests more frequently than expected based on availability within the home range. They also documented that martens used areas near streams heavily; most telemetry locations were within 150 meters (492 ft) of a perennial stream (Raphael and Jones 1997, Jones and Raphael 1991). Additionally, marten selected sites with higher canopy closure during snow periods than during snow-free periods (Raphael and Jones 1997). In Washington, canopy cover at rest sites averaged 75 percent in snow periods and 67 percent in snow-free periods. Marten use a variety of structures for rest and den sites. Resting and denning sites offer protection from predation and thermal stress; thus, availability of quality denning sites likely increases the rates of survival and fecundity in marten (Raphael and Jones 1997). In the Washington Cascades, Jones and Raphael (1991) found martens resting in live trees (42 percent), snags (23 percent), and slash piles (11 percent). Large diameter trees were used more often than smaller trees with an average dbh of live trees of 100 cm (39 inches) and 81 cm (32 inches) for snags. They also located 5 natal dens in large diameter live trees or snags. In addition to providing rest and den sites, down wood is an important component of marten habitat because the primary prey of martens is small mammals associated

with down wood. Subnivean (under snow) spaces created by logs provide marten with access to prey during the winter (Bull and Blumton 1999, Buskirk and Ruggiero 1994, Sherburne and Bissonette 1994). Habitat does exist in the analysis area.

DecAID analysis suggests that in general densities of snags are relatively higher in late-seral stands in Montane Mixed Conifer Forests. MMC Forests naturally provide more dead wood habitat across the landscape than the other habitat types. This habitat type likely provides the best habitat for marten. The MMC habitat type constitutes only small proportion of the analysis area, and only a fraction of the acres proposed for thinning. No late successional stands in this habitat type, (or any other type) are proposed for thinning.

Threats:
Past extensive logging of mature forests and trapping have led to extirpation of marten in some areas (NatureServe 2010). This reduction in the amount of late-seral habitat, as well as fragmentation of the remaining habitat, and associated declines in snags and coarse wood all continue to be of concern with marten populations (Wisdom et al. 2000; Hargis et al. 1999). Further, roads that fragment habitat can also lead to continued trapping pressure (Wisdom et al. 2000). Other threats include limited availability of prey (Wisdom et al. 2000), predation (Bull and Heater 2001), and mortality resulting from territorial interactions between martens (Bull and Heater 1995).

Future:
The selected alternative for the NWFP (USDA and USDI 1994a) was determined to meet the NFMA requirement to provide for a diversity of plant and animal communities.

The American marten was one of 15 mammals determined to be closely associated with late-successional and old-growth forests (USDA and USDI 1994b; 3&4-182). A viability assessment was completed by the Forest Ecosystem Management Assessment Team (FEMAT) (1993). The viability outcome for the American marten was assessed and additional mitigation measures were implemented to increase the likelihood that habitat would be of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across federal lands under the NWFP.

The mitigation measures implemented in the NWFP to increase this likelihood were to increase the amount of "CWD" in the matrix and to implement wider Riparian Reserves. Implementation of these mitigation measures "would be sufficient to support a stable, well-distributed population throughout most of its range. However, marten populations are low in the Olympic Peninsula and the Oregon Coast Range, and there is some chance that populations may not recover in those provinces" (USDA and USDI 1994b; J2-473).

The Forest Service has been implementing the NWFP and monitoring late-successional habitat trends since 1994. The 10-year monitoring report (Haynes et al. 2006) states "…it appears that the status and trends in abundance, diversity, and ecological functions of older forests are generally consistent with expectations of the Plan. The total area of late-successional and old-growth forest (older forests) has increased at a rate that is somewhat higher than expected, and losses from wildfires are in line with what was anticipated."

As a result projects consistent with the NWFP should be expected to maintain viability of late-successional associated species such as the marten. This assumption will need to be supported with additional analysis on the Siuslaw and Olympic National Forests. Projects designed to enhance late-successional forest should result in a call of improving habitat conditions.

Pileated Woodpecker

The pileated woodpecker (*Hylatomus pileatus*) is a wide-spread resident in forested areas of Oregon and Washington. The birds use mature and older closed canopy stands for nesting and roosting, but may use younger (40 to 70 year old), closed-canopy stands for foraging if large snags are available; large snags and decadent trees are critical habitat components for pileated woodpeckers; down logs do not appear to be an important foraging substrate for pileated woodpeckers on the west side of Oregon and Washington (Hartwig et al. 2004, Mellen et al. 1992, Raley and Aubry 2006).

Nest trees on the Olympic Peninsula were in both decadent live trees and snags; Pacific silver fir was the preferred species, but many nests were in decadent (dead top) western hemlock trees; nest snags were primarily broken topped (Aubry and Raley 2002). Roost trees were larger than nest trees; typically roosts were in western hemlock snags or live western redcedar; roost trees contained extensive hollows created by heartwood decay; pileated woodpeckers used an average of 7 different roost trees per year (Aubry and Raley 2002). Sites used for foraging had higher densities of large snags (greater than 51cm (21 inches) dbh and greater than 7.5 meters (25 feet) tall), which were sound or moderately decayed (Raley and Aubry 2006); the average density of large snags in plots with recent pileated woodpecker foraging activity was 100 percent greater than in plots with no recent foraging activity (Raley and Aubry 2006). Patches of these large, relatively hard snags in closed-canopy habitat conditions provide optimal foraging habitat.

The species has a large mean home range on the Olympic Peninsula: female pileated woodpeckers is 2,371 acres; males is 2,208 acres; and for pairs, is 2,132 acres (Aubry and Raley 1996).

Threats:
The availability of large snags on the ONF is the likely limiting factor for pileated woodpeckers given that several large snags per acre are required to meet the nesting, roosting, and foraging requirements of the species. Forested areas on the landscape that have not been harvested are more likely to meet these requirements, while managed stands may or may not, depending on how many legacy snags were left during the initial harvest operations. The 6,045 acres in the project area that have been identified as northern spotted owl and marbled murrelet "suitable habitat" would largely correspond with late-successional forest conditions and would likely meet pileated woodpecker needs. DecAID analysis and field data suggest that few if any of the stands proposed for thinning would meet even the 30 percent tolerance level for large snags for pileated woodpeckers, for either nesting or foraging. Medium size snags would be provide a modicum of foraging value, but eh larger size snags are most valued by this species as discussed above.

Population trends from breeding bird data for pileated woodpecker are negative, however some concerns (small sample sizes, imprecise results, and inconsistent trends) exist with the numbers (Sauer et al. 2008). From the Partners in Flight database (Panjabi et al. 2005), the population

trend is described as "highly variable, or unknown," and threats listed as "expected future conditions for breeding populations are expected to remain stable, no known threats."

Future:
The selected alternative for the NWFP (USDA and USDI 1994a) was determined to meet the NFMA requirement to provide for a diversity of plant and animal communities. The pileated woodpecker was one of 36 birds determined to be closely associated with late-successional and old-growth forests, with occurrence of large snags necessary for optimal habitat (USDA and USDI 1994b; 3&4-177). A viability assessment was completed by the Forest Ecosystem Management Assessment Team (FEMAT 1993). The viability outcome for the pileated woodpecker suggested that "Habitat is of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across federal lands" (USDA and USDI 1994b; 3&4-179). This outcome determination was based on provisions of: 1) a large system of LSRs, 2) standards and guidelines for riparian reserves, and 3) retention of green trees, snags, and CWD within the matrix.

The Forest Service has been implementing the NWFP and monitoring late-successional habitat trends since 1994. The 10-year monitoring report (Haynes et al. 2006) states "…it appears that the status and trends in abundance, diversity, and ecological functions of older forests are generally consistent with expectations of the Plan. The total area of late-successional and old-growth forest (older forests) has increased at a rate that is somewhat higher than expected, and losses from wildfires are in line with what was anticipated." As a result projects consistent with the NWFP should be expected to maintain viability of late-successional associated species such as the pileated woodpecker.

Primary cavity excavators

Primary cavity excavators is a group that represents species dependent on standing dead trees or snags of varying sizes for feeding, resting and nesting. Five species of primary cavity excavators occur on the Olympic Peninsula including the downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), northern flicker (*Colaptes auratus*), red-breasted nuthatch (*Sitta canadensis*), and red-breasted sapsucker (*Sphyrapicus thyroideus*). All of these species require snags of an appropriate size, species, and condition and density, but the snags must be provided in the right habitat type. Table Wildlife-4 summarizes the general habitat of each bird species. In general, larger snags are better and provide for more individuals in a population.

Table Wildlife-4. Primary Cavity Excavator Species Information within Lower South Fork and North Fork Skokomish Watersheds.	
Species	**Habitat Description Specific to Forested Landscapes**
Downy woodpecker	Deciduous riparian woodlands and lowland deciduous forest (alder, cottonwood, willow, aspen, oaks). Low and mid-elevations. Nest primarily in dead trees, with preference of red alder.
Hairy woodpecker	Dry and wet coniferous forests at low to mid-elevations. Also use deciduous forest and riparian areas, especially if adjacent to coniferous forest. Use all ages of forest stands, possible preference for older stands for nesting. Nest primarily in moderately decayed snags with Douglas-fir and western hemlock preferred species. Occur in higher densities in mature and old-growth stands on the west side of the Cascades.
Northern flicker	Habitat generalist, though most abundant in open forests or forest edges. Use coniferous and deciduous forest, and riparian woodlands. Nests are in large snags. Douglas-fir and western hemlock snags primary nest trees.
Red-breasted nuthatch	Breeding habitat is conifer and mixed conifer-hardwood forest. West of the Cascades the species may be more abundant in older forests. During non-breeding season they may occur in deciduous woods. Nest in snags or dead limbs of Douglas-fir, grand fir, and big-leaf maple.
Red-breasted sapsucker	Wet and moist coniferous forests and mixed deciduous-coniferous forests. Abundance increases with stand age. Nests are typically in large snags or trees with decay. Occur in higher densities in mature and old-growth stands on the west side of the Cascades.

In general, larger snags are better and provide for more individuals in a population. Cavity-nesting birds, which include primary cavity excavators as well as other species, will use medium snags as well, but at higher densities of these medium snags for a given tolerance level, compared to large snags. In other words, it takes fewer large snags to provide for a larger proportion of the population compared to medium sized snags. DecAID analysis suggests that as much as a third of the analysis area would fail to meet even the 30% tolerance level for medium snags for these groups of species. Late seral stands would likely provide for these species at the 80% tolerance level. Field data suggest a slightly higher proportion of stands proposed for thinning that would meet the 30% or 50% tolerance level. However, for large snags, DecAID analysis suggests that the majority of the analysis area (likely representing the area outside of late seral/suitable spotted owl habitat) would not even meet the 30% Tolerance Level for large snags for this groups of species. Field data showed very low densities of large snags in stands proposed for thinning.

From 1993 to 2001, landbird monitoring was conducted in eight watersheds on Olympic National Forest (Whittaker and Engelman 2001, Huff and Brown 1998). Results from this survey effort indicated that primary cavity excavators, including the hairy woodpecker, red-breasted nuthatch, northern flicker and pileated woodpecker, were fairly widespread on the Forest. Two other species, the downy woodpecker and red-breasted sapsucker were also detected but not extensively, likely because the study sites only included old coniferous forest habitats. Systematic landbird surveys have not been conducted since 2001, but incidental sightings also indicate that these cavity nesting species occur and are widespread (though abundance is not known) on the Forest.

Threats:

As with the pileated woodpecker, the availability of large snags and different species of snags on the ONF is the likely limiting factor for primary cavity excavators. Forested areas on the landscape that have not been harvested are more likely to meet these requirements, while managed stands, in most cases, probably do not. The 6,045 acres currently in the project area that

have been identified as northern spotted owl and marbled murrelet "suitable habitat" would largely corresponds with late-successional forest conditions, and would likely have the range of sizes and species of snags required by this group of animals. Each of these species is expected to occur within the analysis area.

Future:
The selected alternative for the NWFP was determined to meet the NFMA requirement to provide for a diversity of plant and animal communities (USDA and USDI 1994a). Ten cavity-nesting MIS were determined to be closely associated with late-successional and old-growth forests, with occurrence of large snags necessary for optimal habitat (USDA and USDI 1994b; 3&4-177). A viability assessment was completed by the Scientific Analysis Team (SAT) (Thomas et al. 1993). The viability outcome for the cavity nesting species found on the Olympic National Forest suggested that "Habitat is of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across federal lands" (USDA and USDI 1994b). This outcome determination was based on provisions of: 1) a large system of LSRs, 2) standards and guidelines for RRs, and 3) retention of green trees, snags, and CWD within the matrix.

The Forest Service has been implementing the NWFP and monitoring late-successional habitat trends since 1994. The 10-year monitoring report (Haynes et al. 2006) states "…it appears that the status and trends in abundance, diversity, and ecological functions of older forests are generally consistent with expectations of the Plan. The total area of late-successional and old-growth forest (older forests) has increased at a rate that is somewhat higher than expected, and losses from wildfires are in line with what was anticipated."

As a result, projects consistent with the NWFP should be expected to maintain viability of the cavity-nesting MIS.

Roosevelt Elk and Columbia Black-tailed Deer

Roosevelt elk (*Cervus canadensis roosevelti*) and Columbia black-tailed deer *(Odocoileus hemionus columbianus)* are known throughout the ONF and Olympic Peninsula. Elk on the Olympic Peninsula are associated with the Olympic elk herd, although they are distributed throughout a variety of watersheds in smaller groups (WDFW 2005). Deer occur throughout the subwatersheds associated with the project area. Both species use a combination of habitats comprised of cover, forage, water, and space.

The Forest Plan requires that twenty percent of the area necessary for winter survival should be managed as optimal cover (USDA 1990). Winter range for deer and elk on the west side of the Olympic Peninsula is typically defined as land below 1,500 feet in elevation, due to snow accumulations at higher elevations (Taber and Raedeke 1980a, 1980b). The analysis area has approximately 17,879 acres that are below 1,500 feet.

Optimal cover has understory and overstory components which provide forage as well as snow-intercepting canopy to allow more forage to be available. These criteria are generally achieved when dominant trees average 21 inches in diameter or greater, there is 70 percent or greater canopy closure, and the stand is predominantly in the large sawtimber condition (USDA 1990).

Models to evaluate elk habitat have recently been developed and validated by researchers, and include elk nutrition and elk habitat use components (Boyd et al. 2011). These models place

more emphasis on summer range because of the importance of this seasonal period to elk productivity (Hutchins 2006). The Westside Elk Summer Nutrition model predicts the amount of dietary digestible energy (DDE) that elk can acquire from a given plant community during this period. It can be used on its own or with the more comprehensive elk habitat use model. The inputs that drive the nutrition model are potential natural vegetation zone (PNV), modeling region, percent canopy cover of all live trees, and the proportion of total live trees that are hardwoods. Only the latter two inputs are generally subject to management manipulation. In general, higher DDE values are attained with decreasing canopy cover and increasing proportion of hardwoods. Forage quality is inherently limiting to most Westside environments. Therefore any increase in the amount of area within the higher DDE values can potentially result in benefits to elk nutrition and associated productivity. Within the analysis area, results from the Nutrition model suggest the majority of the analysis area is in the "poor" to" low-marginal" category for forage quality under existing conditions. This includes areas proposed for treatment. Adjacent non-federal lands show a higher proportion of area in the "low-marginal" to" high marginal" categories. The only areas modelled in the "Good" or "Excellent" categories are lowland private agricultural lands and (small) higher elevation openings or meadows on National Forest lands, respectively.

The Westside Elk Habitat Use model incorporates the nutrition model along with additional inputs to predict levels of elk use across the landscape. Those inputs are distance to cover-forage edge, mean slope, and distance to public use roads. In general terms, higher use occurs closer to cover-forage edges, on more gentle slopes, and further from public use roads. Results from the Habitat Use model suggest medium-low levels of use by elk across the majority of the analysis area and proposed treatment units, with medium to medium-high levels of use predicted in areas adjacent to non-federal lands.

Reported home range size for elk varies widely on the Olympic Peninsula, depending on the study area and habitat quality, as well as the estimation technique used. Mean home range sizes of up to 7,240 acres (Hutchins 2006) or 12,108 acres (Storlie 2006) have been recently reported for elk within managed forests within their home range. Home range size is generally smaller where habitat quality is higher. Concentrated use or "core" areas, where the elk spend the majority of their time, are generally much smaller than the home range size.

Home range sizes for deer on the Olympic Peninsula are much smaller, with a recent study showing an average of 373 acres (range 168-1583 acres; McCoy and Gallie 2005). That particular study area likely has more early seral habitat than typical National Forest project planning areas. Therefore, home ranges on National Forest Lands may be larger. As with elk, there is generally a much smaller concentrated use area for deer when the habitat quality is greater.

Threats:

The availability, abundance and quality of forage are important factors influencing the productivity of populations of both deer and elk. Elk reproductive rates and survival are influenced by home range quality and nutrition (Cook et al. 2004, Hutchins 2006). Preferred forage areas are in natural openings or managed stands generally less than 20 years old. Lower elevation, south-facing slopes in the late winter or early spring that have an earlier emergence of grasses and forbs are a particularly important source of forage for cow elk in the late term of pregnancy (M. Zahn, pers. comm., 2009). The enhancement of forage through management

activities such as thinning and the creation of openings can have a positive benefit on elk home range quality. Complex, uneven-aged timber stands are generally preferred by deer over more simplified, even-aged stands. Small openings and structural heterogeneity within and between stands are also beneficial to deer (Nelson et al. 2008).

In the short term, thinned areas, especially the more open "gaps", would likely develop more understory that could be available as forage for a longer period, due to minor reductions in canopy cover. This will benefit both species. Silvicultural prescriptions which retain and favor hardwoods would also benefit the elk nutrition component. Currently those stands probably function primarily as hiding cover.

Both species are susceptible to disturbance or direct mortality associated with vehicle access. Harvest of both species is generally allowed, though restrictions vary by Game Management Unit (GMU). The cluster of stands proposed for thinning in the North Fork Skokomish portion of the project area are located in GMU 621. However the largest proportion of stands proposed for thinning are in GMU 636.Winter mortality, legal harvest, and poaching were reported as the primary causes of elk and deer morality in Washington (Taber and Raedeke 1980a, 1980b, Bender et al. 2004). Poaching of elk is believed to be prevalent on the Olympic Peninsula (WDFW 2005). A high density of roads can have a negative impact on elk, due to increased disturbance from legal hunting and poaching (CEMG 1999, McCorquodale et al. 2003). Therefore, closing roads no longer needed results in a notable reduction in disturbance to elk (Witmer and deCalesta 1985), and would also benefit deer. Habitat guidelines for black-tailed deer suggest decommissioning of unneeded roads after management activities are complete in order to reduce road effects, as well as the monitoring and treatment of invasive plant species along road systems (Nelson et al. 2008).

The Washington Department of Fish and Wildlife (1996) recommends that road densities stay below 1.5 miles per square mile in elk summer/fall range and below 1.0 miles per square mile in winter/spring range. Roads closed to highway vehicle traffic that are accessible to OHVs and other forms of travel can still have impacts on elk (Naylor 2009). Road densities in the drainages across the analysis area are variable, but in many drainages are higher than the recommended levels. The road density for open, drivable roads is 1.86 miles per square mile across the entire analysis area; in the area of summer range (above 1,500 feet), the road density is 2.1 miles per square mile, and in winter range (below 1,500 feet) it is 1.6 miles per square mile. The further breakdown of drivable road densities by drainage (HUC 7) is provided in Table Wildlife-5. These figures represent the totals for each entire drainage that overlaps with the project area and are not clipped to the project area boundary.

Table Wildlife-5. Current Road Density by 7th Field Watershed within Analysis Area in South Fork Skokomish and North Fork Skokomish Watershed. (This table uses open road density compared to the table in fisheries analysis which uses all roads).

HUC 7 Watersheds	Miles of Drivable Roads	Square Miles	Road Density (Miles/SqMiles)
Big Creek	11.86	5.84	2.03
Brown Creek	0.02	7.98	0.00
Fir Creek	3.49	2.70	1.29
Flat Creek	18.44	6.84	2.70
Frigid Creek	4.27	3.91	1.09
Lake Cushman	3.96	18.11	0.22
Lilliwaup Creek	0.03	17.84	0.00

Table Wildlife-5. Current Road Density by 7th Field Watershed within Analysis Area in South Fork Skokomish and North Fork Skokomish Watershed. (This table uses open road density compared to the table in fisheries analysis which uses all roads).

HUC 7 Watersheds	Miles of Drivable Roads	Square Miles	Road Density (Miles/SqMiles)
Lower North Fork Skokomish River	3.36	6.42	0.52
Lower South Fork Skokomish River	13.78	13.16	1.05
McTaggert Creek	4.20	5.25	0.80
Middle South Fork Skokomish River	0.13	10.72	0.01
Upper Middle Fork Satsop River	0.16	34.56	0.00
Vance Creek	28.14	21.30	1.32

On the Olympic Peninsula, deer populations have increased in some GMUs and have decreased in others. The 2009 game status and trend report (WDFW 2009) predicted there may be longer term declines on USFS lands where there is little timber harvest or strategies that target older stand ages classes, but stated that populations may have stabilized in these areas over the past decade. There are two population management units (PMU) that encompass the project area. Harvest-based statistics suggest that deer populations in PMU 64 (includes GMU 621) are relatively stable, while the populations in PMU 65 (includes GMU 636) appear to be stable or slightly declining. Population trends within localized areas or within different GMUs may differ from the trend in the overall PMU (WDFW 2014).

For elk on the Olympic Peninsula, overall populations appear to be stable to increasing (WDFW 2010). A 3-point minimum antler restriction on harvested bulls was established in 1997 to increase bull escapement (WDFW 2005). Elk in PMU 64 occur in low densities overall and the majority are found in GMU 621 within the PMU. Productivity and calf recruitment rates are believed to have declined in this PMU since the late 1990's and early 2000's. This decline includes a drop at or below levels necessary to promote population growth from 2007 to 2009, with an increase in these rates in 2013. For elk in PMU 65, trends in total harvest and hunter success rates suggest the elk population in PMU 65 has remained stable or increased slightly since 2001. Calf recruitment rates have been at or slightly below levels necessary to promote an increasing population (WDFW 2014). Variable density thinning and native forage seeding projects on USFS lands are expected to increase forage in those areas, although the gains may be modest (WDFW 2010; 2014).

Future:

The selected alternative for the NWFP (USDA and USDI 1994a) was determined to meet the NFMA requirement to provide for a diversity of plant and animal communities. Project activities should improve the quality and quantity of understory forage resources for both deer and elk, however moderately. Reduction in open road densities should reduce effects from disturbance and direct mortality and enhance foraging in those areas. As such, activities should maintain or improve summer range habitat in the short term and enhance optimal cover over the long term. As a result, the project should be expected to maintain the viability of early-successional associated species such as the Roosevelt elk and black-tailed deer.

Neotropical Migrant Birds and Landbirds of Priority

Executive Order (EO) 13186, signed by the President on January 10, 2001, defined the responsibility of federal agencies to protect migratory birds and their habitats. The intent of the

EO was to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and minimize the take of migratory birds through consideration in land use decisions and collaboration with the USFWS. Pursuant to EO 13186 the Forest Service entered into a Memorandum of Understanding with the USFWS in January 2001 with the express purpose of incorporating migratory bird habitat and population management objectives and recommendations into the agency planning processes.

The ONF falls within the Northern Pacific Rainforest delineation of Bird Conservation Regions (BCR) identified by the North American Bird Conservation Initiative (Partners in Flight 1998). High priority breeding forest birds include the northern spotted owl, marbled murrelet, northern goshawk (*Accipiter gentilis*), chestnut-backed chickadee (*Poecile rufescens*), red-breasted sapsucker (*Sphyrapicus ruber*), and hermit warbler (*Dendroica occidentalis*). Birds of Conservation Concern (BCC) for BCR 5 include the northern goshawk, olive-sided flycatcher (*Contopus cooperi*), rufous hummingbird (*Selasphorus rufus*), and purple finch (*Haemorhous purpureus*). The project area provides habitat to the species mentioned above. The northern spotted owl, marbled murrelet, and northern goshawk were addressed earlier in this document. The factors to address for neotropical migratory birds include the effects to seasonal habitats.

In coniferous forests of Western Oregon and Washington, 27 species of neotropical migratory birds have experienced large recent declines (1980-1996) or long-term (1966-1996) declining trends based on breeding bird surveys, while 12 species have seen substantially increased population trends (Link and Sauer 1997). An indicator of western forest bird species, based on long-term monitoring data for 39 obligate breeding species (the majority of which are migratory), showed a decline of 20% from 1968 to 2012, including continued decline since 2009 (NABCI 2014). Both early seral species and mature forest bird species are declining. The reasons for the decline vary with species. Past intensive forest management practices may have led to declines due to the loss of older forest habitats. However, more recent forest management may have led to the increase of some species due to the increase in a variety of forest seral stages across the landscape. For many species the reason behind the decline is unknown.

Of the other neotropical migratory bird species, many occur in coniferous forest. Some are associated with taller trees while others are found in closer association with understory shrubs or early successional habitats. Hagar et al (1996) found bird species richness was correlated with habitat patchiness and the density of hardwoods, snags and conifers. Hardwood stands, particularly those associated with riparian areas, are of particular importance as a key habitat for some breeding neotropical and winter resident songbirds and can be an important predictor of bird species richness (Hagar et al. 1996). There are small pockets of hardwood stands and mixed hardwood/conifer stands scattered throughout the proposed project stands of the project area, as well as in habitat connecting the stands. For most species, critical breeding periods last from early spring through late-summer Although there have been no surveys conducted specifically for forest landbirds relative to this project, a variety of species is likely to occupy the area.

Environmental Consequences

Alternative A – No Action

Direct Effects and Indirect Effects

The No Action Alternative would result in no changes and, therefore, no direct effects to individual wildlife species or wildlife habitats (Threatened, Endangered, and Sensitive Species, Management Indicator Species, and migratory birds) are anticipated. Current conditions would be maintained in the watersheds. The indirect effects expected will be the delayed development of additional acreage of late-successional/old-growth forests that could provide future habitat for species associated with older stands. Forested stands would remain longer in early-or mid-seral conditions, generally overstocked with a single canopy layer, fewer than optimal larger diameter snags and CWD, and a high canopy closure with a corresponding lack of vegetation on the forest floor. Natural tree mortality due to competition would conceivably continue to provide some snags and CWD in the smaller size classes. For species dependent upon early-aged stands, enhancement opportunities through thinning would be lost.

Overall, effects to wildlife and wildlife habitats of no action will result in reduced availability and distribution of stands that could develop into suitable habitat for late successional habitat-related species (northern spotted owl). There will be reduced availability and development of hardwood-related wildlife species habitat in the understory as hardwoods are outcompeted by the continuing encroaching conifers. For species dependent upon hardwoods or mixed conifer-hardwood, and wetland or riparian areas, there would be no indirect negative impacts from not developing late-successional habitat because these species do not depend on this habitat type.

Cumulative Effects

Cumulative effects to wildlife habitat are related to effects of vegetation which is analyzed in this EA Section 3.1. Timber harvest on private lands adjacent of the project area is expected to continue and is assumed that most areas on these ownerships will not develop into late-successional forest characteristics. The Upper South Fork Skokomish Vegetation Management Project which includes commercial thinning of about 880 acres of young stands would begin in less than five years. Additional timber harvest and associated road building, and disturbance from these activities would not be additive to the watersheds.

Compliance with law, regulation, policy, and the Forest Plan

The No Action Alternative proposal would not be consistent with Recovery Actions described in the 2011 Revised Recovery Plan for the Northern Spotted Owl, the 2012 Designation of Revised Critical Habitat for the Northern Spotted Owl, the 1997 Marbled Murrelet Recovery Plan, the 2011 Revised Critical Habitat for the Marbled Murrelet, and the Migratory Bird Treaty Act as well as Forest Service Sensitive Species and Management Indicator Species direction. Active management to restore and enhance habitat is paramount for recovery of the federally listed species, or to ensure other species of special status are not elevated for further listing.

Alternative B – Proposed Action

Direct Effects and Indirect Effects

Due to the proposed action alternative not occurring in its known range and not affecting any habitat, there are no expected direct, indirect, or cumulative effects on the federally-listed Taylor's checkerspot butterfly. Likewise, the proposed action will not impact the habitat of the habitat of following Forest Service Sensitive Species: Olympic marmot, Olympic pocket gopher, common loon, golden hairstreak, Makah copper, Olympic artic, Puget blue, lupine blue and valley silverspot. With respect to the above mentioned Sensitive Species, the proposed action will not cause any direct, indirect, or cumulative impacts and will not contribute to the loss of

viability or move any of these species toward federal listing. Because the project is outside of the documented range of the Hoko Vertigo snail there will be no impact on this Survey and Manage Species.

Federally Listed Species and Critical Habitat

Habitat Northern Spotted Owl and Marbled Murrelet

Most the project area contains a mix of size classes, large logs and snags, and possess conifer and hardwood diversity but, in general, units identified for potential commercial thinning are very dense and heavily stocked with early or mid-successional trees; these stand conditions can affect current and future suitable habitat quality for northern spotted owls. Variable density thinning prescriptions would create conditions that would foster growth of stand structural characteristics necessary for northern spotted owl and marbled murrelet nesting, such as multi-story canopies; large, lateral branch growth; large diameter trees; recruitment of large diameter standing and downed trees on approximately 4,237 acres of forest. Thinned stands would continue to function as dispersal habitat. These stands would not immediately become nesting habitat and the activities, in the short-term, may disturb individual owls that are using the proposed stands for dispersal or foraging, or murrelets moving through or overhead as they return from foraging trips to their nests.

Northern Spotted Owl

The Proposed Action Alternative will maintain and not degrade, downgrade, or remove suitable (nesting, roosting, foraging) habitat of the northern spotted owl. All acres of nesting/roosting habitat will be maintained; no acres of suitable nesting/roosting/foraging habitat will be degraded, downgraded, or removed within the one 1.4-mile northern spotted owl nest core area or within the three 2.7-mile home ranges that overlap with the project area. As such, project activities would not contribute to the suitable habitat deficits below thresholds for spotted owl core areas and home ranges that overlap with the analysis area (Table Wildlife-2). The thinning is designed to accelerate late-successional habitat conditions on 4,237 acres, which would assist in raising the suitable habitat levels for these areas above thresholds in the future.

Dispersal habitat will be degraded or removed with the construction and reopening of roads and thinning of 4,237 acres of young stands. Thinning would result in the short-term degradation of 1,280 acres of dispersal habitat within Designated Critical Habitat, but the dispersal function of the habitat would be maintained. Table 2-3 displays the road development associated with this project. Of that total approximately 3.74 miles of temporary road construction/reconstruction would occur in dispersal habitat within critical habitat with this alternative (within the analysis area. This would result in the removal of 7 acres of dispersal habitat. This represents a maximum since portions of the existing unclassified or decommissioned/rehabilitated road prisms passing through dispersal habitat likely have not developed back into dispersal habitat yet. Rock pit development would permanently remove up to 2 acres dispersal habitat (Big Creek Rock Pit), outside of any of the nest core areas, but inside the home range of the Skinwood Creek activity center. The development of landings would result in the removal of less than 3 acres of northern spotted owl dispersal habitat within Designated Critical Habitat. This translates into a total removal of 12 acres of dispersal habitat adjacent to roads within Designated Critical Habitat (Table Wildlife-6), though the majority of those acres would not be permanently removed. Immediate post-operation decommission and revegetation of the proposed roads and

landings would mitigate effects. This habitat will retain its function at the stand level within the analysis area.

Table Wildlife-6. Northern Spotted Owl Dispersal Habitat within Designated Critical Habitat Affected by Proposed Activities.

Proposed Treatment	Acres of Dispersal Habitat Affected in Analysis Area	Acres of Dispersal Habitat Degraded or Removed in Critical Habitat
Thinning	4,237	1,280 (short-term degraded)
Temporary Road	33	7 (short-term removed)
Landing	3	3 (short-term removed)
Rock Pit Development	2	2(permanent removed)

Negative effects maybe greatest during the short-term in stands within the Adaptive Management Area that will be treated by heavier thinning prescription and larger openings (gaps) than those within the Late Successional Reserve (see Chapter 2, Section 2.4.2.6) for a description of treatments in AMA and LSR). Some of the removed habitat from treatment may decrease the remaining canopy cover, but the function of the dispersal habitat will be maintained at the watershed level. Current habitat conditions, which facilitate dispersal of individuals, would remain. These treated stands of trees will continue to increase in stand diversity and complexity and eventually develop into multi-aged stands. A small number of larger trees (greater than 20 inches dbh) identified as northern spotted owl suitable nest tree (SNT) may need to be removed for safety issues associated with aircraft on helicopter units, including around landings, as well as adjacent road reconstruction and temporary road construction; however, the majority of these landings and roads are in younger-aged stands and unlikely will have spotted owl SNTs within them (See PDC table 2-4). In general, buffers placed around SNTs and legacy trees will ensure their protection.

NSO snag and coarse wood

Field reviews identified and marked over 70 legacy snags in or adjacent to proposed thinning units. The project does not propose to remove any large diameter snags (greater than 20 inches dbh) or downed wood in the thinning units unless there is a safety concern during thinning operations or during road and landing construction (Table 2-4 for PDC relating to tree removal for safety). Experiences with previous commercial thinning operations on the ONF, have shown that 30 to 50 percent of existing snags in the range of about 10 to 16 inches in diameter would need to be felled for worker safety. This could also conceivably affect a proportion of the large snags (20-29 inch dbh range) in thinning units, which are already very limited in number. Snags and coarse wood will be retained within the stream-course riparian leave areas within the thinning units. Any snags that need to be felled will be left in the treatment unit and will function as woody debris. Large snags over 30 inches dbh, (buffered) and created wildlife trees will be protected within thinning units and other large snags will be retained with live trees in unthinned areas (see PDC Table 2-4). Because the thinning treatment would improve the vigor and survival of remaining trees, there would be some loss of natural self-thinning (competition-related) mortality in stands that are thinned. Suzuki and Hayes (2003) found that thinning activities can reduce the frequency and cumulative length of small (defined as 4 to 12 inch diameter) and medium (13 to 19 inch diameter) downed wood. This likely would have the most impact on numbers of small snags and logs that would be naturally produced in the project area in the future, and that size class is currently better represented than larger snags. Trees remaining post-harvest will have increased growth opportunities to develop into future suitable nest trees and

habitat for prey. Artificial recruitment of snags and coarse wood, would not likely occur until a decade after thinning, due to the lag time between thinning, subsequent snag and coarse wood monitoring, and potential snag or coarse wood creation efforts.

NSO Prey

Effects on prey species for northern spotted owl may occur in the short-term in the proposed thinning of 4,237acres. A number of studies have examined this possibility, but these studies did not focus on stands that were merely providing dispersal nor did they look at the type of thinnings proposed in this project (variable density thinnings with retention of mid-story and smaller overstory trees). Courtney et al. (2004) summarize studies which suggest that although spotted owl prey and foraging efficiency can potentially increase in areas enhanced for late-successional species (i.e., commercially thinned second-growth stands) and bordered by suitable habitat, there is also the potential for reduced truffle abundance, increased risk of predation to spotted owls, and habitat conditions that may favor barred owls. This short-term effect on the food source (truffles) of flying squirrels, the main prey species for spotted owls on the eastern Olympic Peninsula, could lead to a short term (less than 5 yrs.) decline in flying squirrel numbers (Carey 2000). However, response to management activities may differ between truffle species, and legacy retention (in stands that have remnant trees), as well as variable density thinning (as opposed to conventional thinning) would also benefit truffle abundance and diversity in those stands (Carey et al. 2002). Several authors have indicated that short-term effects may last beyond 5 years (Holloway and Smith 2011; Manning et al. 2012) following forest thinning. Wilson (2010) identified three variables that could correctly classify 97 percent of the stands as supporting either high or low squirrel abundances: 1) variance in overstory tree dbh; 2) area intercept at 33 feet above ground; and 3) amount of canopy gaps. The structural complexity of a forest and how individual structural components are apportioned within multi-dimensional space may determine the capacity of a forest to support abundant squirrel populations. Therefore, the potential for immediate negative effects depends on the degree to which any of these stands are currently being used by flying squirrels. As mentioned previously, DecAID analysis and field review suggest that pre-treatment snag and coarse wood levels are generally only meeting the lower tolerance levels, if at all, for species such as the flying squirrel, especially for larger size snags. While down wood levels may increase slightly following thinning and subsequent disturbance (See Silviculture section), snag levels are likely to be impacted in the short term. Information on northern flying squirrel and other prey use within the proposed thinning stands are not available, so the exact impact on prey species in the areas of thinning will not be known.

In the long-term, the structural condition of the stand would become more varied with the development of understory trees and shrubs and with the development of larger-size standing dead and downed trees as the stand ages. The larger size snags and down wood will provide habitat for a larger number and variety of species. In the meantime, within riparian no-cut buffer areas standing dead and downed woody material would be retained, along with coniferous and deciduous trees which would continue to function as habitat for prey species. This will enhance prey species for northern spotted owl in the long-term by providing more understory structure. As the young trees fill in the gaps between the older trees, the stand structure will likely favor woodrats and northern flying squirrels which are an important food source for spotted owls. As the tree canopy fills in and becomes more connected, flying squirrels will likely increase in numbers as the woodrats will likely decline. Secondary prey species will likely occur in high numbers particularly within stands that develop higher densities of coarse woody debris and

understory vegetation. In short, the longer-term changes in stand structure due to the thinning treatments should still provide sufficient food for foraging spotted owls.

Barred Owl

One of the greatest threats to the northern spotted owl is the presence of barred owl and the evidence that it has a role in the population decline (Gutierrez et al. 2004, Olsen et al. 2005, Davis et al. 2011). While thinning effects to barred owls relative to spotted owls are not fully understood, the proposed action has been designed to minimize impacts to northern spotted owls. Barred owls can utilize a greater diversity of forested environments, stand age, and elevations, so use of the proposed thinned stands by barred owls could occur. The thinning treatments will be in dispersal habitat and not within nesting, roosting, and foraging habitat and are designed to enhance and accelerate the creation of future spotted owl habitat and reconnect fragmented nesting habitat in the watersheds.

NSO Designated Critical Habitat

The management recommendation within designated critical habitat as described in the 2011 revised recovery plan is to focus silvicultural activities in dispersal habitat which would increase large patches of contiguous nesting/roosting habitat. The project area contains about 17,449 acres of spotted owl critical habitat and about 1,555 acres is proposed for commercial thinning in critical habitat. The majority of the thinning units are within dispersal habitat. The proposed treatments may temporarily degrade the dispersal habitat, but would leave the stands above 40 percent canopy closure (previously defined canopy closure threshold for dispersal habitat), and continue to maintain its function for dispersing owls. The proposed action would meet the objectives in the recovery plan for the species. The project does not propose to remove any large diameter (greater than 20 inches dbh) trees within designated critical habitat unless there is a safety concern during thinning operations or during road and landing construction. The thinning units and proposed road reconstruction (including landings) and temporary roads are generally within dispersal or non-habitat; the 2 acres of permanent dispersal habitat removal at Big Creek Rock Pit is within Designated Critical Habitat. Suitable nest trees adjacent to these areas could be proposed for removal, but would be a low occurrence. PDCs (Table 2-4) would minimize impacts on suitable nest trees. Overall, the proposed action would be consistent with designated critical habitat objectives and the critical habitat unit NCO-1 would continue to function in its long-term goal of recovery of the spotted owl.

Marbled Murrelet

Habitat

Because the trees in the proposed action alternative are at least one-half the site-potential tree height, and 47 percent of the proposed stands for thinning are in designated critical habitat (and Late-Successional Reserve land management allocation), surveys to locate suitable nest trees (SNTs) that meet the definition of PCE 1 were conducted. (See Affected Environment discussion for Marbled Murrelet for definitions of these terms). Though surveys were not conducted in all proposed thinning units, nearly all stands in Designated Critical Habitat, as well as others considered high priority, were surveyed (See Figure Wildlife-2). Table Wildlife-7 below provides a summary of these surveys. Formal SNT surveys were conducted in the majority of, but not all, proposed thinning units. Field reconnaissance verified 19 proposed thinning units contain trees within their boundaries that fit the definition of a marbled murrelet SNT. Over 70 percent of the SNTs were Douglas-fir, followed by western hemlock and western red cedar. The range in

diameter was between 19.land 83.2 inches dbh (average 38.6 inches dbh). The number of SNTs in each of these stands, as well as their distribution and association with legacy snags and legacy trees, was variable.

As outlined in the PDC (Table 2-4, PDC WL-01), the 132 trees identified as SNTs during field surveys will be provided a no-cut buffer of all trees adjacent to the SNT that have an interlocking canopy (Table Wildlife-7). In addition, Project Design Criteria WL-02 provides criteria for identifying trees in unsurveyed stands that will receive the same no-cut buffer of the tree itself and all trees with intermingling branches. These conservation measures were developed between the USFWS and ONF wildlife and silviculture staff for commercial thinning activities on the Forest with the goal to provide growing conditions for the SNT to further develop structural conditions, such as branch development, as a nest tree. Suitable nest tree buffers will also function as a 'skip' in the silvicultural prescription, either as a single tree or in groupings of SNTs as appropriate. The proposed thinning prescription excludes harvest of trees greater than 20 in dbh in the LSR (and marbled murrelet designated critical habitat), therefore all PCE1 (SNT) within surveyed stands and most SNTs in the surrogate stands would be retained and provided a no cut buffer. Due to logging system requirements, there may be situations that a group of SNTs that are within a 'skip' may have a logging corridor through them. The SNT would not be removed and the adjacent tree with interlocking branches would not be encroached, however between the buffered SNTs group, a logging corridor, could be placed. The function of the buffer would be retained and serve its function as protection of the SNT. The structural condition and age of the surrounding forest in the proposed thinning units, and platforms occur well above the surrounding canopy, make it unlikely that these stands currently function as current marbled murrelet nesting habitat.

Table Wildlife-7. Marbled Murrelet Suitable Nest Trees Located in Thinning Units.

Unit	Number of Suitable Nest Trees
33	12
37	3
D10	1
D10A	2
D15	12
D1A	32
D2	1
D21	2
D22	28
D23	7
D23B	6
D25	13
D3C	10
D9	2
S2	1
Total	**132**

None of the 7 proposed helicopter landings would require the removal of individual trees identified as SNTs, or within the 0.5-mile nest core of mapped murrelet sites. There could be SNTs that may need to be removed for safety issues associated with aircraft on helicopter units and road construction sites. Field review determined that the majority of these areas are within

younger-aged forest and would have few, if any SNTs that would need to be felled. The proposal for developing rock pits in younger forest would permanently preclude development of future murrelet habitat on six acres for the long term, but these 6 acres are currently non- habitat.

The proposed action alternative will maintain and not degrade, downgrade, or remove habitat suitable for nesting (PCE 1) or buffering of nesting habitat (PCE 2) for the marbled murrelet except in surrogate stands where SNTs may be smaller than the species/diameter thresholds or in surveyed stands where they were missed, or, when required for corridors as discussed above.

Disturbance to NSO and MM

Previous surveys in the watersheds have documented northern spotted owl and marbled murrelets occupying stands during the nesting season, specifically in the Rock Creek, Vance Creek, and Big Creek areas. Because specific surveys using established protocols for both species have not been conducted, any nearby or adjacent suitable habitat blocks are considered occupied for the purpose of applying disturbance buffers. Spotted owls, as well as marbled murrelets, are more vulnerable to disturbance during their breeding season when they are producing and incubating eggs than any other time of year (USDI 2013). The period for the Northern spotted owls is March 1 to July 15; marbled murrelets is from April 1 to September 23. Noise or visual disturbance has the potential to cause nest abandonment and aborted feeding attempts by adults, which could result in undernourishment of the chick or premature fledging (USDI 2003). For the marbled murrelet, after September 23, all chicks have fledged and adults are no longer traveling inland to feed and care for their young. By late September, owlets have fledged and parental care has tapered off, and the young begin leaving their natal areas to search for their own territories (USDI 2003).

The proposed thinning units are predominately surrounded by dispersal habitat which is not considered nesting habitat for either species. Thinning units were prioritized for seasonal restrictions and specific operating periods to minimize effects of disturbance to northern spotted owls and marbled murrelets while accommodating operational concerns (feasibility of being able to complete project activities within any given year) and fisheries and soil concerns (vulnerability of proposed stands and road haul having a negative effect to soil and water from winter activities) (see Table 2-5 for operating periods). Proposed stands and roads were rated as having a 'high', 'medium', or 'low' priority for wildlife restrictions depending on: 1) proximity to historic activity centers or occupied sites; and 2) proximity to relatively large, contiguous blocks of nesting habitat or for murrelets, fly-ways. Contiguous nesting habitat for spotted owls and marbled murrelet are found in the Vance Creek and Rock Creek drainages, the major river corridor of the Skokomish River is a primary murrelet fly-way. In total, approximately 3,757 acres (89% of total treatment acres) are proposed for thinning between June 1 to October 31. Eleven units will not be treated during the nesting season for either species.

In addition to disturbance from work associated with thinning activities (felling, yarding from both ground and helicopter, landings), there is also disturbance from rock pit expansion and road reconstruction and temporary road building. Road work must be conducted in the spring or summer months to avoid other resource impacts. Approximately 2.8 miles of temporary road construction/reconstruction would be constructed during the nesting season for both species. The majority of the roads are within and adjacent to dispersal habitat for the northern spotted owl or PCE2 (buffering habitat) for marbled murrelet. The largest potential source of disturbance

may come from preparatory work along haul routes, since many of these pass within disturbance distance of suitable habitat. However, this figure presumes that every section of haul route would require heavy equipment work to prepare it for haul and that this work would occur during the breeding season. This likely overestimates the amount of disturbance from this activity. Rock pit expansion would include full development at the V1043 quarry (two acres of tree removal, drilling, and blasting), and the other two quarries (Brown and Big Creek) would involve heavy equipment. At V1043 quarry, tree removal would occur in the breeding season for both murrelet and spotted owl, however due to intensity and duration of the drilling and blasting and exposure to contiguous nesting habitat for both species would occur outside the nesting season. Analysis of suitable habitat disturbed for activities within the operating period during either species nesting season were calculated using buffering distances required by the USFWS (USDI 2013); (Table Wildlife-8).

Table Wildlife-8. Suitable Habitat of Northern Spotted Owl and Marbled Murrelets Exposed to Noise by Activity.

Proposed Activity	Acres of Northern Spotted Owl Habitat Exposed to Noise*	Acres of Marbled Murrelet Habitat Exposed to Noise*
Thinning (chainsaw and heavy equipment)	65	171
Landings (Helicopter and heavy equipment)	75	75
Road Building, Reconstruction	25	56
Road Prep Prior to Haul (heavy equipment)	396	662
Rock Pit Development/Expansion (assuming blasting required, chainsaw, and heavy equipment)	¼, rounded to 1 (tree removal only) drilling and blasting outside nesting season	1 (tree removal only) drilling and blasting outside nesting season
Rock Pit Prep and Extraction (heavy equipment)	2	2
Total	564	967

*Area of disturbance calculated as distance from nesting habitat: chainsaw and heavy equipment (65 yards northern spotted owl; 110 yards marbled murrelet); medium-sized helicopter (150 yards northern spotted owl and marbled murrelet); blasting (0.25 miles northern spotted owl and marbled murrelet).

Areas heavily used by humans can result in increased garbage left at sites and this can attract corvids which may increase the chance of predation on nearby marbled murrelet nests (Nelson and Hamer 1995). Project work, including thinning operations, reconstruction of old roads and temporary road building and helicopter lands, will bring more people into some areas which are adjacent to suitable habitat. PDCs (Table 2-4), including garbage removal by project workers and decommissioning opened roads and landings will minimize future access.

Fisher

Suitable (nesting, roosting, foraging) northern spotted owl habitat is used as a proxy to evaluate fisher habitat since it generally contains the structural elements preferred by fisher for denning. Suitable habitat would not be removed or degraded with this project. The purpose and need for thinning is to enhance young forest stands by accelerating and developing late-seral conditions in those stands. Large trees and standing dead trees are generally protected and large trees may benefit from the thinning of intermediate trees surrounding them. Minor effects could occur with

any removal of larger snags or legacy trees with cavities for safety reasons, since these could serve as denning or resting sites and are already in limited supply in these stands, but the incidence of such removal would be expected to be small. Approximately 369 acres of units (in AMA) would receive silvicultural treatment leaving 40-60 percent canopy cover. Heavy thin areas along with "gap" creation treatments, could lead fisher to avoid those areas due to lack of overhead cover (Weird and Harestad 2003) in the short term. However, the same treatments would benefit future fisher habitat by creating larger trees and more structurally diverse vegetative structure (Zielinski et al. 2004) over the long term. The project could have adverse short term effects on individual fisher within the footprint of the treatment area, including but not limited to short-term changes in prey availability and displacement of foraging, denning, or resting individuals. However, proposed units would not likely serve as optimal foraging areas in their current conditions due to lower prey densities. Regardless, the scale of these effects are small or moderate (there are approximately 4,237 acres total in the pool of proposed units) relative to the size of fisher home ranges on the Olympic Peninsula (less than a single home range would be affected), and the project in the long-term would improve late-seral conditions that are important to fisher's life history. Fishers denning habitat (using spotted owl suitable habitat as a surrogate) will not be treated and resting areas will remain available within skip areas within the treatment units. However, individual snags used by fisher may be removed during thinnings or road construction, although such isolated snags are less likely to be used by fishers than snags in more complex habitat.The Fisher Reintroduction Plan Environmental Assessment (USDI 2007) outlined a conservation measure that would implement a seasonal restriction for motorized/mechanized activities around all known, active denning sites, between Mid-March and late May, should they be discovered. This recommendation will be written into contracts so that future known denning sites will receive this protection.

Other Late-Successional Dependent Species

The silvicultural prescription for thinning across 4,237 acres of younger-aged forest and PDCs for this project will protect the larger trees preferred as nesting habitat by goshawks, and nesting and foraging by potential goshawk prey species. Suitable northern spotted owl habitat is used as a proxy to evaluate northern goshawk habitat. Within the project area, the higher quality, existing goshawk foraging and nesting habitat ("suitable habitat") would not be impacted. The areas proposed for thinning likely only provide foraging opportunities at best, with prey populations likely being limited in many of the more homogenous, mid-seral stands proposed for treatment. The commercial treatment will result in short-term degradation of 4,237 acres; however, foraging habitat function would be maintained after treatment.

Recruitment and retention of large trees, along with overall development of structural diversity would benefit goshawks at the landscape scale and is generally consistent with management recommendations (Desimone and Hays 2004, Finn et al 2002). In the short term, reductions in canopy cover and resulting development of understory may not be in line with recommendations outlined by Desimone and Hays (2004) and Finn et al. (2002) which are intended to ensure foraging access to goshawk prey. Wiens et al. (2006) also stressed the importance of forest management prescriptions that support an abundant prey population, while maintaining access to that prey in nesting areas, in order to increase juvenile goshawk survival. Retention of dominant overstory trees and thinning from below to maintain and develop deep canopies, CWD and snag protection, and development of mature and late-successional forest characteristics at the large

scale are aspects of the project that are consistent with recommendations by these same authors. Overall, enhancement of structural diversity would benefit goshawk prey population abundance. The availability of prey in thinned units would likely improve over time as canopy closure exceeds 70 percent and understory cover levels off. Availability of prey in adjacent unthinned forest (including no-cut buffers and skip areas) would not likely change. Because there are no known goshawk nesting territories in the analysis area and activities would not occur directly in preferred nesting habitat, disturbance effects would likely be limited to foraging individuals along the periphery of suitable habitat (See Table Wildlife-8 for examples of how different project activities create disturbance to adjacent suitable habitat). In short, while there might be minor short-term effects to individuals using the project area, overall long-term term effects to goshawks would be beneficial. Implementing the proposed action would not contribute toward a need for conservation action for the northern goshawk.

The most likely roosts used by Keen's myotis would be in old-growth habitat that would not be affected with this project. There could be minor, short-term disturbance effects to any bats roosting in residual legacy trees or large diameter snags in stands to be thinned (or in adjacent old-growth), due to harvest activities, particularly in the stands that may be harvested during in the spring or summer (*3,757 acres 89 percent of proposed stands), which is also the breeding and rearing time for the bats. Longer-term effects would more likely be positive given that thinning and gap creation would promote the growth of larger trees for roosting, and promote vegetative diversity of understory and overstory species such as vine maple. Braun et al. (2002) found that vine maple may have a significant influence on the forest lepidopteran communities and leaf-based food webs, which would be of benefit to a variety of forest-dwelling bat species.

There could be minor short-term impacts to Johnson's hairstreak using stands proposed for thinning, but removal of mistle-toe infected trees is likely to be minimal, especially since a number of those trees would be protected under conservation measures for SNTs or LTs, and the trees more likely to be used would be in adjacent late-seral habitat, which will be protected. Long-term impacts would more likely be positive given that the proposed action would not remove old growth habitat, and the objectives of the thinning would promote future development of this age class. Eventually development of some level of disease infestation, such as dwarf mistletoe, could enter the stand as it ages, favoring habitat for Johnson's hairstreak, as well as species that would use the infected "brooms" as nesting substrate.

Standing Dead and Downed Dependent Species

Large standing dead (snag) habitat is not abundant at present in the proposed thinning areas, or adjacent forested stands and likewise, less than 40 percent of the watershed provides optimal habitat for species such as the pileated woodpecker. Thinning the proposed stands may have short term negative impacts from disturbance on foraging woodpeckers and other primary cavity excavators. Additionally, future recruitment of snags will be affected as trees are removed as part of the thinning process. However, the long-term, more indirect, impacts would be to increase the size of future snags due to increased tree growth and improve overall habitat, including the snag and down wood component, which also can be enhanced through MMs, such as snag creation. Snags and down wood would not be removed in the thinning prescriptions except for safety reasons. Legacy snags (greater than 30 in dbh and 12 ft tall or greater) have been identified and marked in proposed thinning units, and will be retained wherever possible and provided a no-cut buffer of 1.5 times its height to provide worker safety during thinning operations. Given the

amount of treated area across the watershed (4,237 acres thinned) compared with the size of the watershed, it is not expected that habitat gains from this project will be substantial. Densities of snags are higher in late seral stands in Montane Mixed Conifer Forests, which would not be affected (see project record; DecAID Analysis).

In general the homogenous nature in many of the proposed thinning units do not provide for the various habitat needs for species such as the downy woodpecker, hairy woodpecker, and red-breasted nuthatch to occur in the same area. It is expected that some species, such as red-breasted nuthatch and hairy woodpecker, may be more common in older forests and those with legacy snags and trees and so would not be as affected by project activities (though foraging activity by hairy woodpeckers was commonly observed in project stands).

There may be some disturbance, particularly within units (3,757 acres) that are to have activities during the breeding seasons. Because these species are unlikely to be nesting within every thinning unit, given the numbers of snags present, the impacts should not be adverse. Disturbance impacts are more likely for species nesting in adjacent suitable habitat, since this provides higher densities and larger sizes of snags for nesting. Table Wildlife-8 provides examples of how different activities could create disturbance in adjacent suitable habitat, though disturbance distances for these species may vary. Habitat capability should improve over the long-term. The DecAID analyses completed for the South Fork and North Fork Skokomish watersheds suggest that outside of late-successional stands, only the lower (30-50%) tolerance levels would likely be met for medium snags, and that even the 30% tolerance level is not met for large snags for a variety of species. The silvicultural prescriptions used with this project would maintain all snags of all size classes unless they pose a human safety hazard. Likewise, coarse wood would not be removed and, if disturbed, would in some instances be returned to its original location. This project is expected to improve habitat conditions in the long term for users of snags and down wood on 4,237 acres of the watershed.

American martens use live trees, snags, and slash piles for resting, denning and foraging, and would be more likely to be using late-successional/old-growth forests. Efforts to maintain these habitat components within project units would benefit marten, and enhancement efforts from post-treatment KV activities, such as snag and down wood (slash piles, log pyramids) would also benefit the species. Minimal impacts to resting, denning, or foraging sites could occur with the removal of large snags or live trees, but this is expected to be minimal due to conservation measures. As described above for various species, the longer term benefits of thinning on understory diversity, and dead wood elements will also benefit prey species for the marten. Activities adjacent to older forests (See Table Wildlife-8 for examples) could create disturbance to marten resting, denning or foraging there, though disturbance distances have not been determined and impacts would likely be minimal. At the present time, it is uncertain if marten even exist in the watershed, therefore negative impacts are not expected and habitat would be improved in the future across 4,237 acres.

Potential impacts to snags in the larger range which are not buffered (20-29 inches dbh) could provide minor impacts, though the incidence of their removal would likely be small. With the implementation of snag-related PDCs (Table 2-4), and due to no activities proposed in older forested habitat (where larger snags are more abundant), the proposed action alternative will not

limit the availability of large snags and live legacy trees with cavities for Keen's myotis, little brown bat, Townsend's big-eared bat, pileated woodpecker, primary cavity excavators in the analysis area.

Hardwood, Riparian, and Open Habitat-Dependent Species

Road constructions or reconstruction associated with temporary roads through Riparian Reserves (See Fisheries and Water Quality section and Table Fisheries-8) will result in the removal of approximately 5 acres of habitat in or adjacent to riparian areas. Thinning will also occur in a proportion of the Riparian Reserves outside of no-cut buffers (979 acres, Table Fisheries-6). Both of these activities could result in short-term impacts to hardwood-associated, riparian and aquatic wildlife species. However, the implementation of project design features related to hardwood, wetlands, streams, Riparian Reserves, and other unique habitats in the project area, the proposed action does not limit the availability of habitat for riparian and deciduous-associated species such as harlequin duck, bald eagle, Van Dyke's salamander, Olympic torrent salamander, Puget Oregonian snail, Malone's jumping slug, Broadwhorl tightcoil snail, keeled jumping slug, blue-gray tail-dropper slug, downy woodpecker or migratory landbirds.

The potential effects to mollusk species would include removal of overstory vegetation that provides microclimate buffering of habitat, removal of CWD habitat, and the potential for direct loss of individuals during thinning operations or the construction and use of temporary roads. Duncan et al. (2003) state that in cases where habitat elements being used by a particular species are being negatively affected by a project, substantial negative impacts are not expected if less than 5 percent of the available amount of that element, or 5 percent of the project area, is affected. Project design criteria that retain CWD and avoid excessive soil compaction will minimize direct and indirect impacts to many mollusk species. In addition, silvicultural prescriptions which retain and promote maintaining hardwood species and shrub and ground cover species diversity should also provide microclimate, food and substrates for the fungi that mollusks feed upon and are consistent with management recommendations (Burke et al. 1999). However, as mentioned in the spotted owl section, there may be some short term impacts to fungi associated with thinning operations and construction of temporary roads. Habitat for the Survey and Manage mollusks is not present in proposed rock pit expansion areas, therefore surveys are not required. Information from previous surveys on the forest has identified few observations on the Forest of the majority of these mollusk species, and indicates that their presence in the project area would be highly unlikely.

With the implementation of the PDCs (Table 2-4) and expectation of an increased development of a deciduous understory, the availability of hardwoods for migratory birds and hardwood-associated species such as the downy woodpecker would be expected to improve. The prescription requires protection of vine maple and alder unless cutting is necessary for yarding. This will serve to minimize impacts to invertebrate prey that require the deciduous foliage. Thinning would likely benefit bats and insect-eating birds in the long term as vine maple, and other understory shrubs that support Lepidopterans and other invertebrates (Braun et al. 2002). These species respond to more open understory conditions post-treatment. The deciduous provisions would also serve to reduce effects to or to benefit small mammal prey (for goshawk, fisher, and marten) that feed on vine maple seeds.

Silvicultural prescriptions and riparian and aquatic conservations measures will minimize activities within small wetland areas, springs, seeps and riparian areas which should reduce potential impacts to species dependent upon these ecosystems.

The proposed impacts from thinning activities to western bumble bee is considered unlikely, since the species is a habitat generalist and mainly found in more agricultural and open landscapes, such as meadows and lightly forested stands. The proposed action to reduce densely stocked second growth forests could have a positive effect to the species in the long-term as understory food supply is developing.

As previously discussed, the majority of the best bald eagle habitat on the Olympic Peninsula is not located on the National Forest. Eagles need a combination of both large trees and adequate foraging resources and while the National Forest does have adequate amounts of nesting habitat along its major rivers, the amount of foraging habitat is limiting (USDA Forest Service 1990). For this reason, there are far fewer nesting territories in the interior of the Peninsula as compared with the coast, strait, and Hood Canal. Two years of surveys along the South Fork Skokomish River turned up no sightings of eagles, nor any documentation of nests. There are no historic nest sites within disturbance thresholds of proposed thinning or associated project activities. There should not be any negative impacts to nesting eagles from this project, and impacts to foraging or roosting eagles would be minimal. Thinning activities will contribute to future large trees for nesting or roosting along the mainstem, outside of no-cut buffers (estimate 344 acres in units D3C, D2-06, D15 and D30). Improvements to river and stream habitat over the long term will increase foraging opportunities (though there may be some short-term negative impacts from project operations regarding possible sediment delivery and effects to anadramous fish (prey) are not expected to be substantial with this project) (See Fisheries and Water Quality section).

Roosevelt Elk and Columbia black-tailed Deer

A program of variable density thinning prescriptions and native forage seeding should result in better forage conditions in the ONF (WDFW 2014) overall. In the short term, thinned areas, especially the more open "gaps", would likely develop more understory that could be available as forage for a longer period, due to minor reductions in canopy cover. This will benefit both deer and elk. The magnitude of the benefit would likely be greater with deer, because woody browse comprises a higher proportion of their diet and the thinning is likely to have more benefits to their preferred forage species. However, much of this is predicated on which understory species respond to the thinning, since species such as salal are not especially valuable forage for deer or elk. Silvicultural prescriptions which retain and favor hardwoods would also benefit the elk nutrition component. Currently the stands with minimal understory development and high stem densities probably function as hiding cover.

The Elk Nutrition model predicts only modest gains from thinning, with most treatment units increasing to the "low-marginal" category from the "poor" category, but it would still represent an improvement in forage across the analysis area. "Poor" refers to nutrition levels that would markedly affect reproduction and reduce survival probability. "Marginal" pertains to nutrition levels that may affect nutrition and survival through enhanced probability of winter death, delayed breeding, delayed puberty, etc. "Good" refers to autumn-summer nutrition levels that may exert minor limitations on performance, but the small magnitude of the limitations may not have any practical effects (Boyd et al. 2011). Gaps and other openings would allow for higher gains in

nutrition, as predicted by the model, but at a scale that would not be shown in model results. As mentioned previously, higher forage value areas are either adjacent to or outside of the analysis area. Correspondingly, elk use patterns would not be expected to change substantially across the project area. However, the Habitat Use model suggests that, depending on location and harvest prescription, some thinned areas adjacent to non-federal lands could receive slightly higher increases in elk use compared to other portions of the project area.

Temporary increases in road densities primarily in the McTaggert, Frigid, and Lower South Fork Skokomish drainages due to road building could have minor negative impacts on deer and elk use patterns in the short term. However, once timber harvest activities are completed and the roads are closed then the road densities would return to pre-project levels, which are currently above recommended levels in most drainages. Additional efforts to reduce open road densities below these thresholds, and re-vegetate temporary roads and landings after use with native forage seed mixes would benefit elk and deer.

Remnant forest being maintained for suitable northern spotted owl and marbled murrelet habitat may also function as optimal cover, though may vary in the amount of forage available. Likewise, activities intended to develop late-successional conditions should also help to develop optimal cover for deer and elk in the long term.

Cumulative Effects

The greatest effects to northern spotted owls, marbled murrelets and other species associated with older aged stands have come from large-scale habitat conversion on state and private lands of late-successional forest to stands that are now predominately single-species plantations and second-growth stands, depending on when they are harvested. Road building, which has facilitated this process, has contributed by fragmenting and isolating remaining stands of old-growth and also by allowing human access that can result in disturbance and increase predation for some species. The LSVMP does not propose to remove any nesting habitat for species dependent upon old-growth stands. The thinning restoration work itself is designed to enhance and/or accelerate the creation of future nesting habitat for federally listed species.

The greatest effect to spotted owls has come from large-scale habitat conversion, and associated disturbance, on Federal and non-federal lands, of late-successional forest to stands that are now single-species (predominantly) plantations and second-growth. Road building, which has facilitated this change, has also contributed to the effect by fragmenting and isolating remaining stands of old-growth. Additionally, most of the current evidence suggests that barred owls are exacerbating the population decline of spotted owls, especially in Washington (Gutiérrez et al. 2004; Olsen et al. 2005; Davis et al. 2011); there have been not been observations of barred owls at the spotted owl activity centers. The LSVMP does not propose to remove any suitable habitat, though some individual trees (greater than 18 in dbh) may be removed around landing sites and along new temporary road construction. The thinning restoration work itself is designed to enhance and accelerate the creation of suitable habitat and connections to suitable habitat. Therefore, it should not add negatively to the cumulative effects of previous activities..

Historic timber harvest and road building have had the greatest impact on Forest Service Sensitive and Survey and Manage mollusk species. Harvest of conifer habitat around the project area is expected to continue on other ownerships, limiting the potential of these species to occur on private lands. Removal of conifers in the proposed thinning units, and the associated short-term disturbance, may impact certain individuals. Given the large amount of habitat in the

watershed not being treated and the project's short-term impacts on mollusks, any lasting, negative effects upon these species should be minimal.

Forage enhancement efforts elsewhere in the analysis area on NFS and non-NFS lands (e.g., Holman Flats) , along with unintended forage gains from projects such as the Skokomish Prairie Burn and openings created during in-stream wood enhancement activities, would combine with forage gains from this proposed action to provide additional forage benefits for ungulates.

Broad herbicide applications no longer occur on ONF lands (only targeted applications for invasive species), but may still occur on adjacent non-federal lands. These broad treatments can have negative impacts on bird species that glean insects from deciduous foliage (Betts et al. 2013).

Summary of Effects

Northern Spotted Owl – The proposed action **may affect, likely to adversely affect** individual northern spotted owls potentially nesting in suitable habitat adjacent to management activities within the planning area due to harassment during the breeding season (564 acres).

Northern Spotted Owl Designated Critical Habitat- The proposed action **may affect, not likely to adversely affect** critical habitat within the planning area because 1) there would not be removal or degradation of suitable habitat, and 2) there would be approximately 12 acres of dispersal habitat removal (temporary road construction and rock pit expansion), 2 acres of which include permanent removal. The individual stands, the planning area, and critical habitat will continue to function for dispersal.

Marbled Murrelet – The proposed action **may affect, likely to adversely affect** individual murrelets potentially nesting in suitable habitat adjacent to management activities within the planning area due to harassment during the breeding season (967 acres).

Marbled Murrelet Designated Critical Habitat – The proposed action **may affect, likely to adversely affect** critical habitat since limited numbers of primary constituent element (SNTs) may be removed in four possible scenarios: 1) SNTs may be missed during SNT surveys; 2) where surveys are not conducted, the use of surrogate features may result in some SNTs not being buffered, e.g. those western hemlock and western red cedar < 28-inch DBH and Douglas-fir < 32-inch DBH may not be buffered; 3) SNTs in unsurveyed stands that are smaller than the harvest limit may be harvested (It is unlikely that SNTs would be less than the species/size buffering limits and extremely unlikely they would be smaller than the cutting limits); and 4) SNTs may be felled at landings and road corridors where needed for safety or logistics.

Pacific Fisher (Proposed for Federal Listing) – The proposed action could have adverse effects on individual fisher, including but not limited to short-term changes in prey availability and displacement of foraging, denning, or resting individuals. However, the scale of these effects are small or moderate, therefore the proposed action **would not likely jeopardize the continued existence of fisher on the West Coast**.

Regional Forester Sensitive Species

The proposed action **will not cause any direct, indirect, or cumulative impacts** to the Olympic marmot, Olympic pocket gopher, common loon, golden hairstreak, Makah copper, Olympic artic, Puget blue, lupine blue and valley silverspot, and will not contribute to the loss of viability or move any of these species toward federal listing. The proposed action **may impact individuals**

or habitat of the Northern goshawk, peregrine falcon, bald eagle, harlequin duck, Van Dyke's salamander, Olympic torrent salamander, Townsend's big-eared bat, Keen's myotis, little brown myotis, Puget Oregonian, Malone's jumping slug, Keeled jumping slug, Broadwhorl tightcoil, western bumblebee, and Johnson's hairstreak) **but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species**.

Survey and Manage Mollusk Species - The proposed action will have no direct, indirect or cumulative impacts on the Hoko Vertigo snail. The proposed action may have minor impacts on the individuals or habitat of the Puget Oregonian snail, Malone's jumping slug, keeled jumping slug, and Blue-Gray tail dropper slug, but less than 5% of habitat components in the project area would be affected. **Pre-disturbance surveys are not required for these species.**

Olympic National Forest Management Indicator Species - The proposed action may have minor impacts on individuals or habitat but **should be expected to maintain the viability** of the Pacific bald eagle, American marten, pileated woodpecker, primary cavity excavators, , Roosevelt elk, and Columbia black-tailed deer **on the Olympic National Forest**.

Neotropical Migratory Birds - The proposed action **would not contribute toward the need for additional conservation action for these species.**

Compliance with law, regulation, policy, and the Forest Plan

The Proposed Alternative B would be consistent with Recovery Actions described in the 1973 Endangered Species Act, the 2011 Revised Recovery Plan for the Northern Spotted Owl, the 2012 Designation of Revised Critical Habitat for the Northern Spotted Owl, the 1997 Marbled Murrelet Recovery Plan, the 2011 Revised Critical Habitat for the Marbled Murrelet, the 1918 Migratory Bird Treaty Act, the 1940 Bald and Golden Eagle Protection Act, as well as Forest Service Manual 2670 for federally listed and Sensitive Species, and the 1990 Forest Plan standards and guidelines for Management Indicator Species. Active management to restore and enhance habitat is paramount for recovery of the federally listed species, or to ensure other species of special status are not elevated for further listing.

3.6 Fire and Fuels

Methodology

Overview of Methodology

In order to determine the effects of the proposed actions as they relate to fire and fuels, a multipart process is used involving both field data collection and computer modeling. Field data is collected to determine the existing fuel conditions in the project area utilizing standard fuels inventory practices. In addition to the existing fuel characteristics in the project area, local climatic conditions are also compiled and this data is used to spatially model fire behavior across the project area. Following the initial modeling, the proposed project activities, in this case commercial thinning, are modeled utilizing the silvicultural prescription and the best available science to determine the changes to the fuel characteristics that can be expected if the proposed actions are conducted. These newly derived fuel conditions are used to again spatially model fire behavior and effects to determine if and by what degree fire behavior and effects will change. The modeled future condition is also compared to the baseline fire history and fire regime of the project area in order to determine if there is an increased departure from the natural historic condition.

The fuel treatments are designed to mitigate any actions that create a negative change in the fire hazard that is created by the proposed thinning actions.

Analysis Indicators

Proposed actions are determined to have a negative impact to the fire hazard in the project area if they increase either the spread rate or the flame length associated with a wildfire incident. An increase in either of these indicators reduces the ability of fire resources to contain and control a potential fire start. In the Olympic mountains most fires can be readily controlled due to the local climate conditions, which are unsuitable for frequent high intensity fires, however due to the extreme slopes that can be found in the project area, changes to the availability of fuels and the amount of fuels in the smaller, flashier classifications can make an otherwise controllable fire increasingly difficult. Because of this, additions of fuels in the 1, 10, and 100 hour classifications combined with steep, southerly facing slopes require increasing levels of mitigation in order to effectively manage any fire hazards created by the proposed actions.

Spatial and Temporal Context

For the purposes of this project, fire behavior, effects, history, and regime were modeled at the watershed scale. This provides spatial resolution to incorporate the entire project area as well as a fine enough scale to appropriately cover the many microclimates created by the topography and typical weather patterns of the project area. Fires for this project were all modeled using the same conditions that represent an average extreme fire weather condition for the area in the past decade. Climate data in the project area and nearby was collected and analyzed for as far back as weather information was available in order to at least partially account for climate change.

Affected Environment

In terms of fire and fuels, the affected environment is not limited to the proposed cutting areas, as any fire that occurs has the potential to cross into or out of the areas proposed for thinning. Watershed boundaries tend to provide natural barriers to fire, as well as having a relatively similar climate across the watershed, making the watershed a better scale for evaluation than the project boundary itself. Fire danger and fuel loadings are currently within the historic range of variability. Much of the project area is encompassed in vegetation condition classes 2 and 3 (moderate to high departure from historic stand and strata level structure and diversity). These large blocks of homogenous stands provide a reduced resiliency to what would historically be a mixed severity fire regime. Continuous even aged stands without mosaic patterns of vegetation density and variations in fuels may contribute to reduced variability in future fires.

Environmental Consequences

The environmental consequences in terms of fire and fuels of the proposed alternative are only realized with the occurrence of a fire within a thinning area following harvest. Those consequences are dependent upon the weather conditions at the time of the fire, the topographic conditions in the immediate fire area, and the time since the thinning was conducted. For example, a fire occurring on a flat aspect under relatively damp and cool conditions may not have any greater environmental impact than if the area had not been thinned. As weather conditions get hotter and drier, and the slope and aspect increase, flame lengths and spread rates can be increased by 100 percent or more in the thinned areas. Any increase in flame length is

associated with an increased percentage of tree mortality and an increase in the size of trees directly affected by fire. Increased burning intensity also corresponds to increased fuel consumption, exposing more mineral soil to weed contamination, erosion, volatilizing a greater variety of nutrients in the soil, as well as creating increases in smoke emissions in all classifications (Agee, 1993). In addition, increased flame lengths and spread rates reduce the ability of fire suppression resources to effectively contain and control a fire and typically result in increased acres burned.

Alternative A

Direct Effects and Indirect Effects

There are no direct effects of the No Action Alternative. Fire danger and fuel loadings are currently within the historic range of variability. Indirect effects under the No Action Alternative are related to the vegetation condition class within the larger FRCC. Much of the project area is encompassed in vegetation condition classes 2 and 3 (moderate to high departure from historic stand and strata level structure and diversity). No action will maintain this high departure from the historic natural vegetation condition without the introduction of some kind of disturbance (insect, fire, wind, landslide etc.).

Cumulative Effects

The cumulative effects of the No Action Alternative, is a continuation of the current even aged simplified forest structure present across much of the project area. These large blocks of homogenous stands provide a reduced resiliency to what would historically be a mixed severity fire regime. Continuous even aged stands without mosaic patterns of vegetation density and variations in fuels may contribute to reduced variability in future fires.

Alternative B

Direct Effects and Indirect Effects

Increases in fuel loadings and the increased availability of fuels due to the opening of the canopy and the reduction of wind and sun sheltering are the direct effects of thinning. It is estimated that canopy coverage will be reduced on average in thinning units by approximately 20 percent. This will increase the amount of solar radiation reaching surface fuels, which in turn increases fuel temperatures and decreases drying times between moisture events, thus making any fuels present available for burning for a greater amount of time, as well as allowing an increased influence of winds beneath the canopy. When combined with the increase in fuels, especially in the 1to 3 inch size class, the indirect effect is a large increase in fire danger in thinned areas. This is quantified through the use of fire behavior models which have shown an increase in flame lengths and rate of spread of 100 percent or more in some areas given the same burning conditions.

Direct consequences of a fire as a result of thinning treatments include a substantial mortality rate of trees and understory vegetation, as well as the associated effects to the soil. Any increase in fire intensity will create an increase in severity given constant vegetation and soil conditions, but because the proposed thinning stands are relatively young, the trees within are at greater risk of damage in any fire scenario. The increase in fire behavior in a still young stand of predominantly Douglas-fir can create a stand replacement scenario as young Douglas-firs do not develop their ability to withstand fires until they develop a thick mature bark (Agee, 1993). In the historic stand conditions, most of the stands within the project area burn with mosaic

severity, while an even-aged stand of fire intolerant trees will see much higher percentages of mortality/severity than historic stands. All of these direct effects will be minimized or eliminated with implementation of fuels treatments as proposed in Chapter 2.

Indirectly, fires occurring in activity generated fuels provide a much greater difficulty to suppress than fires in a natural fuel loading. Line production rates for a 20 person handcrew digging line in fuel model 8 (closed timber litter conifer) are estimated at 2 chains per hour. In fuel model 11 (light slash) those rates drop in half to 1 chain per hour. This increases suppression costs either through additional resources needed to suppress the fire or in additional time needed to suppress that same fire. When increased fire activity is added, costs very quickly rise even further as well. Increased difficulty to suppress a fire, increased fire activity, and deeper more continuous fuel beds, all lead to increased acreages burned and greater effects on the soil as the fire burns longer and hotter and consumes a greater portion of the available fuels. This being said, proposed fuel treatments will reduce or eliminate these indirect effects.

Cumulative Effects

Cumulative effects of the proposed action alternative include an increased fire danger in the thinned areas for a decade or more (Fasth et al. 2011; Harmon et al. 2014; Janisch et al. 2005). Thinned areas provide a structural change and introduce heterogeneity to the landscape. In future large fire scenarios, this heterogeneity may help contribute to a more historic mixed severity burn regime, but until fuels revert back to near natural loadings and arrangement, will lead to increased suppression costs and increased resource damage in a wildfire event. Fuels treatments proposed will greatly minimize the potential for long-term cumulative impacts from potential wildfire in the project stands and in the project area watersheds as a whole.

Compliance with law, regulation, policy, and the Forest Plan

The mitigations described later in this document as PDCs fall in line with national fire management policy, and the ONF fire management plan by providing the opportunity to suppress human caused fires at "at the lowest cost with the fewest negative consequences with respect to firefighter and public safety." (NIFC 2009). In addition they are rooted in the best available science and provide acceptable risk levels while seeking to enhance ecosystem health as provided in the proposed action.

The Washington State Department of Ecology is responsible for enforcing the Clean Air Act of 1972. The State's Smoke Implementation Plan provides guidelines for compliance which are intended to meet the requirements of the Clean Air Act. All burning plans for activities with the LSVMP would comply with this plan.

3.7 Recreation and Scenery

This report serves to provide analysis of the effects of the proposed action with respect to the recreation and visual quality resources within and directly related to the planning area. It includes descriptions of the recreation and visual quality resources within the project area and an analysis of the potential effects to these resources. Recreation and visual quality analysis is largely guided by the Forest Plan.

Affected Environment

The planning area consists of two spatially separated sub-areas. One planning area is located in the Lower North Fork and Lower South Fork Skokomish watersheds and is 22,306 acres. A total of 4,484 acres are proposed for treatment within this sub-area. The second planning area is located in the Middle North Fork Skokomish River and is 8,728 acres. A total of 329 acres are proposed for treatment in this planning area. This section will describe the affected environment as it pertains to recreation and visual quality by first describing the Skokomish watershed planning area.

Lower North and South Fork Skokomish Watershed Sub-Area: Recreation and Visual Quality

The South Fork Skokomish River watershed is located in proximity to population centers and Highway 101 and provides the residents of Puget Sound with easy access to the area's recreational opportunities and subsequently this area experiences moderate to high use during summer months. Open roads within the watershed are available for visitors to drive for pleasure. In addition, there are 27 miles of trails within the watershed, which include the Upper and Lower South Fork Skokomish trails, Brown Creek Nature trail, Pine Lake trail, and Church Creek trail. The watershed also offers access to the Wonder Mountain Wilderness, although there is no official trailhead or trail to this primitive wilderness area. The watershed also offers developed camping opportunities at LeBar Horsecamp, Brown's Creek Campground and a walk-in site at the Oxbow camping area. Dispersed recreation opportunities are numerous in the Upper South Fork Skokomish watershed, with many areas being accessible for rustic camping and privacy. The High Steel Bridge is also located in the watershed and is situated 420 feet above the South Fork Skokomish River. It is a popular site to visit year-round and is on the National Register of Historic places.

The planning area for the thinning project does not encapsulate all of the aforementioned recreation opportunities, but the access roads passing through the planning area do. Forest Service Roads 23 and 2340 offer primary access to the opportunities described above and these roads are proposed to be used as hauling routes during thinning operations. Thinning operations are proposed to occur directly adjacent to these roads as well. Of the recreation opportunities listed above, the planning area includes the Oxbow camping area (Forest Plan, A-3- Developed Recreation Sites and Administration Sites), the High Steel Bridge (Forest Plan, A-4B River Corridors), and a small amount of scattered dispersed camping opportunities.

The Skokomish watershed planning area is classified in the Recreation Opportunity Spectrum (ROS) class as "Roaded Modified" (USDA 1990). This class provides the opportunity to experience, "areas that are characterized by predominantly natural-appearing environments with high evidence of the sights and sounds of humans. Such evidence may not harmonize with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident and may not harmonize with the natural environment" (USDA 1990 page, III - 101).

The planning area contains three visual quality objective (VQO) zones. Visual quality objectives are defined in the Forest Plan on page III-120-121. The VQOs are designed to manage the degree to which the landscape deviates from a natural-appearing landscape. The VQOs included in the

planning sub-area treatment units include: partial retention (1,298 acres), modification (3,040 acres) and maximum modification (2,040 acres). Current conditions comply with designated VQOs. Visual quality objectives are defined below:

- Partial Retention: Management activities may be evident, but must remain subordinate to the characteristic landscape.
- Modification: Management activities may dominate the landscape, but they follow naturally established form, line, color, and texture.
- Maximum Modification: Management activities may dominate the landscape, but they should appear as natural occurrences when viewed in the background.

Middle North Fork Skokomish River Watershed Sub-Area: Recreation and Visual Quality

The treatment units located in this sub area are dispersed around F.S. Road # 24 near the entrance of Big Creek Campground (Forest Plan, A-3- Developed Recreation Sites and Administration Sites) and some units directly west of the campground. Unit 33 is located along a portion of the Upper Big Creek Loop Trail. Hauling will take place on Forest Service Road #24 which provides exclusive access to the Cushman Lakeshore recreation area, as well as to Staircase in Olympic National Park. These recreation areas include numerous trailheads, picnic areas, day use sites, and one National Park campground. Visitation to this area is very high during summer months and hundreds of vehicles enter this road daily during peak season. The treatment areas are located in areas designated as "Roaded Natural" in the ROS (USDA 1990b). This type of area is characterized as an environment where, "resource modification and utilization practices are evident, but harmonize with the natural environment" (USDA 1990 page, III - 101).

It is important to note that Forest Service recreation sites and facilities on the Cushman Lakeshore and Big Creek Campground are currently undergoing drastic improvements as part of the Cushman FERC Relicensing Agreement. Visitor use is expected to increase as a result of these improvements which are tentatively scheduled to be completed at the end of 2015. In addition, the Big Creek rock pit is proposed to be expanded by two acres. This rock pit is adjacent to Big Creek Campground and the Big Creek Campground Loop Trail.

A total of 284 acres of treatment units are situated within a "retention" VQO zone. This VQO is defined as an environment where: "management activities are not evident to the casual Forest visitor" (Forest Plan, II – 2). Current conditions in this subarea meet this objective.

Proposed Actions and Alternatives Analyzed

The ONF proposes to commercially thin second growth forest stands to accelerate the development of some of the structural and compositional features of late-successional forests and accelerate growth of forest stands.

Methodology

A combination of GIS analysis, on-ground review, and professional judgment was applied to perform the analysis in this section. The scope of the analysis includes the planning area as well as all recreation areas accessed via hauling routes within the planning area. These areas are

included to capture the impacts that thinning operations may have on the recreation and visual resources.

Analysis Indicators

- Access impacts to recreational sites as a result of project actions.
- Impacts to recreation experience as a result of project actions.
- Visual impacts to forest visitors within the project area.

Spatial and Temporal Bounding of Analysis Area

Environmental effects to recreation resources are assessed at the planning area scale as well as all recreation areas where access depends on road corridors that are included as part of project operations. The temporal bounding of the analysis will primarily focus on time periods in which on-the-ground project operations take place, as well as residual effects that occur as a result up to one year beyond the project.

Environmental Consequences

Alternative A – No Action

This alternative is the no action alternative. The discussion of direct, indirect and cumulative effects of this alternative is provided below.

Direct Effects and Indirect Effects

Direct Effects

If there is no action, there will be no direct effects to the recreation and visual resources in the project areas. There will be no recreation access impacts or visual quality impacts as a result of no action. Roads and trails within the project area would remain accessible to the public, and would continue to be managed to allow access for driving to scenic pullouts, photography, wildlife viewing, firewood or mushroom gathering, hunting, or dispersed camping.

Indirect Effects

Taking no action could result in increased stand density that may not appear as visually appealing than if the stands were thinned to accelerate the development of some of the structural and compositional features of late-successional forests. Depending on the intensity, high stand density may not align with the VQOs of retention or partial retention.

Cumulative Effects

The no action alternative would not create significant cumulative effects within the project area. Access would not be hindered to any recreation sites due to the absence of project activities. The project thinning units may also become visually unappealing as the stand density increases, thus displaying more evident effects of management activities.

Alternative B – Proposed Action

Alternative B includes approximately 4,484 acres of commercial thinning treatments. Proposed logging systems include ground-based skidding, cable yarding, helicopter yarding, and helicopter yarding with ground-based pre-bunching equipment. The proposed action also includes rock pit expansion, fuels treatments, and associated maintenance and road construction and reconstruction as described in Chapter 2 of this EA.

Direct and Indirect Effects

Direct Effects Recreation

The majority of project operations will take place between May and November in order to protect sensitive species habitat. Under alternative B, no major recreation access roads will be closed during operations. Major recreation access roads include NFTS Roads 23, 24, and 2340. While the 23, 24, and 2340 roads will not be closed, they will be subject to delays as these are primary hauling routes. The majority of the thinning and hauling operations will occur between May and November so there is a high possibility that many recreationists could experience delays as they travel to many popular summer recreation destinations within the South Fork Skokomish river valley, the Cushman Lakeshore, and the Staircase recreation area in Olympic National Park. Standard traffic control methods will be implemented to ensure visitor safety. Visitors to all of the recreation sites mentioned in the affected environment section may be forced to stop by a flagger for a period of time in order for hauling operations, including helicopter hauling, to safely occur. Traffic delays will become most frequent when thinning operations are occurring near a road.

In addition to the aforementioned possible traffic delays, various roads may be closed within the South Fork Skokomish River Valley during project operations. It is likely that these are locations where a yarder would need to be set up in the road to accomplish project activities. Possible road closures and their associated thinning units are listed in the table below. While these roads do not provide access to developed trail or camping opportunities, they do provide access to various dispersed camping opportunities, as well as popular hunting access which occur in the fall. It is important to note that these possible road closures would be staggered, rather than occurring simultaneously.

Table Rec-1. Forest Service Roads that may experience road closures during operations. Operating season is also noted.

Forest Service Road	Stands	Operating season
2340-200	D22, D24	summer
2340-230	D10, D12, D15	summer, winter
2340-250	D22, D24, D25	summer
2340-270	D11	summer
2342-200	V22, V26	summer
2350	V1, V4, V5	winter
2351	D29B, D29C, R12, V8, V14, V33	summer
2351-160	R9, R11, R18	summer, winter

Table Rec-1. Forest Service Roads that may experience road closures during operations. Operating season is also noted.		
2352	R7, R8, R23	summer
2352-100	R8	summer

*Summer operating season falls between June 1st and October 31st , winter operating season falls between September 24th and February 28th

Unit 33 will impact recreation access on the Upper Big Creek Loop trail. The treatment unit contains approximately 0.33 miles of trail directly west of the Big Creek Campground. There is also a temporary road proposed to bisect the trail to facilitate ground skidding. This will impact hiker access during project operations, which has an operating season of July 16th through October 31st in unit 33. While this unit is thinned, the western portion of the Upper Big Creek Loop Trail from the campground to the junction with the Mt. Ellinor Connector Trail will be closed to public access. Adequate trail closure signs and online information will be provided long before the closure is implemented so that the public is aware of the closure and can plan hiking trips in the area accordingly.

Planned thinning on units 9 and 11 near the entrance of Big Creek Campground will occur from September 15th through October 31st. Therefore the campground would remain open during normal operating season. However, project operations within units 9 and 11 will require closing access to the Big Creek Campground Loop and Upper Big Creek Loop access trailheads within the campground. This closure would be relatively short and have no long term impacts.

The Oxbow camping area will be accessible during hauling and thinning operations in units D15, and D30. Ground based skidding is proposed to occur on the 23-220 spur which provides walk-in access to the camping area. There is also a helicopter landing proposed for development on this road which will require a maximum of a one acre clearing. Helicopter yarding is planned adjacent to Oxbow on the east side of the river. The Brown Creek Pit is just north of this area (Maps Appendix A). Blasting and crushing operations may be necessary to extract rock for road maintenance. These activities will be restricted to an operating season of September 24th through February 28th to reduce impacts to recreation in the area.

The Big Creek Rock Pit will be expanded by 2 acres to provide gravel material for road maintenance and construction during planning operations. This will require clearing and blasting 2 acres directly adjacent to the Big Creek Campground and the Campground Loop trail. The effects of blasting and clearing additional rock pit acres will create serious noise pollution at the nearby campground and may be unsafe for hikers and campers. Therefore clearing, blasting and crushing operations associated with the Big Creek Rock Pit will have an operating season of September 24th through February 28th (Table 2-4, REC-01). The Campground Loop trail may be closed during this operation season of the project year during rock pit expansion depending on where the expansion occurs. In order to minimize impacts it is recommended that the rock pit be expanded on the north side of the existing rock pit or at least 200 feet from the trail corridor in order to mitigate the aforementioned effects.

The V1043 pit, located on the 2360-100 spur, is also planned to expand by 2 acres. This operation should not impact recreation access or experience as this area is not generally used by recreationists. This road may close during operations.

Indirect Effects: Recreation

The planning area contains two ROS classes in which thinning operations will take place: "roaded modified" and "roaded natural". These classes provide a recreation setting where: "resource modification and utilization practices are evident and may not harmonize with the natural environment" (USDA 1990 page, III - 101), and "resource modification and utilization practices are evident, but harmonize with the natural environment" (USDA 1990 page, III - 101) respectively. Thinning operations appear consistent with the ROS class as the purpose of the thinning process is to facilitate the development of "old-growth" characteristics.

Indirect impacts to recreation may include displacement of visitors to nearby locations, which could add pressure to less used recreation destinations in the general vicinity of the planning area. Dispersed camping, nature viewing, hunting, fishing and other activities within the planning area may be perceived as limited at times due to project operations and thus visitors may decide to engage in their desired activity elsewhere. Specifically, visitors who typically visit the Oxbow camping area or many of the roads that will be affected by thinning operations will likely decide to disperse camp or perform their desired recreation activity in a different area. This may add pressure to dispersed camping areas and other recreation areas that are not impacted by project activities within the South Fork Skokomish drainage.

The expansion of the Big Creek Rock Pit may create long term noise pollution impacts to hikers and the Big Creek Campground Loop trail. The increased amount of available gravel at the Big Creek Pit will likely increase the use of heavy machinery in this area as the rock source is utilized. This may include future blasting as well. These effects will be minimized due to late fall/winter operating season, where a generally low number of visitors hike this trail.

Direct Effects: Visual Quality

The complete project planning area contains four VQOs: retention, partial retention, modification and maximum modification. In areas designated as modification and maximum modification visitors can typically expect to view obvious signs that the landscape deviates from its natural character. For the purpose of this analysis, retention and partial retention will only be discussed because the latter objectives are easily met under the proposed action.

Retention zones, also referred to as areas possessing "high scenic integrity", encapsulate the majority of the planning subarea. The planning area includes approximately 284 acres of thinning units within retention zones. This VQO is the visual foreground for visitors travelling on Forest Road 24 within the planning area. Partial retention zones are referred to as areas that possess "moderate scenic integrity". The majority of Forest Road 23, and a portion of F.S. Road 2340 are surrounded by partial retention zones which make up the visual foreground. A total of approximately 447 acres of thinning operations are planned within partial retention zones.

To meet retention visual quality requirements, landscape character must appear intact and must not be evident to a casual forest visitor. Partial retention areas permit management activities to be present, but must conform to general landscape patterns.

Direct effects to visual quality include the presence of logging equipment including cables and downhill cables that may be near or on the road at times. Cable yarding may cause the appearance of unnatural breaks in the forest. Logging operations will create the appearance of management activities in many units along Forest Roads 23, 24 and 2340. Slash and general understory disturbance from ground based skidding may also be evident in both retention and partial retention zones during and directly after project operations. Efforts will be made to reuse old skid trails to reduce ground disturbance (SOIL-04), and course woody debris in the understory will be left undisturbed whenever possible (WL-11). Sights and sounds of logging operations will generally be apparent including six units that will utilize helicopter operations. Sights and sounds from helicopter operations would be brief and have no lasting impacts.

Two acres of forest near the Big Creek Rock Pit, situated in a "retention" zone, will be cleared to increase the area of the rock pit. Clearing this area will likely decrease visual quality as experienced by campers and hikers within the Big Creek Campground. A popular loop trail lies adjacent to the existing rock pit; approaching well within 100 feet of the clearing. Expansion of the pit will increase evidence of management activities in this area. The proposed rock pit expansion lies within a retention zone, where the management directive is to provide a setting where the casual forest visitor will not detect management activities. With the clearing of an additional two acres adjacent to the campground and trail, it is highly likely that these management actions will be noticeable to casual forest visitors. It would be preferable if rock pit expansion could take place north of the existing pit or at least 200 feet from the trail corridor. However, management activities may appear in less than 5 percent of this VQO (FEIS III – 124). The two acre expansion of the Big Creek rock pit is small when the retention area is taken as a whole.

As mentioned in the 'impacts to recreation' section, unit 33 contains about 0.33 miles of hiker trail on the Big Creek Loop trail. The treatment unit contains approximately 0.33 miles of trail directly west of the Big Creek Campground. There is also a temporary road proposed to bisect the trail to facilitate ground skidding. Thinning prescriptions proposed for this project will generally meet the requirements of a retention zone. Vegetation will grow over stumps within 1-2 years and little evidence of management activities will remain.

Plans to expand the V1034 rockpit on the 2360-100 spur will occur within a VQO zone of "modification". These management actions will not impact the VQO designated at that site.

Indirect Effects: Visual Quality

While evidence of management actions will be apparent during project operations, the outcome of thinning will enhance the "naturalness" of the area in the long run. Thinning the project area to accelerate the development of some of the structural and compositional features of late-successional forests will decrease the evidence of management actions within the planning area. Visitors will be able to enjoy more diverse vegetation as they travel through the forest and the forest itself will appear more "open" and natural than if it had not been thinned. Evidence of cable yarding will decrease and evidence of thinning will be greatly reduced within about one year and the forest understory will recover from ground based skidding as vegetation grows back within the area.

Cumulative Effects

Project operations will create no long term adverse effects to recreation or visual quality resources. The Oxbow camping area will likely be affected by road delays during summer months when the project is implemented, but no long term impacts will result thereafter as the area reopens to public use. Rock pit expansion near the Big Creek Campground may create noise pollution for hikers but this impact is anticipated to be minimal due to the off-peak season operation season designated for Big Creek Rock Pit expansion. Access to two trailheads within the campground will be closed as units 11 and 9 are thinned in order to protect public safety, but this is also anticipated to cause minimal impacts due to the limited operating season designated for these units. Various roads within the Skokomish Valley may be closed as a yarder located in a roadbed may be required to accomplish project activities. These roads do not provide access to developed trails or campgrounds but are used for dispersed camping and hunting. Therefore, hunting and dispersed camping areas may be limited within these areas as a result of road closures. However, all of these aforementioned impacts will occur during a relatively short time period and no major lasting effects will exist.

Visual quality objectives will primarily be met in the long term as a result of this project. Thinning will decrease stand density, mimicking the appearance of late successional growth and create a more visually appealing viewing corridor in areas designated for retention and partial retention. However, it is anticipated that project operations will affect visual quality as obvious evidence of thinning operations occur during moderate to high use summer months. However, upon completion of project activities, ground disturbance will gradually disappear and the viewing corridors will show little evidence of management actions to the casual forest visitor.

Compliance with law, regulation, policy, and the Forest Plan

Under alternative B, the Forest Plan will be met as it pertains to recreation and visual quality resources.

3.8 Economic Viability

Methodology

The Forest Service's Region 6 TEA.ECON (version 6.1) economic analysis tool was used to evaluate the economic viability of the action alternative. This tool was developed to evaluate timber sale economics at the planning or sale layout level, and takes into account factors such as estimated timber volume, the market value of wood products, planning, and implementation costs. The analysis was conducted in April 2015, using values current at that time. The estimated value of wood products is based on regional market values and the revenues that local Forests are receiving from actual timber sales. The values take into account tree species, tree size, and wood quality. The estimated implementation cost is also based on regional and local logging costs, including the type of yarding system to be used (ground-based, cable, helicopter). Estimated revenue can fluctuate over time as market conditions change. If a timber sale is bid higher than its appraised value, then there would be more revenue returned to the US Treasury, part of which would be available for qualifying restoration or improvement projects such as those described in Chapter 2, Additional Restoration and Improvement Activities.

This analysis considers only identifiable and quantifiable economic benefits and costs, and does not reflect non-quantifiable economic considerations such as wildlife habitat, water quality, and other ecosystem services. Those considerations are assessed in other sections of this chapter. The socio-economic environment affected by activities within the ONF is discussed in the Final Environmental Impact Statement (FEIS) for the ONF Forest Plan (USDA 1990a)

The following table displays the timber output, benefit-to-cost ratio, net present value (NPV), and expected timber sale bid value for the action alternative. A benefit-to-cost ratio greater than 1.00 indicates that revenues would exceed costs, and the project would produce additional revenue above and beyond the anticipated costs that were analyzed. While an overall project may be viable, a benefit-to-cost ratio less than 1.00 indicates that project costs would exceed revenues, and either the costs would have to be reduced, or supplemental funding would be required to fully implement the project. There is also the potential that individual timber sales would be bid up during auction.

Table Econ-1. Expected timber sale volumes and bid rates for all alternatives.

Timber volume output (CCF)	**Alt. A**	**Alt. B**
Total volume output	0	81,663
Timber values		
Total timber value at predicted high bid rate	$0	$1,611,556
Total net present value (NPV)	$0	-$88,336
Benefit-to-cost ratio	n/a	0.93
Total discounted NPV per acre	$0	-$21
Sale appears viable	n/a	Yes
Project is above/below cost	n/a	Below

Environmental Consequences

Alternative A-No Action

Direct, indirect, and cumulative effects

Alternative A would provide no timber output, and would have no costs or revenues. Sale viability is irrelevant under this alternative because no timber sales would be offered. With no costs or benefits, the PNV would be zero and there would be no benefit-to-cost ratio. Because there would be no project activities, there would be no cumulative economic effects from this alternative.

Action Alternative B

Direct and indirect effects

While the net present value shows a deficit, implementation of the project could provide funding and other indirect economic benefits by helping maintain the wood products and forestry service contract industries.

Cumulative effects

The action alternative would contribute wood products to the local economy, indirectly supporting jobs. There would be no adverse cumulative economic effects associated with the action alternative.

3.9 Cultural Resources

Methodology

Overview of Methodology

Heritage resource analysis takes into consideration the effect of Forest projects on cultural resources, the remains of past human activities, within the Forest landscape. These cultural resources may be archaeological in nature, historic structures, objects, or sacred or traditional cultural areas of significance to Tribes having ancestral ties to the landscape.

Heritage Resources

The analysis methods used for heritage resources consist of a review and synthesis of all pertinent literature, records, and documentation available on the history and prehistory of the project and surrounding areas, and are generally bounded by the project planning area. This information includes not only that available from a variety of generalized sources, but also that information resulting from several years' worth of Forest Service heritage resource inventories conducted within and adjacent to the project area. Tribes who have ancestral ties to the area are informed of the project area to give them the opportunity to identify sites that may be of interest to them. The information on the results of these previous inventories and previously documented cultural resources also allows some idea of the type, frequency and location of cultural resources likely to be found within the analysis area.

This synthesis of past data is then used during field inventories conducted of the proposed activities' areas of potential effect (APE) and adjacent areas of high site probability. Information from previous inventories may be adequate and can be used to cover a current area APE if upon review it meets current inventory standards. Then, additional inventory is conducted of the APE in areas where no previous inventory was conducted, where previous inventory was not adequate or around known sites to relocate and verify their location, or where the potential to find cultural sites is considered to be high.

If no cultural resources are located within the project's area of potential effect (APE), the project may proceed under the terms of the *Programmatic Agreement regarding Cultural Resources Management on National Forests in the State of Washington (1997).*

If cultural resources are identified during inventory, they are analyzed to determine their eligibility to the NRHP under the criteria defined in the NHPA. For those considered eligible, the potential effects of the project on that historic property are analyzed. Where adverse effects may occur to a historic property, measures are designed to mitigate these effects. The State Historic Preservation Office is consulted for concurrence on each of these three steps. The consultation on all three steps is usually conducted simultaneously. Federally recognized tribes are consulted where Native American sites are involved.

Tribal Consultation

Federal historic preservation laws, executive orders, regulations and policies regarding protection, management and stewardship of cultural resources require consultation between the ONF and those tribal governments with ancestral ties to the Forest's lands. This consultation is

distinct and complementary to the responsibilities of the Forest for developing and maintaining the government-to-government relationships with Tribal governments regarding sovereignty, self-determination, treaty rights, cultural interests and other areas of Tribal concern.

Consultation conducted under these historic preservation laws, executive orders and policies are intended to help identify, protect and manage cultural resources, sacred sites and other landscapes of significance to Tribes.

Consultation conducted with Tribal Governments under these various laws, along with government-to-government consultations may be conducted simultaneously. Government-to-government consultation is conducted between agency and tribal officials. Additional consultation and coordination may occur between agency and tribal specialists may where natural and cultural resource issues arise. These additional consultations are also generally considered to fall under the government-to-government relationship, occur outside of the public scoping process, and depending on the nature of the issues and concerns, these communications may be exempt from release under FOIA.

Analysis Indicators

The measurement indicators for cultural resources are adverse effects to historic properties. Adverse effects are impacts to the integrity of the property, destroying a portion or all of the property and the information that it could yield, or destroying characteristic features of the property. A direct adverse impact occurs during the activity itself, such as when a road is built through a historic property and the construction process destroys the site. An indirect adverse impact can occur as a side effect of the activity or after the activity is complete, such as runoff from a road that eventually erodes a historic property adjacent to it.

In some cases where an action is possible to reduce or eliminate a potential or ongoing adverse impact, a no action determination that does not implement that action could be adverse if it allows greater degradation or deterioration of the historic property.

Other actions could have beneficial effects by stabilizing a historic property such as controlling erosion through an archaeological site, restoring and maintaining a historic building, or reducing fuels concentrations around a historic property to reduce the potential for a wildfire to impact it.

This planning process allows adverse impacts to be avoided altogether through project redesign, or mitigated through project modification or scientific investigation and/or removal of the site so that there are no adverse impacts to historic properties. Avoidance, mitigation or stabilization measures are agreed to in consultation conducted under Section 106 of the National Historic Preservation Act (NHPA) with the State Historic Preservation Officer (SHPO) and allow the project to proceed with no adverse impact to historic properties. Tribes are also involved where Native American sites are involved.

Spatial and Temporal Context

While research information is gathered about the entire planning area, site-specific surveys focus on the APE. The APE is the area where there is the potential for direct and indirect effects to cultural resources. This boundary may vary based on the type of sites known or predicted to be in the planning area as well as the potential effects of the project.

Affected Environment

Tribal

The project area falls into an area that was ceded to the United States under the 1855 Treaty of Point No Point. The modern tribes descended from the original signatories of the treaty include the Jamestown S'Klallam, Port Gamble S'Klallam, Lower Elwha and Skokomish. Article 4 of the treaty reserved to the tribes the right to fish at usual and accustomed grounds and hunting and gathering on open, unclaimed lands.

The Forest identified the Skokomish Indian Tribe as having ancestral ties to this project area. Initial consultation was conducted during a June 30, 2014 meeting, followed with a September 11, 2014 letter.

Cultural Resource Inventories

Four previous inventories were conducted within the planning area although none covered areas within the project's APE. One previously documented site also lay in the project area. This site, the remains of a forest fire lookout, was determined not eligible in 1992.

The current inventory covered approximately 1,200 acres using pedestrian survey and shovel tests. Survey focused on high probability areas and covered all closed roads and old railroad grades that are proposed roads. Pedestrian transects were spaced about 25 meters apart, and boot scrapes or shovel probes were conducted every 25 meters depending on the terrain, soils and ground visibility. Shovel probes were placed in areas of high probability based on the Washington State Department of Archaeology and Historic Preservation's statewide predictive model and topography maps. In addition, shovel probes were placed around cultural artifacts to determine the extent and nature of the resource.

Documented Cultural Resources

A total of four sites or isolates were located within the project area (see table 1). Isolates are not generally protected during project implementation.

The remains of the Dennie Ahl Lookout were determined not eligible in 1992 due to lack of integrity. This site will not be protected during management activities.

A portion of the Simpson Logging Railroad system lies within this project area. Because only a portion of this system was recorded, eligibility cannot be determined at this time so the site will be treated as eligible. Many of the old railroad grades have been previously converted to logging roads and are currently a part of the Forest's road system. These will continue to be used as roads. A small portion of these routes have not been converted or have been only casually used as roads. These sections still retain additional features such as rockwork, indications of ties or other features.

The last site, a lithic scatter, is considered eligible to the National Register of Historic Places and will be avoided during project activities.

Table Cultural-1. List of cultural site types including isolated finds.		
Site Types	**Description**	**Number**
Lithic Scatter	Lithic scatters are artifact scatters containing only flaked and/or groundstone artifacts.	1
Lookout	Forest Service administrative fire lookout remains, not eligible	1
Logging Railroad	Transportation features such as roads, trails, bridges, rock cairns and other markers	1
Lithic isolated find	Low density artifact scatters / isolated finds consist of a few lithic debitage or artifacts spread over a large area. These scatters often do not meet the accepted definition for sites and usually lack the potential to provide significant information and are not generally protected during project activities.	1

Environmental Consequences

The effects on cultural resource sites may vary with the type of site, as well as the type of project. Subsurface cultural materials may be more protected than standing structures, or cultural materials lying on top of the surface. In addition, all sites may be impacted by activities which draw people into an area, increasing the likelihood of vandalism, looting or incidental damage done through use of an area.

Where avoidance of a significant cultural resource site is not possible, measures are developed to mitigate or limit the effects of the project. Where the loss of the site, or a portion of the site will occur, the loss can mitigated by data recovery or interpretation of the history of the site. Data recovery generally includes a synthesis of known information about the site, and a plan for further research to retrieve further information from the site. Further information may be retrieved through excavation and analysis of the results, or researching and documenting the relevant records and histories about the site. Interpretation of the site is generally intended to inform the public about the history of the area to provide greater enjoyment of their cultural environment. Limiting the extent of disturbance to a site could include modifying the operating season of a project so that soil disturbance is kept to a minimum, using certain techniques or technology, or limiting the area where operations can take place to only a portion of the site.

Alternative A No Action

Direct, Indirect and Cumulative Effects

Under this alternative, no actions are proposed and any previously recorded, or as yet undiscovered sites, would remain undisturbed. There are no identified on-going impacts to historic properties that will continue because of no action. The railroad grades which have been converted to Forest roads will continue to be used and maintained as Forest roads.

Cumulative Effects

None

Alternative B

Direct, and Indirect Effects and Cumulative Effects

Under this alternative, eligible sites and features will be avoided by project activities. The routes of the logging railroad that have been converted to road will continue to be used and will be used during project implementation. This includes 26.4 miles which may be affected during the

project. Because the railroad system will be treated as eligible, several sections (1.3 miles total) will be excluded from the project's APE.

Cumulative Effects

None

Summary of Effects

The action alternative will use up to 26.4 miles of railroad grade which has been converted to the Forest road system. These routes are currently used and maintained as roads. There may be slightly more maintenance under the action alternative.

Compliance with law, regulation, policy, and the Forest Plan

The survey and mitigation meets the standards in the Forest Plan which directs that Forest undertakings will be surveyed for cultural resources, identified eligible properties will be managed and protected, with appropriate consultation with SHPO. The inventory report will be submitted to SHPO and the Skokomish Indian Tribe.

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies, such as the Forest Service, to take into account the effects of their actions, or undertakings, on historic or archaeologic properties. This act also establishes the Advisory Council of Historic Preservation (ACHP) as the oversight agency which consults with federal agencies to review undertakings which have the potential to affect significant historic properties, although generally, this consultation and review capacity is delegated to State Historic Preservation Offices (SHPO). The *NHPA* also provides for Native American Tribes with ancestral ties to the area to be consulted in order to identify site of importance to the Tribe, and to be included in consultations where Native American sites are involved.

In some cases the Section 106 consultation process has been streamlined or by-passed by agreement to facilitate project completion when certain conditions are met. Generally, these conditions include adequate inventories where no sites are located in a project's APE or particular site and project types which have recurring similar impacts which have allowed predetermined MMs to be developed by agreement with SHPO, or projects with a low likelihood to impact historic properties. Documentation under these agreements is submitted to the SHPO in an annual report, and may or may not be submitted prior to project implementation.

Both *NHPA* and the *Archaeological Resources Protection Act (ARPA)* prohibit the disclosure of the nature and location of cultural resource sites where a likelihood of harm to the sites could occur through disclosure. The intent of this prohibition is to protect sites from vandalism and looting, and to retain confidentiality of sites culturally significant to American Indian Tribes.

ARPA also establishes civil and criminal penalties for individuals removing or damaging archaeological resources on federal lands.

Any cultural resource survey has the potential for missing unique and/or significant sites. Avoidance or mitigation of effects will be implemented under expedited consultation with Indian tribes, SHPO and ACHP (as provided for under 36 CFR 800.111) for any new site discovered during the course of project activities.

3.10 Climate Change

Introduction

A growing body of scientific evidence and long-term climate modeling indicate that climate change is occurring at a global scale, and that it is associated with increased outputs of carbon dioxide (CO2) and other greenhouse gases (GHGs) resulting from human activities. Mote and Salathe (2009) used a wide range of climate models to explore possible future climate scenarios for the Pacific Northwest. All models indicate that the future climate will be warmer than the past, with rates of warming greater than those observed in the 20th century. Model projections for precipitation are much more uncertain than those for temperature, and remain within the 20th century range of annual variability (Mote 2003). There are others who believe that climate change is not occurring or that, if it is, it is not a result of human activity. They cite evidence such as a downward trend in temperature in the last decade (1998-2009) as a reason to question climate models that predict steady long-term increases in temperature. This analysis is not intended to support or refute any of the various positions on climate change. Its purpose is to fulfill the NEPA requirement to provide the public and the decision maker with relevant information about the environmental effects of a proposed action.

This analysis focuses on aspects of climate change that may lead to changes in the effects, sustainability, vulnerability, and design of the proposed action and its alternatives. It recognizes the limits of our scientific ability to accurately predict climate change effects, and does not devote effort to analyzing wholly speculative effects. It follows the Council on Environmental Quality's (CEQ) regulations at 40 CFR 1502.22 regarding acquisition and disclosure of information that is relevant to reasonably foreseeable impacts and is essential to a reasoned choice among alternatives.

This project was not specifically designed to respond to or mitigate potential climate change. This analysis will consider two types of climate change effects: the effect of climate change on the proposed action; and the effect of the proposed action on climate change. Because these are complex issues, large-scale issues, and there are no fine-scale models available to provide meaningful project-level information, this is not a quantitative analysis.

Potential effects of climate change on the proposed project

Much of the information presented in the following discussion is summarized from *Adapting to Climate Change at ONF and Olympic National Park* (Halofsky et al. 2011). Where no other references are specified, the climate-related information below should be attributed to Halofsky et al. (2011) and references therein.

Some of the most important projected future changes in climate relevant to forest planning on the Olympic Peninsula are:

- Very likely increase in temperature on all seasons, particularly in summer;
- Very likely increase in precipitation, probably as an increase in winter precipitation, but with a decrease in summer precipitation;
- Likely increase in water balance deficit in summer;
- Possible increase in winter extreme precipitation events.

These changes can be loosely summarized as warmer overall, with a likely increase in droughty conditions in the summer, and a possible increase in strong storms in the winter. Climate models predict a warming rate of roughly 0.5 degrees F (0.3C) per decade in the 21st century. Projected changes in average annual precipitation are small, but the distribution of precipitation is projected to become increasingly more seasonal (wetter winters, drier summers).

To increase ecosystem resilience to climate change, the ONF is focusing on maintaining, reconnecting, and reestablishing ecosystem processes and functions, considering past and current management practices, and their contributions to current and future habitat conditions. The possible climate change effects summarized above were taken into consideration during the planning phase of the proposed LSVMP.

Climate change modeling is done on a very coarse scale, and results are generalized over areas considerably larger than a single watershed or planning area. The scale of this analysis is the sub-watershed scale. Potential climate change effects at a scale as small and precise as a single watershed or planning area cannot be effectively modeled, and potential risks associated with climate change at such a localized scale are speculative and cannot be quantified.

Watershed

The implications for physical watershed processes include shifts in timing and magnitude of peak stream flows and the frequency of flooding. Increasing temperatures have led to more precipitation falling as rain rather than snow, earlier spring snowmelt, and reduced spring snowpack. These changes result in higher winter and spring streamflows and lower summer streamflows in snowmelt-dominated and transient (rain and snow mixed) watersheds. The Skokomish River 5th field watershed that contains the planning area is a transient watershed, and is likely to experience these projected changes. It is possible that an increase in extreme winter precipitation events may result in an increase in associated landslide and erosion risk.

Vegetation

Drier conditions associated with projected climate change may increase summer drought stress and fire frequency in the Pacific Northwest. Higher temperatures and lower summer precipitation may result in increased evapotranspiration, slower tree growth, and increased susceptibility to insects and disease. It is possible that an increase in extreme winter storm events may result in increased windthrow. Changing climatic conditions may favor the establishment of invasive plant species.

Alternative A – No Action

Direct and Indirect Effects

Under the No Action alternative, watershed and vegetation conditions in the watershed would not be altered by project-related activities. Watershed and vegetation response to projected trends in climate would not change from their current trajectory. There would be no interactions between project activities and potential effects of climate change on watershed and vegetation conditions within the watershed.

Cumulative Effects

Because no management activities would occur, there would be no cumulative effects with other past, present, or foreseeable future activities.

Action Alternative B

Direct and Indirect Effects

Watershed

The projected trend toward wetter winters and more extreme storm events may increase erosion and landslide risk in the watershed. The project design criteria and other management requirements described in Chapter 2 would likely be sufficient to prevent any of the action alternatives from contributing any increased risk of sedimentation and landsliding associated by the potential effects of climate change. Improvements to road-related drainage conditions resulting from decommissioning of unstable unclassified roads as part of project activities would be likely to decrease existing landslide and sedimentation risks currently associated with these features.

Vegetation

The projected trend toward drier summer conditions may increase drought stress and inter-tree competition in the watershed. In the dense, managed stands proposed for treatment, thinning would reduce competition between trees and may offset potential climate change-related drought stress for a period of time. The proposed thinning prescriptions would temporarily result in increased sunlight reaching currently bare forest floor, potentially increasing evaporation, but the anticipated rapid post-thinning growth of understory and groundcover vegetation would decrease this effect within a few years. Also, post-thinning canopy cover would remain relatively high, ranging from 40 to 90 percent, and the canopy is expected to close again relatively quickly, minimizing any increased drying effects. Thinning prescriptions would be designed to minimize blowdown risk associated with the thinning treatments. The proposed thinning treatments are not anticipated to be directly or indirectly affected by climate change, and are not anticipated to either exacerbate or mitigate climate change effects on vegetation in the watershed.

Cumulative Effects

Because it is difficult to assess the effects of climate change on past management actions in the watershed, it is not feasible to assess whether there may be cumulative effects of climate change interactions with other management actions associated with this project. The project was designed to accommodate potential effects that could be associated with the climate trends presented in Halofsky et al. (2010), and to maintain and increase ecosystem resilience in the face of projected future climate scenarios.

Potential effects of the proposed project on climate change

Forests and forest management influence the production of GHGs and therefore influence global climate change. Forests help mitigate GHG emissions by absorbing carbon dioxide and sequestering carbon in the form of biomass. Large-scale deforestation both releases GHGs (from burning and decomposition of slash and woody debris) and reduces the global rate of carbon sequestration until the forest regrows or the loss of sequestration potential is offset by the growth of other forests or replaced by other means. The use of petroleum-fueled equipment associated with timber harvest and the manufacture of wood-based products consumes fossil fuels and contributes carbon dioxide to the atmosphere. Harvested timber that is converted into building products no longer actively sequesters carbon, but it does continue to serve as carbon storage for the duration of its lifetime of use as structural and non-structural components of buildings.

For this assessment of the potential effects of the LSVMP on climate change, the alternatives will be compared relatively on the basis of changes in carbon sequestration potential (timber output), and GHG (CO2) emissions (use of fossil fuels by harvest equipment).

Alternative A – No Action

Direct, Indirect and Cumulative Effects

Under the No Action alternative, there would be no timber output, and no change to current rates of carbon sequestration in the stands proposed for thinning. Tree growth in these stands is slowing as a result of overcrowding, and competitive exclusion is causing some trees to die. In the absence of disturbance, this process would continue, and the pace of carbon sequestration is likely to remain unchanged. There would be no timber harvest and associated activities, so there would be no project-related GHG emissions. Because there would be no project activities, there would be no cumulative effects with other past, present, and foreseeable future management actions.

Action Alternative B

Although carbon sequestration and release of GHGs are local events, their effect on climate change occurs at a global scale. Because of this, it is impossible to precisely assess the potential effects of the LSVMP, as estimates would be relatively meaningless on a global scale.

Direct and Indirect Effects

Timber harvest may result in a short-term decrease of carbon sequestration potential, but that would be fairly quickly offset by the increase in tree growth that would result from a reduction in inter-tree competition.

Per board-foot harvested, helicopter yarding uses considerably more petroleum-based fuel than cable or ground-based yarding. Therefore, the small portion of the project unit acres that would employ helicopter harvest would have larger GHGs than those units harvested by cable or ground based systems.

Cumulative Effects

Global climate change has been described as the ultimate cumulative effect, overlapping in space and time with countless other human actions across the earth in the past, present, and the foreseeable future. Its extent is worldwide, and it affects different geographical regions differently. On a global scale, the LSVMP is likely to have a negligible cumulative effect on climate change. The ongoing demand for forest products implies that equivalent volumes of timber would be harvested elsewhere. Commercial thinning of forested land that does not convert that land to other uses but retains it in a predominantly forested condition may be preferable than other forms of forest management in terms of its contribution to current trends in global climate change.

3.11 Other Effects and Required Disclosures

This section discusses those effects for which disclosure is required by National Environmental Policy Act (NEPA) regulations, Forest Service policy or regulation, various Executive Orders, or other laws and direction covering environmental analysis and documentation. In many cases, the information found here is also located elsewhere in this document. In other cases, the effects are not necessarily connected to any particular resource area previously discussed in this EA. All of

the effects discussed below are effects that would be associated with Alternative B, the Proposed Action.

National Forest Management Act Compliance

Compliance with the National Forest Management Act (NFMA) can be demonstrated by finding that a project is consistent with the following applicable requirements of 16 USC 1604(g)(3).
(g)(3)(A): insure consideration of the economic and environmental aspects of various systems of renewable resource management, including the related systems of silviculture and protection of forest resources, to provide for outdoor recreation (including wilderness), range, timber, watershed, wildlife, and fish.

This EA considers the effects of implementing the alternatives on the economic and environmental aspects of the planning area. This consideration includes the forest resources of recreation (including Wilderness), watershed, wildlife, and fish.
(g)(3)B: provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.
Actions proposed under the project alternatives provide for a diversity of plant and animal communities within the project area as described in the multiple-use objectives of the Forest Plan. The effects to plant and animal communities are described in the resource sections of this chapter.
(g)(3)C: insure research on and (based on continuous monitoring and assessment in the field) evaluation of the effects of each management system to the end that it will not produce substantial and permanent impairment of the productivity of the land.
Implementation monitoring and other monitoring proposed in this document would provide an evaluation of the effects of implementing any of the project alternatives.

Forest Plan Consistency

The analysis performed by the interdisciplinary team found that the actions proposed under both project alternatives are consistent with the Forest Plan. The project's Purpose and Need are consistent with Forest Plan goals and objectives, and impacts to resources as evaluated in this EA are consistent with Forest Plan direction and standards and guidelines. (Compliance with associated Standards and Guidelines from the Forest Plan Management Allocations is documented in the Forest Plan Consistency Checklist in the project record.)

Effects on Inventoried Roadless Areas

While there is one inventoried roadless area within the project area boundary (Jefferson Ridge IRA, see Map A-9), no treatment units are located within these inventoried roadless areas. The project will have no effect on inventoried roadless areas.

Effects on Wilderness Areas or Potential Wilderness Areas

A portion of the Mt. Skokomish Wilderness area falls within the project area boundary (Appendix A, Figure A-9). However, the Wilderness area is to the west of any treatment units;

no treatment units are located within the wilderness. There will be no effect to wilderness as a result of this project.

The project area contains no potential wilderness areas as the project area has a well-developed road system and a past of extensive vegetation management.

Clean Water Act

Section 303 of the Clean Water Act mandates that Total Maximum Daily Load (TMDLs) be developed for the parameters causing the impairment of beneficial use for all 303d listed waters. The 2008 federal CWA 303(d) list included the segment of the mainstem South Fork Skokomish River (identified as List ID 35267) within T22N R05W Section 15 (WDOE 2009) for temperature. Harvest units are far enough away from the mainstem channel, at least 200 feet, that shade would not be affected, thus not affecting water temperatures in the South Fork Skokomish River. See the stream temperature discussion of the Fisheries and Water Quality Section of this EA (Chapter 3, Section 3.3) for more details.

Clean Air Act

As disclosed in the Fire and Fuels section of this EA, there would probably be burning of activity-generated slash. Any planned burning of this slash would be done in compliance with all State and Federal laws, including the Clean Air Act.

Irreversible Commitment of Resources

Irreversible impacts result from the use or modification of resources that are replaceable only over a long period of time. Soil productivity would be lost to some degree on temporary skid roads, skid trails, and landings due to soil displacement. Full recovery of soil productivity in these areas would not be anticipated for many decades, although measures to reclaim these areas would speed recovery. Permanent roads represent an irreversible modification of the soils within the road prism; the proposed action contains no increases to the existing system of authorized Forest roads. There are no other irreversible commitments associated with the proposed action.

Irretrievable Commitment of Resources

Irretrievable commitments are opportunities for resource uses that are foregone because of decisions that use that land in another way. Rock pit development: The construction and use of roads and landings for this project would be likely to require the application of road surface rock. Existing rock pits in the planning area would be the source for this material. The further development of these rock sources would forego other future uses of the pit area.

Adverse Effects That Cannot Be Avoided

Implementation the action alternative would result in some adverse environmental effects that cannot be avoided. For example, timber harvest and temporary road construction activities could have short-term adverse effects on water quality and soil productivity (See Chapter 3). The magnitude of these effects relative to the entire project would be very small, and would remain within prescribed standards and guidelines. The degree of these adverse effects would be minimized through the project's required design criteria and MMs, described in chapter 2 of this EA.

Conflicts with Plans, Policies, or Other Agencies and Jurisdictions

This project would not conflict with any plans or policies of other jurisdictions, including the Tribes. This project would not conflict with any other policies, regulations, or laws, including the Clean Water Act (see Section 3.3), Endangered Species Act (see Sections 3.3 and 3.5), and Clean Air Act (see Section 3.6).

The Washington State Department of Ecology (Ecology) is responsible for enforcing the Clean Water Act of 1972. A memorandum of Understanding between the Forest Service and Ecology states that BMPs used by the Forest Service to control or prevent non-point sources of water pollution will meet or exceed Washington State water quality standards.

The USFWS is responsible for the protection and recovery of Threatened and Endangered Species and the National Oceanic and Atmospheric Administration (NOAA) is responsible for the protection and recovery of Threatened and Endangered marine fish species. Consultation with these agencies is required and is currently being completed.

Effects on Prime Farm Land, Range Land, and Forest Land

There have been no range activities within the planning area for several decades. There are no prime farm lands or prime range lands associated within the project area. The project would not result in any adverse impacts to the productivity of farmland, rangeland, or forestland.

Potential or Unusual Expenditures of Energy

There would be no unusual energy requirements associated with implementing any of the project's alternatives. Energy consumption needed to harvest timber or for recreation would not necessarily be reduced by lower levels of either activity in the LSVMP planning area. Helicopter yarding operations are always evaluated due to their relatively higher level of fuel consumption, but it is likely that, if they did not occur for this project, they would take place at similar levels elsewhere on the Forest or in the region, with correspondingly similar energy requirements. The LSVMP would not create unusual energy requirements.

Effects on Wetlands and Floodplains

Given the PDCs, BMPs and MMs included in the project, there would be no adverse effects to wetlands or floodplains from the implementation of any of the action alternatives.

Effects on American Indians

The Lower Skokomish Vegetation Management planning area lies within the area ceded to the United States by the 1855 Point-No-Point Treaty. See Cultural Resources Section 3.9 for details regarding consultation with the Tribe.

Effects on Cultural Resources

No known historic and cultural sites are located within the proposed thinning units or access roads. Given the requirement for cessation of project activities if cultural resources are discovered, followed by an evaluation by a Forest Service Archaeologist, there would be no adverse effects to cultural resources from the implementation of the Proposed Action,

Aleternative B. The Washington State of Archaeology and Historic Preservation reviewed the findings of cultural resource surveys conducted within the planning area, and concurred with the determination that the project would have no adverse effect on historic resources (Dec. 21, 2015; project record).

Consumers, Civil Rights, Minority Groups, and Environmental Justice

There is no known major scientific controversy surrounding the activities and potential effects of this project. While the sale of National Forest timber would create or sustain jobs and provide consumer goods, no quantitative output, lack of output, or timing of output associated with implementation of any alternative would affect the civil rights, privileges, or status quos of consumers, minority groups, women, or American Indians.

Several of the Forest Service roads that would be used for the project are frequently used by the public. Proper road closure and/or signing for safety would follow the Manual in Uniform Traffic Control Devices for Streets and Highways (MUTCD). Special attention would be focused on any helicopter operations associated with the proposed project. There would be no adverse effects to human health or safety associated with the implementation of any alternative, or modification thereof, for this project.

Environmental Justice means that, to the greatest extent practicable and permitted by law, all human populations are provided the opportunity to comment before decisions are rendered, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner, by government programs and activities affecting human health or the environment.

One goal of Executive Order 12898 is to provide, to the greatest extent practicable, the opportunity for minority and low-income populations to participate in planning, analysis, and decision-making that affects their health or environment, including identification of program needs and designs. The Executive Order makes clear its provisions apply fully to programs involving Native Americans.

Analysis for the LSVMP has been conducted under Departmental regulation 5600-2, December 15, 1997, including the Environmental Justice Flowchart, and CEQ's Environmental Justice – Guidance Under the National Environmental Policy Act. The project's proposed action, purpose and need, and area of potential effect have been clearly defined. Scoping under NEPA has utilized extensive and creative ways to communicate. Consultation with Native American Tribes has taken place (see above Section 3.9).

The proposed action and its alternatives do not appear to have a disproportionately high or adverse effect on minority or low income populations, or on American Indian Tribes. The proposed action and alternatives do not have disproportionately high and adverse human health effects, high or adverse environmental effects, substantial environmental hazard, or effects to differential patterns of consumption of natural resources. In some areas of the Forest, the gathering of special forest products, particularly of salal and mushrooms, is an activity where there is the potential to disproportionally affect minority populations. Since salal and mushrooms are readily available over a large portion of the ONF, and within the project area boundary, the

implementation of thinning treatments have a very minimal impact over the total area use of National Forest System lands available for salal and mushroom gathering.

4.0 LIST OF PREPARERS AND AGENCIES CONSULTED

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Olympic National Park
U.S. Fish and Wildlife Service
Washington State Department of Archaeology and Historic Preservation
Washington State Department of Fish and Wildlife

5.0 LIST OF ACRONYMS AND ABBREVIATIONS

ACS	Aquatic Conservation Strategy
AMA	Adaptive Management Area
ATM	The ONF's Access and Travel Management plan
BLM	Bureau of Land Management
BMP	Best Management Practice
CCF	A unit of wood volume measure; one CCF is equal to 100 cubic feet
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHU	Critical habitat unit
CWD	Coarse Woody Debris (on the ground)
dB	Decibel (a logarithmic measure of power or intensity, in this case of noise or sound)
dbh	Diameter at Breast Height (at a height of 4.5 feet)
EA	Environmental Assessment
EUI	Ecological unit inventory (soils)
FSH	Forest Service Handbook
GHG	Greenhouse Gas
GIS	Geographic Information System
GMU	(Wildlife) Game Management Unit
IDT	Interdisciplinary Team
Forest Plan	ONF Land and Resource Management Plan (1990)
LSR	Late-Successional Reserves
LT	Legacy Tree (large live tree left in place during past timber harvest activities)
LWD	Large Woody Debris (in stream course or river)
MBF	Thousand board feet (one board foot is the volumetric equivalent of a piece of lumber 1' wide by 1' long by one inch thick
MIS	Management Indicator Species
ML	Road maintenance level
MMBF	Million board feet (1,000 MBF)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NFS	National Forest System (when applied to NFS Lands or NFS Roads)
NWFP	Northwest Forest Plan (common name for the April 1994 Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl)
NSO	Northern Spotted Owl
REO	Regional Ecosystem Office
RR	Riparian Reserve
SDI	Stand density index
SMU	Soil Map Unit
SNT	Suitable Nest Tree (for Northern Spotted Owl or Marbled Murrelet)
STUDS	Siuslaw Thinning and Underplanting for Diversity Study

TPA	Trees per acre
USDA	United States Department of Agriculture
USDI	United States Department of the Interior

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Appendix A

Appendix A: Maps

Note: Larger versions of maps can be found on the project website.

Map A-1. ONF Forest Plan management allocations within the lower portion of the project area.

Map A-2. ONF Forest Plan management allocations within the upper portion of the project area.

Map A-3. Northwest Forest Plan land management allocations within the lower portion of the project area.

Map A-4. Northwest Forest Plan land management allocations within the upper portion of the project area.

Map A-5. Alternative B –Logging systems, roads, and rock sources for units in the lower portion of the project area.

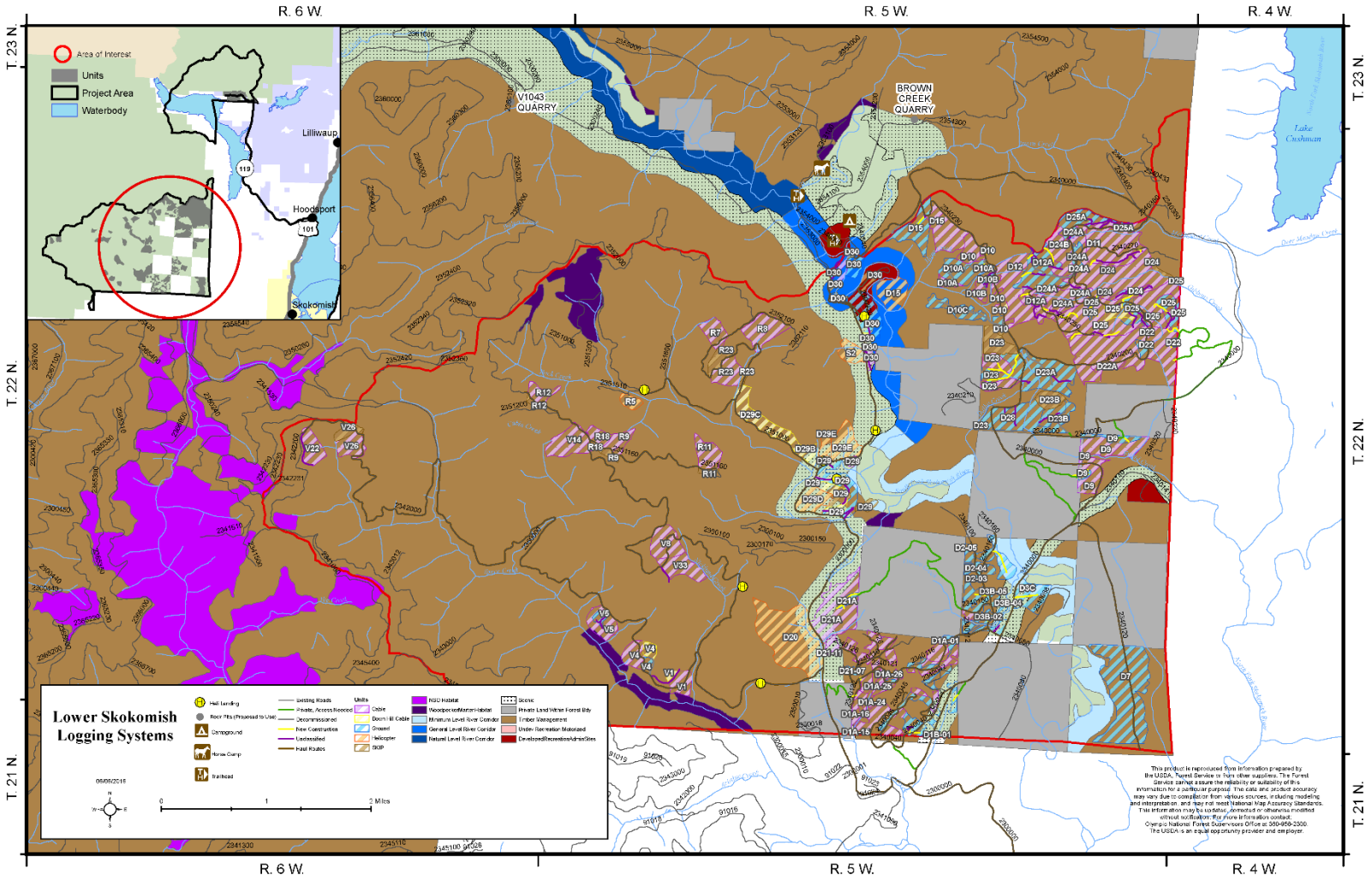
Map A-6. Alternative B – Logging systems, roads, and rock sources for units in the upper portion of the project area.

Map A-7. Alternative B – Seasons of operation for treating units in the lower portion of the project area.

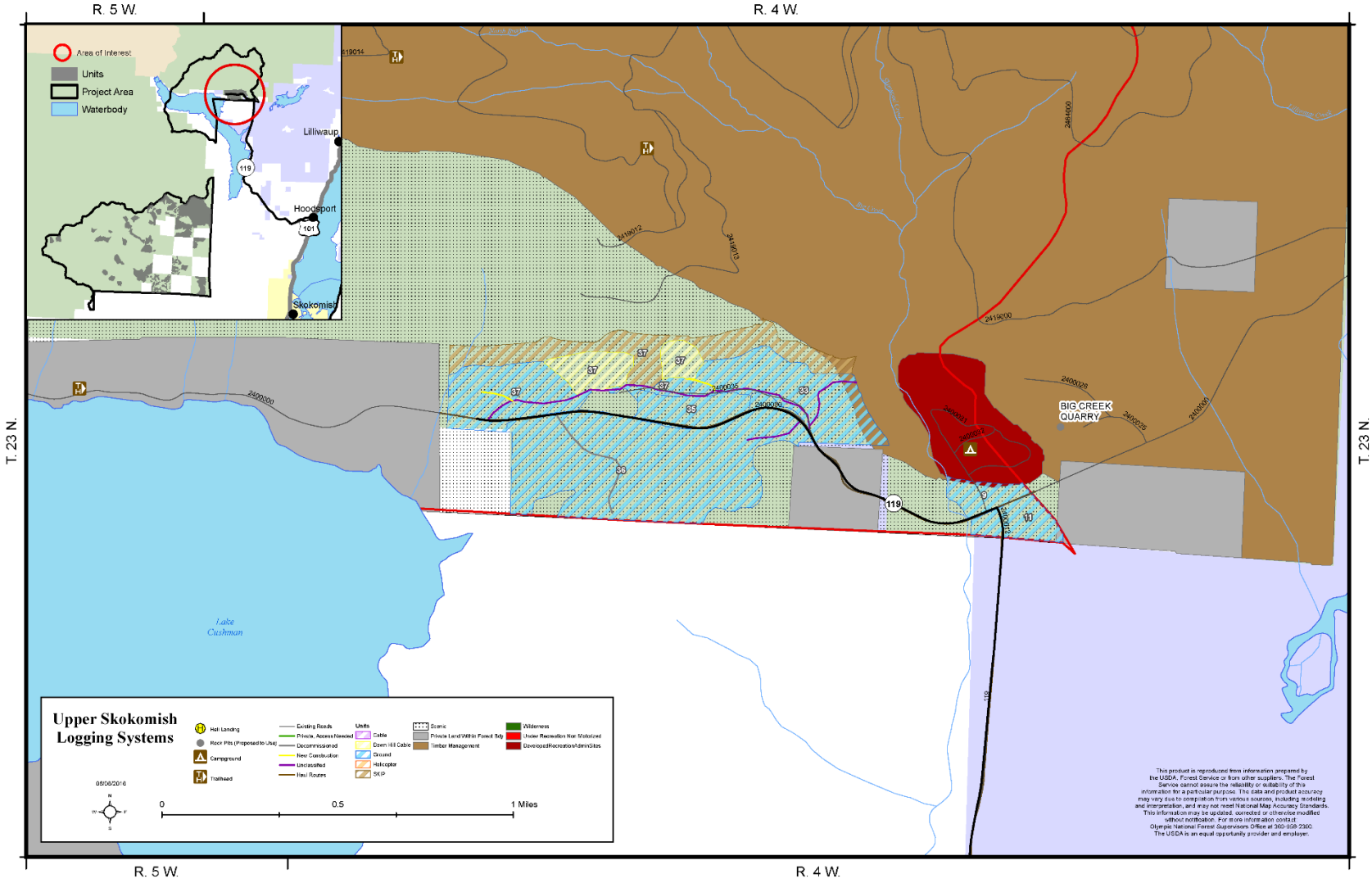
Map A-8. Alternative B – Seasons of operation for treating units in the upper portion of the project area.

Map A-9. Inventoried Roadless Areas and Wilderness areas within the upper portion of the project area. (There are no IRAs or Wilderness areas adjacent to the lower portion of the project area or treatment units).

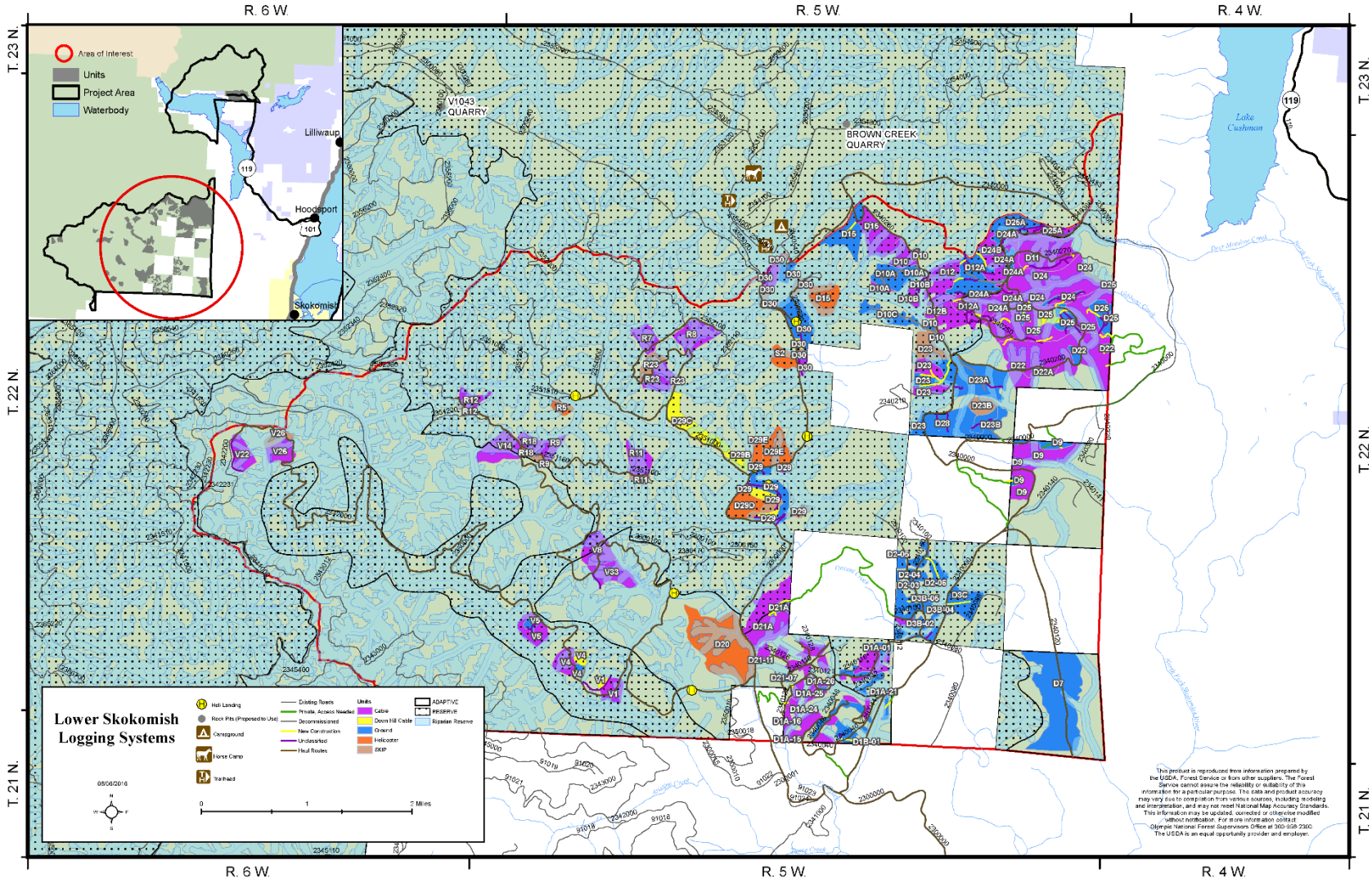
Map A-1. 1990 ONF Forest Plan management allocations the lower portion of the project area.



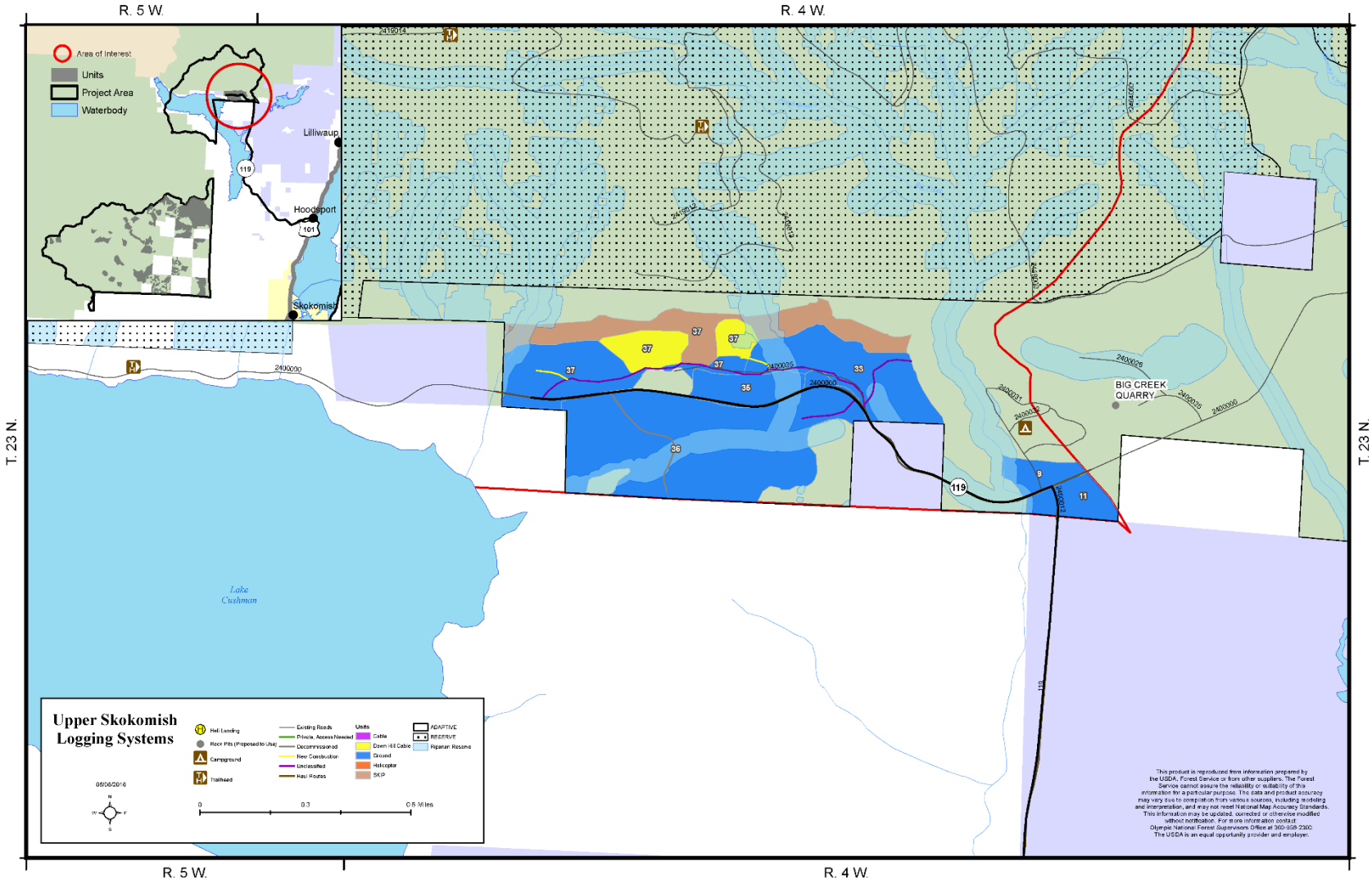
Map A-2. 1990 ONF Forest Plan management allocations within the upper portion of the project area.



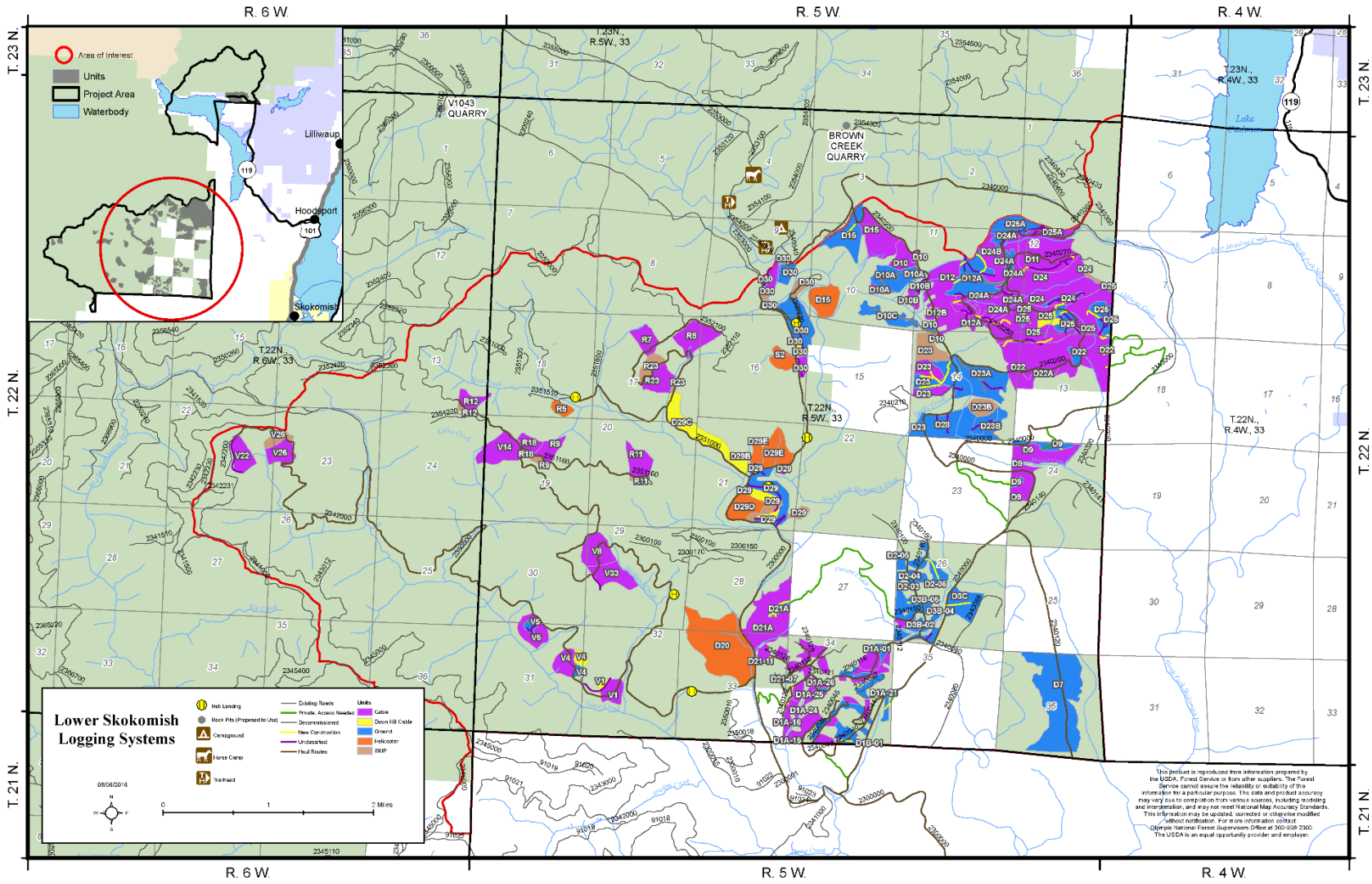
Map A-3. Northwest Forest Plan land management allocations within the lower portion of the project area.



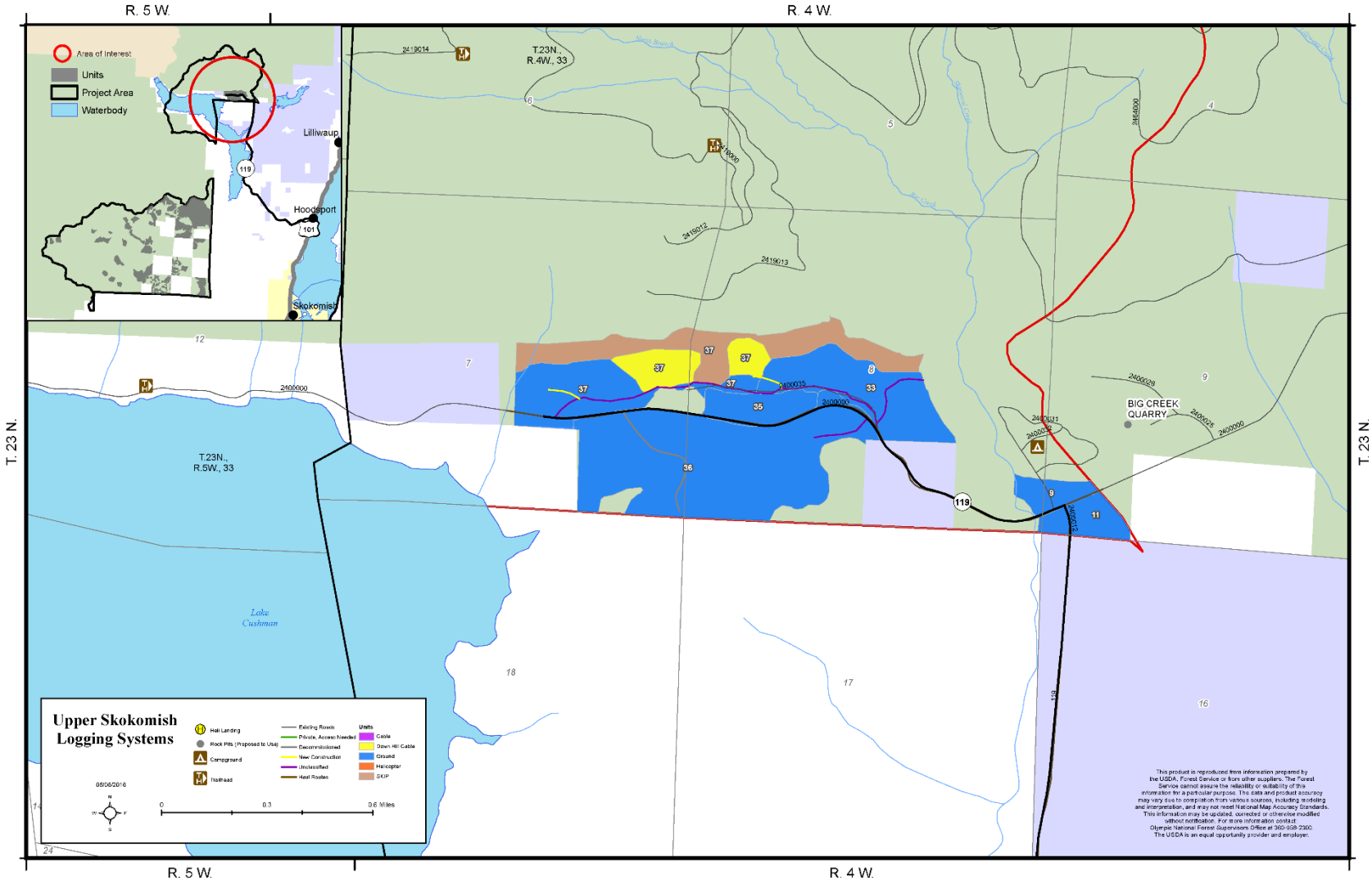
Map A-4. Northwest Forest Plan land management allocations within the upper portion of the project area.



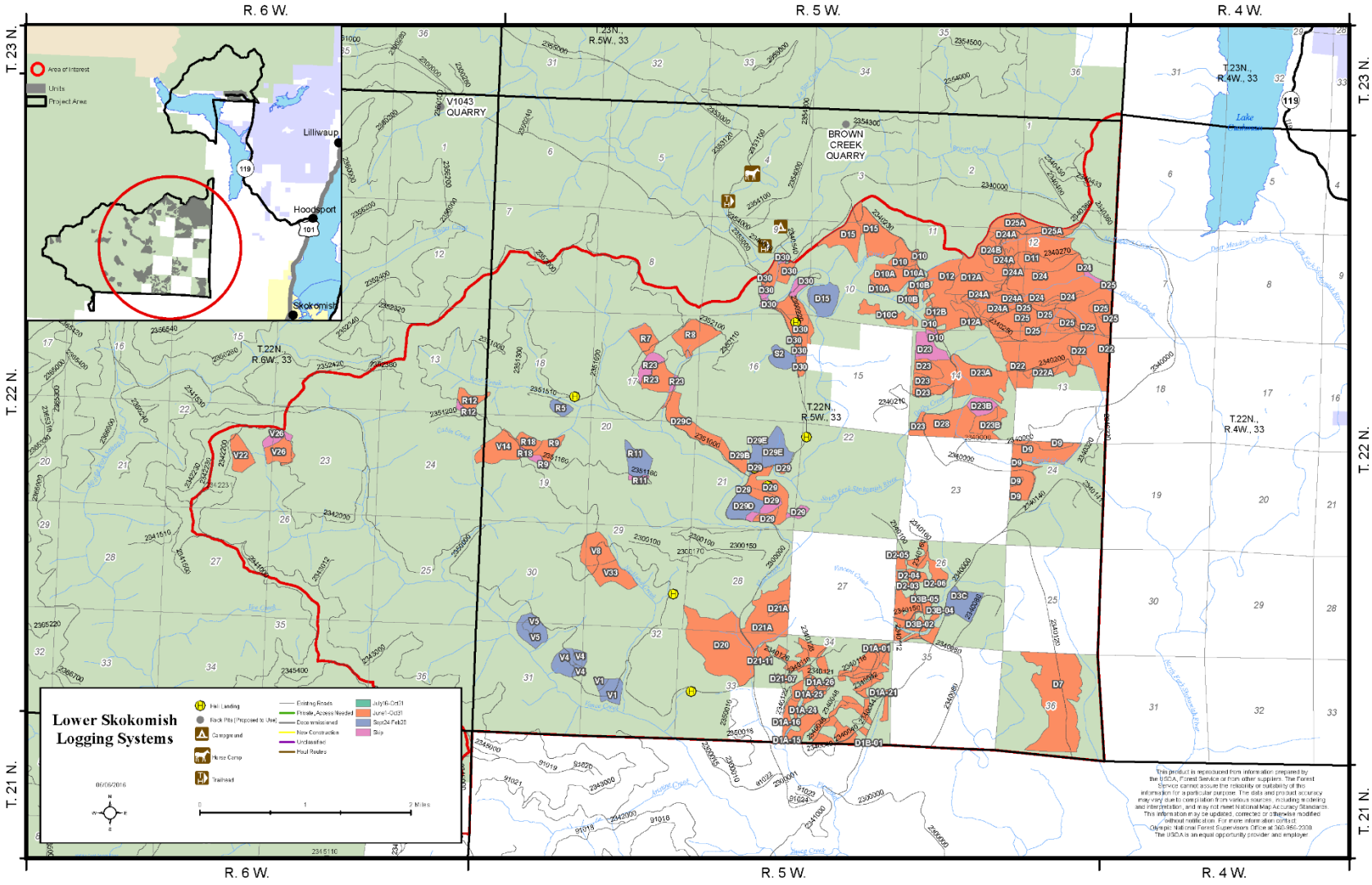
Map A-5. Alternative B – Logging systems, roads, and rock sources for units in the lower portion of the project area.



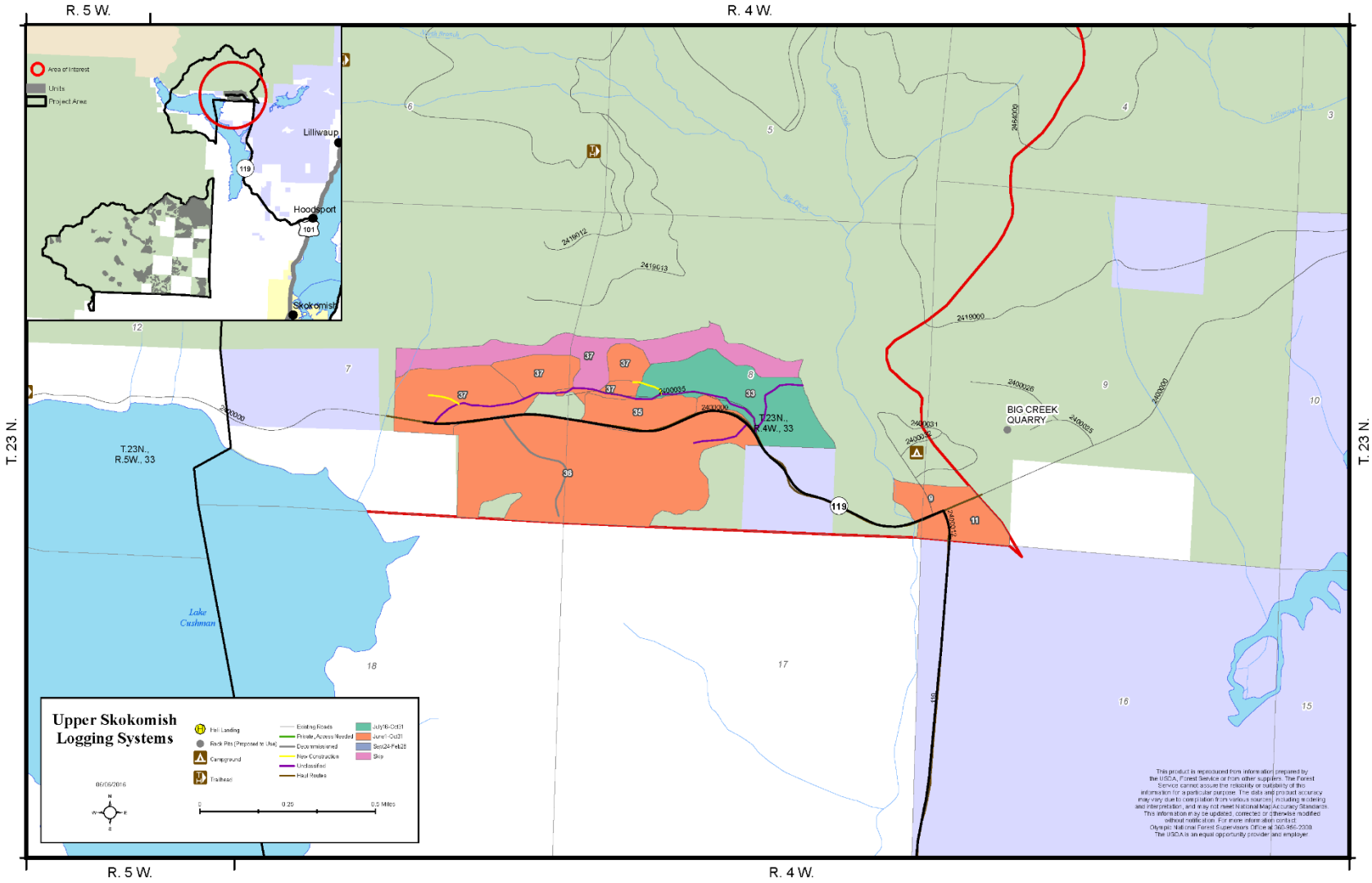
Map A-6. Alternative B – Logging systems, roads, and rock sources for units in the upper portion of the project area.



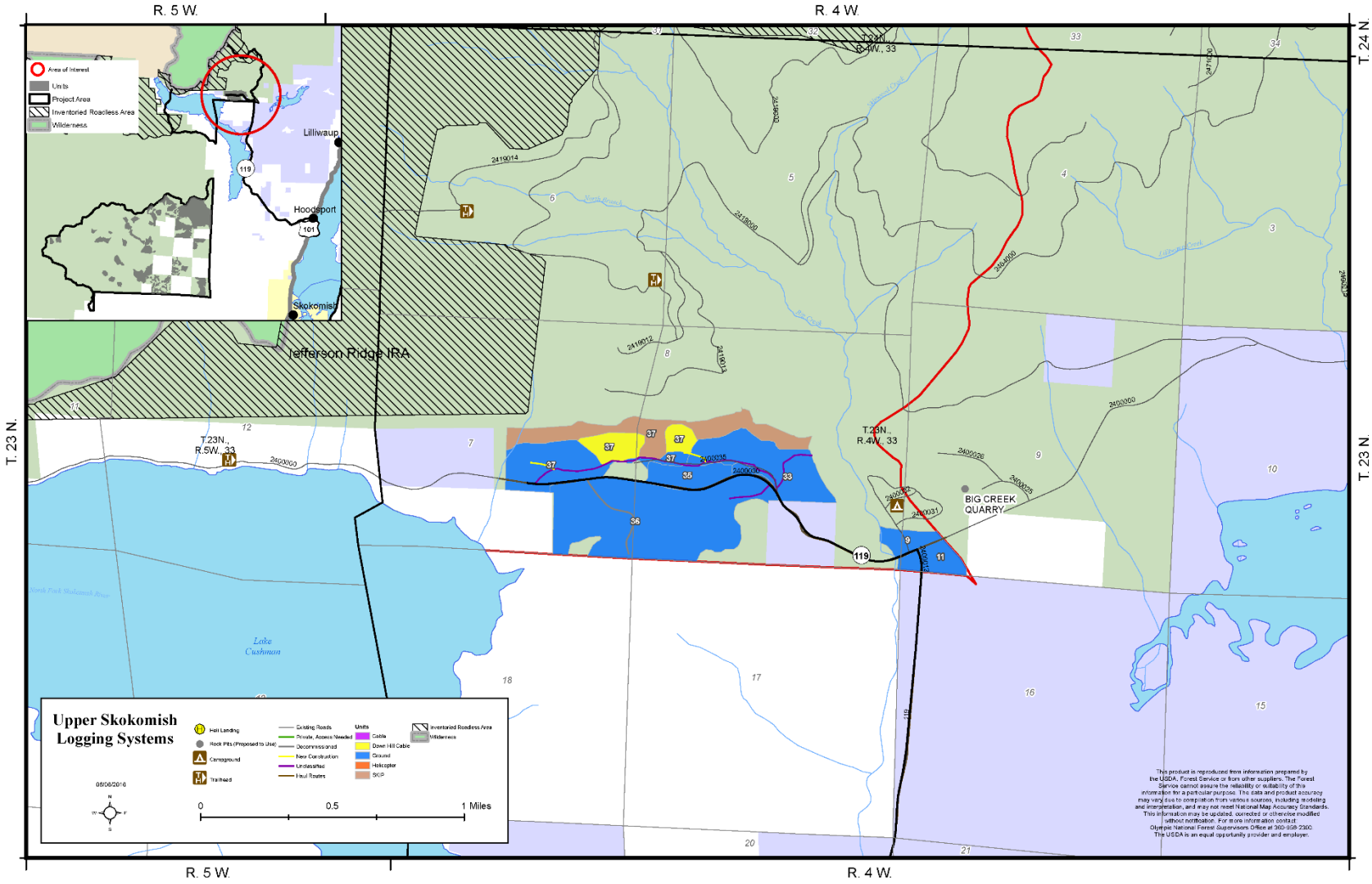
Map A-7. Alternative B – Seasons of operation for treating units in the lower portion of the project area.



Map A-8. Alternative B – Seasons of operation for treating units in the upper portion of the project area.



Map A-9. Inventoried Roadless Areas and Wilderness areas within the upper portion of the project area. (There are no IRAs or Wilderness areas adjacent to the lower portion of the project area or treatment units. Therefore map not shown.)



Appendix B

Appendix B: Project Road Development, Haul Routes, and Treatment Units

Road development

Table B-1. Temporary road development planned for treatment/access.		
Route Number	**Status**	**Length (miles)**
36-2	Previously Decommissioned	0.39
V4-1	Previously Decommissioned	0.16
D12-7	Previously Decommissioned	0.46
D23-9	Previously Decommissioned	0.19
D23-10	Previously Decommissioned	0.45
D10C-1	Previously Decommissioned	0.77
D10-4	Previously Decommissioned	0.51
D30-4	Previously Decommissioned	0.05
D15-2	Previously Decommissioned	0.11
D10-5	Previously Decommissioned	0.05
D12-1	New Temporary Road	0.09
D12-3	New Temporary Road	0.06
D12-7	New Temporary Road	0.08
D9-1	New Temporary Road	0.16
D9-2	New Temporary Road	0.04
D21-2	New Temporary Road	0.04
D21-1	New Temporary Road	0.28
D21-3	New Temporary Road	0.03
D24-3	New Temporary Road	0.12
D25-3	New Temporary Road	0.23
D24-4	New Temporary Road	0.14
D22-1	New Temporary Road	0.12
D25-2	New Temporary Road	0.15
D25-4	New Temporary Road	0.03
D1-7	New Temporary Road	0.08
D22-3	New Temporary Road	0.04
D22-4	New Temporary Road	0.11

Table B-1. Temporary road development planned for treatment/access.		
Route Number	**Status**	**Length (miles)**
D25-9	New Temporary Road	0.17
D25-9	New Temporary Road	0.18
35-3	New Temporary Road	0.09
37-1	New Temporary Road	0.09
D15-1	New Temporary Road	0.12
D12-5	New Temporary Road	0.23
D9-3	New Temporary Road	0.20
D9-4	New Temporary Road	0.07
D24-1	New Temporary Road	0.20
D24-1	New Temporary Road	0.06
D11-1	New Temporary Road	0.04
D11-2	New Temporary Road	0.06
D29-4	New Temporary Road	0.04
D1-2	New Temporary Road	0.06
D1-3	New Temporary Road	0.02
D1-6	New Temporary Road	0.03
D1-4	New Temporary Road	0.06
D1-5	New Temporary Road	0.02
D1-1	New Temporary Road	0.01
D23-8	New Temporary Road	0.09
D23-7	New Temporary Road	0.22
D23-6	New Temporary Road	0.46
D2-2	New Temporary Road	0.13
D3-3	New Temporary Road	0.04
D10-3	New Temporary Road	0.04
D25-7	New Temporary Road	0.08
D3-4	New Temporary Road	0.23
D2-1	New Temporary Road	0.26
D25-11	Unclassified (non-system, existing road bed)	0.50
D25-12	Unclassified (non-system, existing road bed)	0.12
D11-2	Unclassified (non-system, existing road bed)	0.49
D11-3	Unclassified (non-system, existing road bed)	0.05
D24-7	Unclassified (non-system, existing road bed)	0.04
D24-5	Unclassified (non-system, existing road bed)	0.27
D24-6	Unclassified (non-system, existing road bed)	0.16

Table B-1. Temporary road development planned for treatment/access.		
Route Number	**Status**	**Length (miles)**
D12-8	Unclassified (non-system, existing road bed)	0.19
D12-9	Unclassified (non-system, existing road bed)	0.26
D10-2	Unclassified (non-system, existing road bed)	0.04
D10-1	Unclassified (non-system, existing road bed)	0.20
D23-1	Unclassified (non-system, existing road bed)	0.21
D23-2	Unclassified (non-system, existing road bed)	0.08
D25-3	Unclassified (non-system, existing road bed)	0.08
35-1	Unclassified (non-system, existing road bed)	1.02
D12-4	Unclassified (non-system, existing road bed)	0.33
D12-1	Unclassified (non-system, existing road bed)	0.14
D24-2	Unclassified (non-system, existing road bed)	0.11
D30-2	Unclassified (non-system, existing road bed)	0.22
D30-1	Unclassified (non-system, existing road bed)	0.20
D29-2	Unclassified (non-system, existing road bed)	0.52
D29-1	Unclassified (non-system, existing road bed)	0.46
D29-3	Unclassified (non-system, existing road bed)	0.07
D30-3	Unclassified (non-system, existing road bed)	0.14
V1-1	Unclassified (non-system, existing road bed)	0.36
35-2	Unclassified (non-system, existing road bed)	0.22
D30-3	Unclassified (non-system, existing road bed)	0.07
D15-1	Unclassified (non-system, existing road bed)	0.04
D12-6	Unclassified (non-system, existing road bed)	0.11
D25-10	Unclassified (non-system, existing road bed)	0.22
D24-1	Unclassified (non-system, existing road bed)	0.14
V5-1	Unclassified (non-system, existing road bed)	0.18
V5-2	Unclassified (non-system, existing road bed)	0.07

Table B-1. Temporary road development planned for treatment/access.		
Route Number	**Status**	**Length (miles)**
D23-4	Unclassified (non-system, existing road bed)	0.21
D23-3	Unclassified (non-system, existing road bed)	0.10
D12-2	Unclassified (non-system, existing road bed)	0.16
D28-2	Unclassified (non-system, existing road bed)	0.19
D28-3	Unclassified (non-system, existing road bed)	0.07
D28-1	Unclassified (non-system, existing road bed)	0.04
D24-8	Unclassified (non-system, existing road bed)	0.08
D22-2	Unclassified (non-system, existing road bed)	0.05
D25-8	Unclassified (non-system, existing road bed)	0.28
D25-7	Unclassified (non-system, existing road bed)	0.25
D29-5	Unclassified (non-system, existing road bed)	0.04
V33-1	Unclassified (non-system, existing road bed)	0.17
D1-3	Unclassified (non-system, existing road bed)	0.09
D25-1	Unclassified (non-system, existing road bed)	0.18
36-1	Unclassified (non-system, existing road bed)	0.17
V22-1	Unclassified (non-system, existing road bed)	0.39
D25-9	Unclassified (non-system, existing road bed)	0.18
D25-13	Unclassified (non-system, existing road bed)	0.23
D25-6	Unclassified (non-system, existing road bed)	0.13
D3-1	Unclassified (non-system, existing road bed)	0.09

Haul Routes

Table B-2. Forest Service Roads proposed for use as haul routes.

Road Number	Terminus	Beginning Milepost	Ending Milepost	Segment Length	Jurisdiction	System	Operational Maintenance Level	Surface Type	Lanes	Primary Manager[1]
4164	H/W 101	0	5.6	5.6	C - County, Parish, Borough	C - County, Parish, Borough		Ac - Asphalt	2 - Double Lane	C - County, Parish, Borough
234004	2340 (1250)	0	0.69	0.69	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234027	2340200 (1253)	0	1.2	1.2	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234015	2340100	0	0.3	0.3	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234004	2340040	0	0.22	0.22	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340110	0	0.28	0.28	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234004	2340040	0	0.34	0.34	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234004	2340 (1250)	1.24	1.9	0.66	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234011	2340110 (1251)	0	2.67	2.67	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234013	2340110	0	0.2	0.2	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340110	0	0.11	0.11	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234004	2340 (1250)	0.69	1.24	0.55	FS - Forest Service	P - Private	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340110	0	0.32	0.32	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234013	2340110	0	0.11	0.11	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340110	0	0.33	0.33	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234004	2340040	0	0.31	0.31	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340110	0	0.29	0.29	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234004	2340 (1250)	0	0.69	0.69	FS - Forest Service	NFSR - National Forest System Road	1 - Basic Custodial Care (Closed)	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340 (1250)	0.05	0.36	0.31	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service

Table B-2. Forest Service Roads proposed for use as haul routes.

Road Number	Terminus	Beginning Milepost	Ending Milepost	Segment Length	Jurisdiction	System	Operational Maintenance Level	Surface Type	Lanes	Primary Manager[1]
234012	2340 (1250)	0	0.05	0.05	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340 (1250)	0.36	1.39	1.03	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
234012	2340 (1250)	1.39	2.4	1.01	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
234016	JCT 2340100 (1251)	0	0.45	0.45	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
235116	2351 (V1006)	0	1.6	1.6	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
235100	2350 (V1005)	11.81	12.91	1.1	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Agg - Crushed Aggregate Or Gravel	1 - Single Lane	FS - Forest Service
234020	2340 (1250)	0.45	5.731	5.281	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234220	2342 (V1100)	0	3.4	3.4	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	CO - COoperator
234020	2340 (1250)	0	0.45	0.45	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234023	2340200 (1253)	0	2.1	2.1	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
235100	2350 (V1005)	0	11.81	11.81	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
230022	23 (V1000)	0	1.5	1.5	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
234200	2341 (S800)	14.34	15.98	1.64	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	5.15	5.31	0.16	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234025	2340200 (1253)	0	1.5	1.5	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234010	2340 (1250)	0	1.405	1.405	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
235100	2350 (V1005)	0	11.81	11.81	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
235200	2351 (V1026)	0	10.84	10.84	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
235210	2352 (V1025)	0	0.8	0.8	FS - Forest Service	NFSR - National Forest System Road	2 - High Clearance Vehicles	Nat - Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	3.96	4.45	0.49	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	9.04	12.91	3.87	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	3.16	3.89	0.73	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service

Table B-2. Forest Service Roads proposed for use as haul routes.

Road Number	Terminus	Beginning Milepost	Ending Milepost	Segment Length	Jurisdiction	System	Operational Maintenance Level	Surface Type	Lanes	Primary Manager[1]
240000	CO RD 49200	7.2	8.87	1.67	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Agg - Crushed Aggregate Or Gravel	2 - Double Lane	FS - Forest Service
234000	23 (V1000)	0.56	1.14	0.58	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	2.89	3.16	0.27	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
235000	23 (V1000)	0	12.11	12.11	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	CO-Cooperator
234000	23 (V1000)	0	0.56	0.56	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	1.14	1.78	0.64	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
234000	23 (V1000)	1.78	2.89	1.11	FS - Forest Service	NFSR - National Forest System Road	3 - Suitable For Passenger Cars	Imp - Improved Native Material	1 - Single Lane	FS - Forest Service
230000	CO RD 4164	1.1	2.7	1.6	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Agg - Crushed Aggregate Or Gravel	1 - Single Lane	FS - Forest Service
230000	CO RD 4164	9.15	9.41	0.26	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Ac - Asphalt	2 - Double Lane	FS - Forest Service
230000	CO RD 4164	3.65	4.15	0.5	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Ac - Asphalt	2 - Double Lane	FS - Forest Service
230000	CO RD 4164	0	1.1	1.1	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Ac - Asphalt	1 - Single Lane	FS - Forest Service
230000	CO RD 4164	4.15	9.03	4.88	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Ac - Asphalt	2 - Double Lane	FS - Forest Service
230000	CO RD 4164	2.7	3.65	0.95	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Ac - Asphalt	2 - Double Lane	FS - Forest Service
230000	CO RD 4164	9.41	16.88	7.47	FS - Forest Service	NFSR - National Forest System Road	4 - Moderate Degree Of User Comfort	Agg - Crushed Aggregate Or Gravel	2 - Double Lane	FS - Forest Service
230000	CO RD 4164	9.03	9.15	0.12	FS - Forest Service	NFSR National Forest System Road	4 - Moderate Degree Of User Comfort	Ac - Asphalt	1 - Single Lane	FS - Forest Service
4615		0	0	0.77	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	0.641764	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	1.904595	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	0.140676	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private

Table B-2. Forest Service Roads proposed for use as haul routes.

Road Number	Terminus	Beginning Milepost	Ending Milepost	Segment Length	Jurisdiction	System	Operational Maintenance Level	Surface Type	Lanes	Primary Manager[1]
0		0	0	1.240465	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	0.292895	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	0.13923	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	0.498316	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
0		0	0	0.334749	P - Private	P - Private	P - Private	Nat - Native Material	1- Single Lane	P - Private
234000	23 (V1000)	6.34	7.04	0.7	P - Private	P - Private	P - Private	Imp - Improved Native Material	1 - Single Lane	P - Private
234000	23 (V1000)	4.46	5.15	0.69	P - Private	P - Private	P - Private	Imp - Improved Native Material	1 - Single Lane	P - Private
234000	23 (V1000)	5.31	6.29	0.98	P - Private	P - Private	P - Private	Imp - Improved Native Material	1 - Single Lane	P - Private
119	H/W 101	0	9.5	9.5	S - State	Sh - State Highway	S – State	Ac - Asphalt	2 - Double Lane	S - State
240000	CORD 49200	8.87	10.51	1.64	S - State	Sh - State Highway	S - State	Ac - Asphalt	2 - Double Lane	S - State
240001	CO RD 94200	0	0.1	0.1	S - State	Sh - State Highway	S - State	Ac - Asphalt	2 - Double Lane	S - State

[1]Table includes portions or entire segments of road that cross private lands that will be used for log haul.

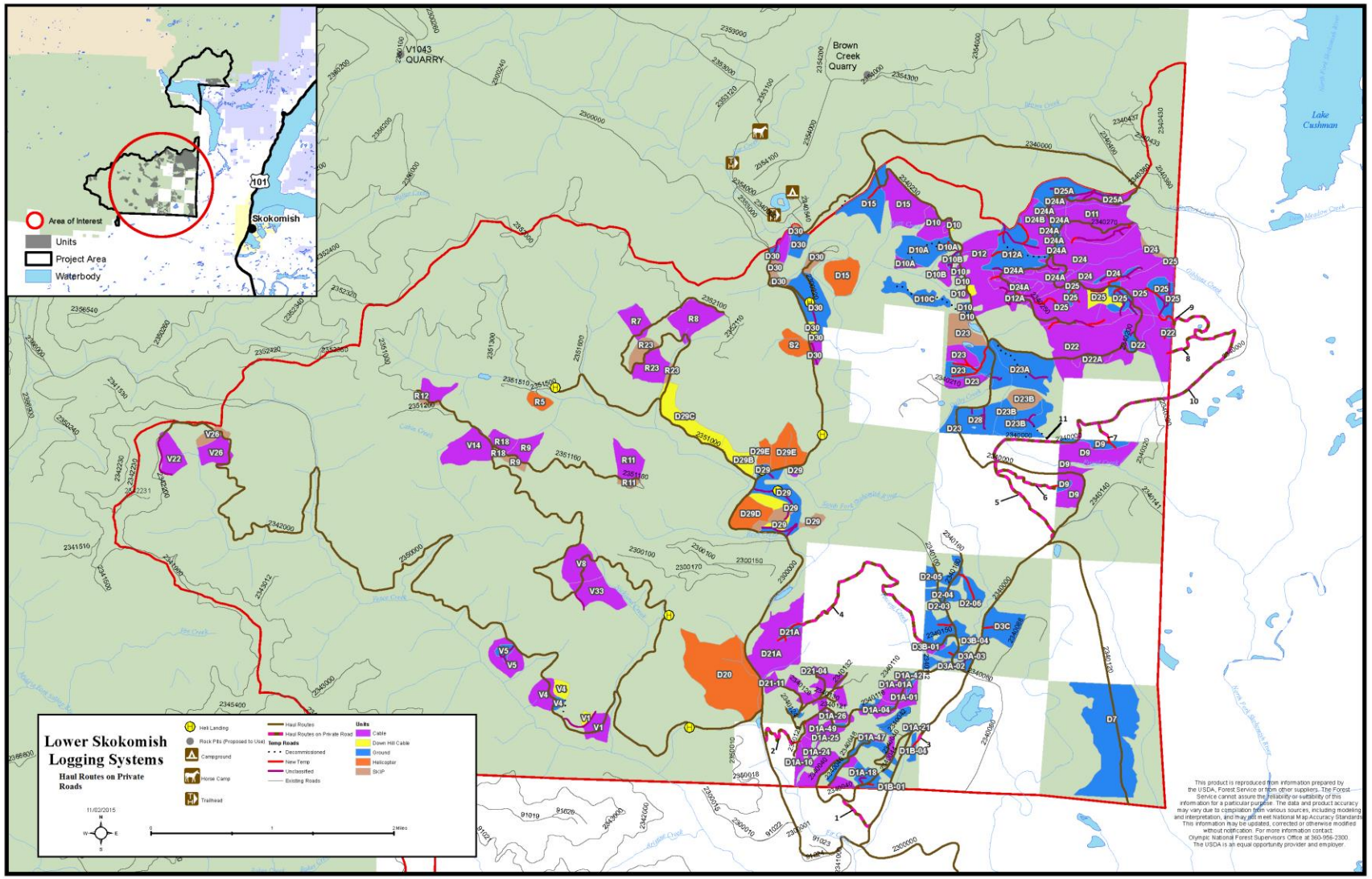
Table B-3. Roads segments on private lands non-FS for project use. (see Figure/Map B-1 below).

Map segment	Road Number	Location notes	Connecting FS Road /Access Point (if any)	Ownership	Milepost/total miles	Unit(s) Accessed
1	GD Rd. 8001	T21N, R5W, Sec. 3	2340-040 coming off 2340	Green Diamond	1600 ft/0.25 miles	D1A-46 Cable
2	GD Rd. 1008 / 1008 B	T22N, R5W, Sec. 33	2340-122 coming off of 2340	Green Diamond	Use of 0.49 miles of existing road. Requires appx. 0.08 miles (250 ft.) of new construction .	D1A-17
3	GD 8031	T22N, R5W, Sec. 35	2340	Green Diamond	Use of 0.14 miles (750 ft.) of existing road. Requires appx. 0.01 miles (50 ft.) of new construction.	D1B-04
4	GD 8200	T22N, R5W, Sec. 27	off 2340-150 coming off 2340	Green Diamond	1.9 miles existing. Requires 0.01 (50 ft) new construction.	D21A (Cable-Ground)
5	GD 8401 FS 2340	T22N, R5W, Sec. 23	2340 washout alternate route	Green Diamond	0.75 miles (4400 ft.) existing road.	Accesses a large portion of the project treatment units (1,700 acres)
6	GD 8405	T22N, R5W, Sec. 23	Comes off 8401	Green Diamond	0.5 miles existing road. Requires appx. 0.06 miles (315 ft.) of new construction.	D9
7	GD 8532	T22N, R5W, Sec. 13	2340	Green Diamond	700 ft existing road. Requires appx. 0.06 miles (315 ft) of new construction.	D9
8	GD 8592	T22N, R4W, Sec. 18 branches to 8592 and 8594A	The 2340 to the east of project area	Green Diamond	8592 0.3 miles existing; Requires	D22

Table B-3. Roads segments on private lands non-FS for project use. (see Figure/Map B-1 below).

Map segment	Road Number	Location notes	Connecting FS Road /Access Point (if any)	Ownership	Milepost/total miles	Unit(s) Accessed
					0.01 miles (50 ft.) of new construction.	
9	GD 8594A North	T22N, R4W, Sec.		Green Diamond	1.24 miles existing road. Requires appx. 0.01 (50 ft.) miles of new construction.	D22/D25
10	2340	T22N, R4W, Sec Sec. 18; T22N, R5W, Sec. 13	Easement or temp access on the 2340 going up to the 8590	Green Diamond	Appx 0.75 miles	D22/D25
11	D23-9 (FS Temp road No.)	T22N, R5W, Sec. 13	2340-310 Previously decommissioned road for use (in roads layer)	Green Diamond	Appx. 75 feet	D23B

Figure B-1. Project logging systems map with road use agreement needs identified (for use across non-FS lands). (Note: Numbers correspond to road segments identified in Table B-3.)



Treatment units

Table B-4. Treatment unit information.

Unit Number	Logging System	Acres	Forest Plan Management Allocation	Stand Age in 2014	Season of Logging Operations
9	Ground based	11	Adaptive Management Area	77	June1-Oct31
11	Ground based	14	Adaptive Management Area	77	June1-Oct31
33	Ground based	47	Adaptive Management Area	78	July16-Oct31
35	Ground based	17	Adaptive Management Area	78	June1-Oct31
36	Ground based	133	Adaptive Management Area	76	June1-Oct31
37	Downhill Cable	14	Adaptive Management Area	73	June1-Oct31
37	Downhill Cable	7	Adaptive Management Area	73	June1-Oct31
37	Ground based	5	Adaptive Management Area	73	June1-Oct31
37	Ground based	36	Adaptive Management Area	73	June1-Oct31
37	SKIP	45	Adaptive Management Area	73	Skip
D10	Cable	28	Late-Successional Reserve	72	June1-Oct31
D10	Cable	2	Late-Successional Reserve	72	June1-Oct31
D10	Cable	3	Late-Successional Reserve	72	June1-Oct31
D10	Cable	1	Late-Successional Reserve	72	June1-Oct31
D10	Cable	4	Late-Successional Reserve	72	June1-Oct31
D10	Downhill Cable	3	Late-Successional Reserve	72	June1-Oct31
D10	Ground based	5	Late-Successional Reserve	72	June1-Oct31
D10	SKIP	6	Late-Successional Reserve	72	Skip
D10A	Cable	9	Late-Successional Reserve	72	June1-Oct31
D10A	Ground based	52	Late-Successional Reserve	72	June1-Oct31
D10A	SKIP	1	Late-Successional Reserve	72	Skip
D10B	Cable	13	Late-Successional Reserve	72	June1-Oct31

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
D10B	Ground based	4	Late-Successional Reserve	72	June1-Oct31
D10C	Ground based	34	Late-Successional Reserve	69	June1-Oct31
D11	Cable	1	Adaptive Management Area	72	June1-Oct31
D11	Cable	107	Adaptive Management Area	72	June1-Oct31
D12	Cable	98	Late-Successional Reserve	72	June1-Oct31
D12A	Cable	16	Both	66	June1-Oct31
D12A	Cable	4	Both	66	June1-Oct31
D12A	Ground based	76	Late-Successional Reserve	66	June1-Oct31
D12B	Downhill Cable	4	Late-Successional Reserve	72	June1-Oct31
D15	Cable	64	Late-Successional Reserve	69	June1-Oct31
D15	Ground based	56	Late-Successional Reserve	69	June1-Oct31
D15	Helicopter	46	Late-Successional Reserve	69	Sept24-Feb28
D1A-01	Cable	5	Late-Successional Reserve	72	June1-Oct31
D1A-01A	Cable	15	Late-Successional Reserve	72	June1-Oct31
D1A-03	Cable	4	Late-Successional Reserve	72	June1-Oct31
D1A-04	Ground based	4	Late-Successional Reserve	72	June1-Oct31
D1A-06	Cable	2	Late-Successional Reserve	72	June1-Oct31
D1A-07	Cable	5	Late-Successional Reserve	72	June1-Oct31
D1A-08	Ground based	1	Late-Successional Reserve	72	June1-Oct31
D1A-13	Cable	6	Adaptive Management Area	72	June1-Oct31
D1A-14	Ground based	2	Adaptive Management Area	72	June1-Oct31
D1A-15	Cable	30	Adaptive Management Area	72	June1-Oct31
D1A-16	Cable	11	Adaptive Management Area	72	June1-Oct31
D1A-17	Cable	7	Adaptive Management Area	72	June1-Oct31
D1A-18	Ground based	14	Adaptive Management Area	72	June1-Oct31

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
D1A-19	Ground based	7	Adaptive Management Area	72	June1-Oct31
D1A-20	Ground based	3	Adaptive Management Area	72	June1-Oct31
D1A-21	Ground based	2	Late-Successional Reserve	72	June1-Oct31
D1A-22	Ground based	13	Late-Successional Reserve	72	June1-Oct31
D1A-24	Cable	2	Adaptive Management Area	72	June1-Oct31
D1A-25	Cable	10	Adaptive Management Area	72	June1-Oct31
D1A-26	Cable	5	Adaptive Management Area	72	June1-Oct31
D1A-26A	Ground based	2	Adaptive Management Area	72	June1-Oct31
D1A-27	Cable	7	Adaptive Management Area	72	June1-Oct31
D1A-31	Cable	8	Adaptive Management Area	72	June1-Oct31
D1A-35	Cable	5	Adaptive Management Area	72	June1-Oct31
D1A-39	Cable	11	Late-Successional Reserve	72	June1-Oct31
D1A-40	Ground based	5	Late-Successional Reserve	72	June1-Oct31
D1A-42	Ground based	8	Late-Successional Reserve	72	June1-Oct31
D1A-45	Ground based	21	Adaptive Management Area	72	June1-Oct31
D1A-46	Cable	9	Adaptive Management Area	72	June1-Oct31
D1A-47	Cable	5	Adaptive Management Area	72	June1-Oct31
D1A-48	Cable	11	Adaptive Management Area	72	June1-Oct31
D1A-49	Cable	2	Adaptive Management Area	72	June1-Oct31
D1A-51	Cable	3	Adaptive Management Area	72	June1-Oct31
D1B-01	Ground based	1	Adaptive Management Area	71	June1-Oct31
D1B-04	Ground based	7	Adaptive Management Area	71	June1-Oct31
D20	Helicopter	1	Adaptive Management Area	67	June1-Oct31
D20	Helicopter	195	Adaptive Management Area	67	June1-Oct31
D2-02	Ground based	32	Late-Successional Reserve	74	June1-Oct31

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
D2-03	Ground based	3	Late-Successional Reserve	74	June1-Oct31
D2-04	Ground based	18	Late-Successional Reserve	74	June1-Oct31
D2-05	Ground based	10	Late-Successional Reserve	74	June1-Oct31
D2-06	Ground based	36	Late-Successional Reserve	74	June1-Oct31
D21-04	Cable	23	Adaptive Management Area	68	June1-Oct31
D21-05	Cable	15	Adaptive Management Area	68	June1-Oct31
D21-07	Ground based	5	Adaptive Management Area	68	June1-Oct31
D21-11	Cable	10	Adaptive Management Area	68	June1-Oct31
D21A	Cable	52	Both	55	June1-Oct31
D21A	Cable	59	Both	55	June1-Oct31
D21A	Ground based	3	Both	55	June1-Oct31
D21A	Ground based	5	Both	55	June1-Oct31
D22	Cable	216	Adaptive Management Area	67	June1-Oct31
D22	Ground based	4	Adaptive Management Area	67	June1-Oct31
D22	Ground based	9	Adaptive Management Area	67	June1-Oct31
D22A	Cable	11	Adaptive Management Area	67	June1-Oct31
D23	Cable	18	Late-Successional Reserve	68	June1-Oct31
D23	Cable	23	Late-Successional Reserve	68	June1-Oct31
D23	Ground based	12	Late-Successional Reserve	68	June1-Oct31
D23	Ground based	41	Late-Successional Reserve	68	June1-Oct31
D23	SKIP	35	Late-Successional Reserve	68	Skip
D23A	Ground based	97	Adaptive Management Area	68	June1-Oct31
D23B	Ground based	50	Adaptive Management Area	68	June1-Oct31
D23B	Ground based	18	Adaptive Management Area	68	June1-Oct31
D23B	SKIP	23	Adaptive Management Area	68	Skip

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
D24	Cable	7	Both	66	June1-Oct31
D24	Cable	208	Both	66	June1-Oct31
D24	Ground based	8	Adaptive Management Area	66	June1-Oct31
D24	Ground based	2	Adaptive Management Area	66	June1-Oct31
D24	SKIP	6	Adaptive Management Area	66	Skip
D24A	Cable	2	Adaptive Management Area	66	June1-Oct31
D24A	Cable	1	Adaptive Management Area	66	June1-Oct31
D24A	Cable	2	Adaptive Management Area	66	June1-Oct31
D24A	Cable	2	Adaptive Management Area	66	June1-Oct31
D24A	Cable	2	Adaptive Management Area	67	June1-Oct31
D24A	Cable	8	Adaptive Management Area	66	June1-Oct31
D24A	Cable	1	Both	66	June1-Oct31
D24A	Cable	5	Both	66	June1-Oct31
D24A	Ground based	3	Adaptive Management Area	66	June1-Oct31
D24A	Ground based	2	Adaptive Management Area	66	June1-Oct31
D24A	Ground based	6	Adaptive Management Area	66	June1-Oct31
D24A	Ground based	4	Adaptive Management Area	66	June1-Oct31
D24A	Ground based	4	Late-Successional Reserve	66	June1-Oct31
D24A	Ground based	1	Late-Successional Reserve	66	June1-Oct31
D24A	Ground based	1	Late-Successional Reserve	66	June1-Oct31
D24B	Cable	48	Both	66	June1-Oct31
D24B	Cable	2	Both	66	June1-Oct31
D25	Cable	109	Adaptive Management Area	65	June1-Oct31
D25	Cable	4	Adaptive Management Area	65	June1-Oct31
D25	Cable	61	Adaptive Management Area	65	June1-Oct31

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
D25	Downhill Cable	19	Adaptive Management Area	65	June1-Oct31
D25	Ground based	27	Adaptive Management Area	65	June1-Oct31
D25	Ground based	4	Adaptive Management Area	67	June1-Oct31
D25	Ground based	21	Adaptive Management Area	65	June1-Oct31
D25	Ground based	4	Adaptive Management Area	65	June1-Oct31
D25	SKIP	2	Adaptive Management Area	65	Skip
D25A	Cable	18	Late-Successional Reserve	65	June1-Oct31
D25A	Ground based	41	Late-Successional Reserve	65	June1-Oct31
D28	Ground based	48	Adaptive Management Area	68	June1-Oct31
D29	Cable	5	Late-Successional Reserve	67	June1-Oct31
D29	Downhill Cable	14	Late-Successional Reserve	67	June1-Oct31
D29	Downhill Cable	8	Late-Successional Reserve	67	June1-Oct31
D29	Ground based	55	Late-Successional Reserve	67	June1-Oct31
D29	Ground based	6	Late-Successional Reserve	65	Sept24-Feb28
D29	SKIP	17	Late-Successional Reserve	67	Skip
D29	SKIP	10	Late-Successional Reserve	67	Skip
D29B	Downhill Cable	26	Late-Successional Reserve	65	June1-Oct31
D29C	Downhill Cable	58	Late-Successional Reserve	65	June1-Oct31
D29D	Helicopter	39	Late-Successional Reserve	67	Sept24-Feb28
D29E	Helicopter	46	Late-Successional Reserve	65	Sept24-Feb28
D29E	Helicopter	13	Late-Successional Reserve	65	Sept24-Feb28
D30	Cable	13	Late-Successional Reserve	56	June1-Oct31
D30	Cable	10	Late-Successional Reserve	59	June1-Oct31
D30	Downhill Cable	5	Late-Successional Reserve	59	June1-Oct31
D30	Ground based	16	Late-Successional Reserve	58	June1-Oct31

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
D30	Ground based	61	Late-Successional Reserve	59	June1-Oct31
D30	Ground based	4	Late-Successional Reserve	56	June1-Oct31
D30	SKIP	12	Late-Successional Reserve	59	Skip
D30	SKIP	7	Late-Successional Reserve	59	Skip
D30	SKIP	4	Late-Successional Reserve	59	Skip
D30	SKIP	7	Late-Successional Reserve	56	Skip
D30	SKIP	3	Late-Successional Reserve	58	Skip
D3A-01	Ground based	8	Late-Successional Reserve	72	June1-Oct31
D3A-02	Ground based	4	Late-Successional Reserve	72	June1-Oct31
D3A-03	Ground based	9	Late-Successional Reserve	73	June1-Oct31
D3B-01	Cable	6	Late-Successional Reserve	73	June1-Oct31
D3B-02	Ground based	10	Late-Successional Reserve	73	June1-Oct31
D3B-03	Ground based	1	Late-Successional Reserve	73	June1-Oct31
D3B-04	Ground based	7	Late-Successional Reserve	73	June1-Oct31
D3B-05	Ground based	8	Late-Successional Reserve	73	June1-Oct31
D3C	Ground based	50	Late-Successional Reserve	73	Sept24-Feb28
D7	Ground based	227	Adaptive Management Area	0	June1-Oct31
D9	Cable	56	Adaptive Management Area	76	June1-Oct31
D9	Cable	41	Adaptive Management Area	76	June1-Oct31
D9	Ground based	6	Adaptive Management Area	76	June1-Oct31
D9	Ground based	17	Adaptive Management Area	76	June1-Oct31
D9	SKIP	3	Adaptive Management Area	76	Skip
R11	Cable	37	Late-Successional Reserve	57	Sept24-Feb28
R11	SKIP	7	Late-Successional Reserve	57	Skip
R12	Cable	20	Late-Successional Reserve	57	June1-Oct31

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
R12	SKIP	5	Late-Successional Reserve	57	Skip
R18	Cable	18	Late-Successional Reserve	55	June1-Oct31
R18	SKIP	4	Late-Successional Reserve	55	Skip
R23	Cable	37	Late-Successional Reserve	47	June1-Oct31
R23	SKIP	21	Late-Successional Reserve	47	Skip
R23	SKIP	5	Late-Successional Reserve	47	Skip
R5	Helicopter	14	Late-Successional Reserve	61	Sept24-Feb28
R7	Cable	30	Late-Successional Reserve	58	June1-Oct31
R8	Cable	55	Late-Successional Reserve	59	June1-Oct31
R9	Cable	23	Late-Successional Reserve	55	June1-Oct31
R9	SKIP	8	Late-Successional Reserve	55	Skip
S2	Helicopter	26	Late-Successional Reserve	61	Sept24-Feb28
V1	Cable	26	Late-Successional Reserve	61	Sept24-Feb28
V1	Downhill Cable	6	Late-Successional Reserve	61	Sept24-Feb28
V14	Cable	27	Both	57	June1-Oct31
V14	Cable	31	Both	57	June1-Oct31
V22	Cable	34	Adaptive Management Area	54	June1-Oct31
V26	Cable	33	Adaptive Management Area	57	June1-Oct31
V26	SKIP	15	Adaptive Management Area	57	Skip
V33	Cable	45	Adaptive Management Area	44	June1-Oct31
V4	Cable	29	Late-Successional Reserve	61	Sept24-Feb28
V4	Downhill Cable	11	Late-Successional Reserve	61	Sept24-Feb28
V4	Ground based	5	Late-Successional Reserve	61	Sept24-Feb28
V5	Cable	33	Late-Successional Reserve	61	Sept24-Feb28
V5	Ground based	9	Late-Successional Reserve	61	Sept24-Feb28

Table B-4. Treatment unit information.					
Unit Number	**Logging System**	**Acres**	**Forest Plan Management Allocation**	**Stand Age in 2014**	**Season of Logging Operations**
V8	Cable	22	Both	59	June1-Oct31
V8	Cable	27	Both	59	June1-Oct31

Appendix C

Silvicultural Information

Table C-1. Stand information.								
UNIT	**COMP**	**CELL**	**YRORIG[1]**	**HCCYR[2]**	**HTHYR[3]**	**FBRYR[4]**	**SPCYR[5]**	**SFLYR[6]**
9	1401	9	1937	1927	-	1928	-	-
11	1401	11	1937	1927	-	1928	1982	-
33	1402	33	1936	1936	1990	-	-	1982
35	1402	35	1936	1936	1990	-	-	1982
36	1402	36	1938	1938	1990	-	-	1982
37	1402	37	1941	1941	-	-	-	-
D1A	4101	160	1942	1937	1998	1937	-	2001
D1B	4101	168	1941	1937	1978	1937	-	1986
D2	4101	128	1940	1936	-	1937	-	1986
D3A	4101	166	1942	1937	1998	1937	-	2001
D3B, D3C	4101	243	1941	1936	-	1937	-	1986
D7	4101	213	1938	1937	2005	-	-	1986
D9	4101	87	1938	1937	-	1938	-	1984
D10	4101	239	1942	1940	-	1941	-	1984
D10	4101	274	1942	1940	1994	1941	-	2001
D10	4101	277	1942	1940	1994	1941	-	2001
D10	4101	278	1942	1940	1994	1941	-	2001
D10	4101	279	1942	1940	1994	1941	-	2001
D10	4101	281	1942	1940	1995	1941	-	2001
D10	4101	288	1942	1940	1994	1941	-	2001
D10A	4101	275	1942	1940	1996	1941	-	2001
D10B	4101	276	1942	1940	1995	1941	-	2001
D10C	4101	280	1945	1940	1996	1941	-	2001
D11	4101	18	1942	1939	-	1940	-	1984
D12	4101	23	1942	1940	-	1941	-	1984
D12A	4101	250	1948	1946	1995	1947	-	2001
D12B	4101	254	1948	1946	1996	1947	-	2001
D12B	4101	285	1942	1940	1994	1941	-	2001
D15	4101	10	1945	1944	-	1945	-	1984
D20	4301	160	1947	1945	-	1946	-	1986
D21	4101	172	1946	1945	1998	1946	-	2001
D21A	4101	157	1959	1945	-	1946	-	1986
D22	4101	58	1947	1945	-	1946	-	1984

Table C-1. Stand information.								
UNIT	**COMP**	**CELL**	**YRORIG[1]**	**HCCYR[2]**	**HTHYR[3]**	**FBRYR[4]**	**SPCYR[5]**	**SFLYR[6]**
D22A	4101	266	1947	1945	1996	1946	-	2001
D23A	4101	269	1946	1946	1994	1946	-	2001
D23A	4101	270	1946	1946	1994	1946	-	2001
D23A	4101	271	1946	1946	1994	1946	-	2001
D23B	4101	74	1946	1946	-	1948	-	1984
D23B	4101	272	1946	1946	1996	1948	-	2001
D24, D24B	4101	53	1948	1946	-	1947	-	1984
D24A	4101	251	1948	1946	1994	1947	-	2001
D24A	4101	252	1947	1946	1994	1947	-	2001
D24A	4101	253	1948	1946	1994	1947	-	2001
D24A	4101	255	1948	1946	1994	1947	-	2001
D24A	4101	256	1948	1946	1993	1947	-	2001
D24A	4101	257	1948	1946	1994	1947	-	2001
D24A	4101	259	1948	1946	1994	1947	-	2001
D24A	4101	260	1948	1946	1994	1947	-	2001
D24A	4101	261	1948	1946	1994	1947	-	2001
D24A	4101	263	1948	1946	1994	1947	-	2001
D24A	4101	264	1948	1946	1994	1947	-	2001
D24A	4101	265	1948	1946	1994	1947	-	2001
D25	4101	56	1949	1946	-	1949	-	1984
D25A	4101	14	1949	1946	-	1947	-	1984
D28	4101	273	1946	1946	1994	1948	-	2001
D29	4101	112	1947	1947	1999	-	-	2001
D29	4301	256	1949	1947	2005	-	1970	1986
D29	4101	289	1947	1947	-	-	-	-
D29B, D29E	4301	251	1949	1947	-	-	1970	1986
D29C	4301	80	1949	1947	-	-	1970	1986
D29D	4101	290	1947	1947	-	-	-	1986
D29E	4301	96	1949	1947	-	-	1970	1986
D30	4101	28	1956	1956	-	1956	-	-
D30	4101	34	1958	1955	-	1955	-	-
D30	4101	38	1955	1955	-	1955	-	-
R5	4301	116	1953	1953	-	-	1988	1987
R6	4301	114	1955	1956	-	1956	1989	1987
R7	4301	47	1956	1957	-	1957	1988	1989
R8	4301	48	1955	1956	-	1956	1974	1989
R9	4301	129	1959	1956	-	1957	1976	1987
R11	4301	122	1957	1957	-	1958	1979	1987

Table C-1. Stand information.								
UNIT	**COMP**	**CELL**	**YRORIG[1]**	**HCCYR[2]**	**HTHYR[3]**	**FBRYR[4]**	**SPCYR[5]**	**SFLYR[6]**
R12	4301	110	1957	1956	-	1956	1976	1987
R18	4301	247	1959	1960	-	1960	1976	1987
R23	4301	61	1967	1967	-	1967	1980	1989
S2	4301	52	1953	1953	-	-	1975	1989
V1	4301	212	1953	1952	-	1953	1969	1987
V4	4301	210	1953	1952	-	1954	1970	1987
V5	4301	209	1953	1952	-	1955	1973	1987
V8	4301	169	1955	1955	-	1956	1989	1987
V14	4301	139	1957	1956	-	1958	1979	1987
V22	4305	23	1960	1959	-	1960	1976	1987
V26	4305	25	1957	1958	-	1959	1978	1987
V33	4301	170	1970	1971	-	1976	1983	1987

Notes:

1. Stand year of origin.
2. Year of clearcut harvest
3. Year of commercial thinning.
4. Year of broadcast burning.
5. Year of precommercial thinning.
6. Year of fertilization.

Table C-2. Vegetation Characteristics.

				Overstory					Understory	
Stand ID	Comp & Cell	Age (2014)	Acres	Major Species	Minor Species	BA[1]	TPA[2]	QMD[3]	Species	TPA[2]
9	1401/9	77	10.8	DF	WH/WRC	200	198	13.6	WH/WRC	60
11	1401/11	77	14.4							
33	1402/33	78	46.9	DF	WRC/WH	211	135	16.9	WH/WRC /DF	360
35	1402/35	78	17.0							
36	1402/36	76	133.1	DF	WRC/RA BLM/WH	206	217	13.2	WH/WRC /RA	320
37	1402/37	73	106.9	DF	BLM/WRC	227	154	16.4	WH/DF/ WRC	40
D1A	4101/160	72	245.8	DF	WH/RA	153	108	16.1	WH/DF	60
D1B	4101/168	71	8.0	DF	RA/WH BC/BLM	172	118	16.4	WH	100
D2	4101/128	74	99.1	DF	WH	215	217	13.5	WH	20
D3A, D3B	4101/166, 243	72, 73	53.1	DF/WH	RA	206	198	13.8	WH	60
D3C	4101/243	73	49.5	DF	WH	191	214	12.8	WH/WRC	30
D7	4101/213	76	226.8	DF	WH/RA	87	71	15.1	WH/DF/ RA	180
D9	4101/87	76	123.0	DF	WH/WRC	243	199	15.0	WH/WRC /WWP	180
D10	4101/239, 274, 277, 278, 279, 281, 288	72	51.3	DF	WH	313	283	14.2	WH/WRC /DF	110
D10A	4101/275	72	61.9	DF/WH	RA	260	217	14.8	WH/WRC /RA	220
D10B	4101/276	72	17.2	DF/WH	RA/WRC	195	146	15.5	WH/WRC	140
D10C	4101/280	69	34.5	DF/WH	RA/BLM	246	194	15.2	WH/WRC /RA	260
D11	4101/18	72	108.0	DF/WH	WRC/BLM	262	426	10.6	WH/WRC	180

Table C-2. Vegetation Characteristics.

				Overstory					Understory	
Stand ID	Comp & Cell	Age (2014)	Acres	Major Species	Minor Species	BA[1]	TPA[2]	QMD[3]	Species	TPA[2]
D12	4101/23	72	98.1	DF	RA,WH	253	208	14.9	WH/DF/ WRC	30
D12A, D12B	4101/250, 254, 285	66,72	100.0	DF/WH	RA	209	193	14.1	WH/RA	420
D24A	4101/251, 252, 253, 255, 256, 257, 259, 260, 261,263,264, 265	66	45.7							
D15	4101/10	69	166.2	DF/WH	RA/BLM	237	244	13.4	WH/WRC /WWP	90
D20	4301/160	67	195.3	DF	WH	256	243	13.9	WH	110
D21	4101/172	68	53.0	DF	RA/WH	132	95	16.0	WH/WRC	90
D21A	4101/157	55	119.3	DF/WH	-	222	284	12.0	WH/DF/ WWP	100
D22, D22A	4101/58, 266	67	240.3	DF	WH/RA/WWP	228	269	12.5	DF/WH/ WRC	80
D23	4101/74	68	128.6	DF	WH/WRC	244	277	12.7	WRC/WH /DF	110
D23A	4101/269, 270, 271	68	96.9	DF	RA/WH	198	161	15.0	WH/RA/ WRC	150
D23B	4101/74, 272	68	91.7	DF	WH/BLM	199	192	13.8	DF/WH/ WRC	190
D24	4101/53	66	232	DF/WH	WRC/WWP	211	282	11.7	WH/WRC /DF	170
D24B	4101/53	66	50.3	DF/WH	-	231	262	12.7	WH/WRC	70
D25	4101/56	65	251.7	DF/WH	RA/WRC	230	225	13.7	WH/WRC	200
D25A	4101/14	65	59.4	DF/WH	-	253	326	11.9	WH/WRC	80
D28	4101/273	68	47.7	DF	RA/WH	213	130	17.3	WH/WRC /RA	50
D29	4101/112, 256	67	114.5	DF/WH	BLM/WRC	196	155	15.2	WH/WRC /RA	3000
D29B	4301/251	65	25.5	DF	RA	240	135	18.1	WH/DF/ BLM	170
D29C	4301/80	65	58.2	DF/RA	BLM/WH	235	205	14.5	WH/DF	140

Table C-2. Vegetation Characteristics.

				Overstory					Understory	
Stand ID	Comp & Cell	Age (2014)	Acres	Major Species	Minor Species	BA[1]	TPA[2]	QMD[3]	Species	TPA[2]
D29D	4101/290	67	39.3	DF	WH	172	228	11.6	WH/DF/ WRC	50
D29E	4301/96, 251	65	58.8	DF	WH/RA	220	186	14.7	WH	100
D30	4101/28,34, 38	56,59	142.1	DF/WH	BLM/BC/RA	210	256	12.4	WH/WRC	130
R5	4301/116	61	14	DF/WH	-	251	263	13.2	WH/WRC	320
R6	4301/114	59	36.5							
R7	4301/47	58	30.4	DF	WRC/WH	213	242	12.7	WH/WRC	250
R8	4301/48	59	54.7	DF/WH	-	206	355	10.3	DF/WH/ WRC	210
R9	4301/129	55	31.5	DF/WH	-	235	297	12.1	WH/WRC	660
R11	4301/122	57	43.6	DF/WH	-	216	383	10.2	WH/WRC	390
R12	4301/110	57	25.3	WH/DF	-	257	309	12.3	WH	390
R18	4301/247	55	21.8	DF	WH	219	252	12.6	WH/DF/ WRC	250
R23	4301/61	47	63.1	DF	WH	219	352	10.7	WH/DF/ BLM	280
S2	4301/52	61	26.5	DF/WH	BLM/RA	244	259	13.1	WH/WRC	250
V1	4301/212	61	31.5	DF	WH	235	223	13.9	WH/WRC	120
V4	4301/210	61	44.4	DF	WH	297	218	15.8	WH/WRC	110
V5	4301/209	61	42							
V8	4301/169	59	49	DF/WH	-	211	191	14.3	WH/DF/ WRC	300
V14	4301/139	57	58.1	DF/WH	WRC	262	292	12.8	WH/DF/ WRC	310
V22	4305/23	54	34.4	DF/WH	-	235	275	12.5	WH/DF/ WRC	290
V26	4305/25	57	47.7	DF	WH/WRC	225	308	11.6	WH/WRC /DF	400
V33	4301/170	44	45.2	DF	-	202	398	9.6	WH/DF	260

Notes:

1. Basal Area (ft^2/acre)

2. Trees per acre

3. Quadratic mean diameter (inches) of trees 5in dbh and larger

Species Codes: Douglas-fir (DF), western hemlock (WH), western redcedar (WRC),western white pine (WWP), red alder (RA), black cottonwood (BC) and bigleaf maple (BLM)

Table C-3. Coarse woody debris and snags.

Stand ID	Comp & Cell	CWD Cover %[1]	Snags 10.0-19.9"[2]	Snags 20.0"+[2]	QMD Snags[3]
9	1401/9	0-5	19	-	10.6
11	1401/11				
33	1402/33	0-5	-	-	-
35	1402/35				
36	1402/36	0-5	-	-	-
37	1402/37	6-10	2	-	18.8
D1A	4101/160	6-10	-	1	34.6
D1B	4101/168	6-10	-	-	-
D2	4101/128	6-10	12	-	10
D3A, D3B	4101/166, 243	6-10	28	-	11.2
D3C	4101/243	0-5	1	-	10
D7	4101/213	0-5	5	1	12
D9	4101/87	0-5	3	1	15
D10	4101/239, 274, 277, 278, 279, 281, 288	0-5	18	-	11.8

Table C-3. Coarse woody debris and snags.

Stand ID	Comp & Cell	CWD Cover %[1]	Snags 10.0-19.9"[2]	Snags 20.0"+[2]	QMD Snags[3]
D10A	4101/275	6-10	6		12
D10B	4101/276	6-10	19		12.7
D10C	4101/280	0-5	-	-	-
D11	4101/18	6-10	10	-	12.7
D12	4101/23	0-5	3	-	15
D12A, D12B	4101/250, 254, 285	6-10	10	1	16.9
D24A	4101/251, 252, 253, 255, 256, 257, 259, 260, 261,263,264, 265				
D15	4101/10	6-10	21	2	12.4
D20	4301/160	6-10	15	-	11
D21	4101/172	6-10	5	-	17.7
D21A	4101/157	6-10	4	1	15
D22, D22A	4101/58, 266	6-10	5	3	15.8
D23	4101/74	6-10	10	-	12.2
D23A	4101/269, 270, 271	6-10	15	-	12.9
D23B	4101/74, 272	6-10	8	-	14.9
D24	4101/53	6-10	8	-	14.8
D24B	4101/53	6-10	12	-	13.7
D25	4101/56	6-10	7	2	14.6
D25A	4101/14	0-5	-	-	-
D28	4101/273	6-10	3	-	14

Table C-3. Coarse woody debris and snags.

Stand ID	Comp & Cell	CWD Cover %[1]	Snags 10.0-19.9"[2]	Snags 20.0"+[2]	QMD Snags[3]
D29	4101/112, 256	0-5	7	-	16
D29B	4301/251	0-5	17	-	13.8
D29C	4301/80	0-5	28	-	12.6
D29D	4101/290	0-5	6	-	12
D29E	4301/96, 251	0-5	6	-	12
D30	4101/28,34, 38	6-10	7	-	13.8
R5	4301/116	6-10	-	-	-
R6	4301/114				
R7	4301/47	0-5	10	-	10
R8	4301/48	6-10	3	-	16
R9	4301/129	6-10	-	-	-
R11	4301/122	6-10	-	-	-
R12	4301/110	6-10	10	1	12.7
R18	4301/247	6-10	-	-	-
R23	4301/61	6-10	8	-	10
S2	4301/52	6-10	18	-	11.3
V1	4301/212	6-10	11	-	14.7
V4	4301/210	6-10	18	-	10.9
V5	4301/209				
V8	4301/169	0-5	-	-	-
V14	4301/139	6-10	3	-	16

Table C-3. Coarse woody debris and snags.					
Stand ID	Comp & Cell	CWD Cover %[1]	Snags 10.0-19.9"[2]	Snags 20.0"+[2]	QMD Snags[3]
V22	4305/23	6-10	11	-	12.1
V26	4305/25	6-10	-	-	-
V33	4301/170	6-10	7	-	11

Notes:

1. Percent ground cover of coarse woody debris with a diameter of 5 inches and larger.

2. Snags per acre

3. Quadratic mean diameter (inches) of all snags with a dbh of 10 inches or larger.

Appendix D

Appendix D: Response to Comments Received

D.1 Response to Scoping Comments

An opportunity to provide scoping comments on the project was announced via letter to the Skokomish Tribe dated September 11, 2014. Letters or emails were mailed to interested and affected parties on September 24, 2014. Six letters and/or email messages and one phone call were received (Table D-1 below).

Table D-1. List of scoping commenters.

Commenter, Affiliation, (Abbreviation Code in Table D-1)	Date Received	Comment Letter No.
Herb Gerhardt, Individual, (HG)	Sept. 26, 2014, email	1
Rousseau, Individual (PR)	Sept. 30, 2014, email	2
Dick Artley, Individual, (DA)	Oct. 2, 2014, email	3
Bruce Verhei, Individual, (BV)	Oct. 9, 2014, phone call	4
Harold Brunstad, Individual, (HB)	Oct. 20, 2014, email	5
Chuck Burley, Interfor (IF)	Oct. 24, 2013, email	6
Matt Comiskey, American Forest Research Council (AFRC)	Oct. 24, 2014, email	7

Comment documents were tracked upon receipt to assure that all comments were captured. The letters were logged in and scanned into an electronic file. Individual comments from within each comment document were identified and highlighted.

Comments, questions, and issues were raised by the public. Issues are points of discussion, dispute, or debate about the environmental effects of proposed actions. Comments have been categorized as follows:

1. Relevant Issue. These issues were defined as concerns about effects that may be directly or indirectly be *caused by* implementing *the proposed action*. Relevant issues were resolved through alternative or project design criteria (PDC) development, or modification of the proposed action (also an option).

2. Other Issue. An issue may not be relevant for any of the following reasons:

- **a.** The issue is outside the scope of the proposed action, and is not related to the decision to be made.
- **b.** The issue is a procedural concern, which is already decided by law, regulation, policy, or direction (Forest Plan).
- **c.** The issue is a procedural concern, which was addressed through project design or was/will be addressed through analysis.
- **d.** The issue is not supported by scientific (or factual) evidence.

3. Concern. These are general comments or questions that do not meet the definition of an issue as stated above.

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
HG-1.1	I fully support this thinning and restoration project. In the long run it will create a much healthier forest…please use thinning and selective harvesting as part of your management plan in this area.	3	Comment noted.
PR-2.1	I support the Lower Skokomish Vegetation Management Plan as presented	3	Comment noted.
DA-3.1	For many years before I retired from the USFS I attempted to convince the Responsible Officials on our forest to use best science when developing projects. In a few cases, the Purpose & Need goals were not even based on best science. In too many cases I was asked to help develop EAs or EISs with P&Ns that described actions necessary to create private-industrial tree farm conditions. As you know, private-industrial tree farms are not real, fully functioning forests. They are areas that have been stripped of their biodiversity. They are areas with trees standing on the stump until the tree-farm director believes its time to take them to the mill. This describes your project. This is not what the USFS promises the recreating public	3	General comment based on the commenter's opinion. The best available science was utilized for analysis. The project was designed to meet the purpose and need as stated in the EA (Section 1.4).
DA-3.2	I am including **Opposing Viewpoints Attachments #1 and #4**. These attachments contain recent statements made by over 390 Ph.D. scientists who describe the major ecological damage caused by logging and road construction. Please modify the P&N and Proposed Action such that they follow the advice of these scientists. By following their advice the resource damage resulting from logging and roading they describe will not occur. Please include these attachments in their entirety online when you post the draft EA or EIS. This will assure the general public you have based this project on best science.	3	Comment noted. The purpose and need and Proposed Action are proposed in order to provide resource benefits while minimizing effects through mitigation measures, Project Design Criteria, and best management practices. Resource effects analysis of this project consider best available science. The attachments and references provided by the commenter and FS responses can be found in Appendix E of this EA.
DA-3.3	Please do not log in Riparian Reserves. There is no science literature written by independent scientists not affiliated with the USDA that describes situations where benefits from logging riparian areas transcends the major damage inflicted in these sensitive areas.	2c and 3	Project Design Criteria are developed to minimize impacts to riparian reserves (see EA Table 2-4). Riparian buffers are used to mitigate impacts associated with thinning treatments adjacent to streams. Treatment is restricted to areas outside of buffered riparian areas. The best available science was used for this analysis to inform the effects analysis presented in the EA.

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
BV-4.1	Concerns for thinning (and planting) is that we thin trees with set spacing "on a grid". He wasn't sure if this was limited by the contract. He feels that uniform spacing leads to closed canopy and would like to see more breaks in openings, a 2 acre patch doesn't open it up enough. Need to go with natural clumps move away from tree farming mentality.	2c	Procedural. General silvicultural prescriptions are described in Chapter 2, Section 2.4.2.6.
HB-5.1	Support project because it will provide wood fiber for the economy and opportunities to upgrade the road system for public access in the project area.	3	Comment noted.
HB-5.2	I have supported vegetation management (thinning) projects in the past and will do so in the future but I have an annoying concern of the cumulative impacts the repetitive management prescriptions and objectives will have on the ability of the forest to continue to be accessible for public recreation and remain a source of wood fiber for the Olympic forest economy in the future.	2a	Outside the scope of the proposed action. Wider ranging effects of all historical activities and legacies of activities fall outside the scope of this project. Within the project effects analyses for any given resource (as discussed in chapter 3), historical activities are captured as part of the existing condition or affected environment or, in cumulative effects analysis.
HB-5.2a	The severely restrictive timber harvesting allowed on all forests under the NWFP is primarily driven by the habitat protections and population recovery for the Northern Spotted Owl. The migration of the Barred Owl into the NSO habitat subsequent to the implementation of the NWFP has changed the dynamics of recovering and sustaining an NSO population in many areas in forests under the NWFP. Some scientists have suggested the NSO is unrecoverable in the Olympic forest irrespective of the amount of NSO habitat that exists. Has the changed status of the NSO resulted in any modifications in the forests management prescriptions and objectives related to the NSO?	2a	Outside the scope of the proposed action. The Federal Listing Status of the NSO has not changed; therefore management prescriptions and objectives related to the NSO are compliant with the Endangered Species Act and the ONF Forest Plan.
HB-5.3	Forest management direction and desired future condition of the 1990 Olympic Forest Management Plan has become murky since the implementation of the NWFP. Answers to this concern are generally bureaucratic or elusive. It seems the management focus on accelerating the development of late successional characteristics throughout most of the Olympic National Forest acreage coupled with the restriction of any harvesting of stands age 80 and older has destined the Olympic Forest to morph into a Forest Preserve within a few decades. How is the forest going to continue to be a credible wood fiber contributor to the Peninsula communities' forest economy as this occurs? The project areas on vegetation management projects are considerably larger than the area to be treated. Is it management's	2a	Outside the scope of the proposed action. While this comment speaks to an issue that is beyond the scope of this project and has more to do with larger scale forest management and the Northwest Forest Plan, Alternative C – which was eliminated from further analysis describes the initial project area proposed and the process (coarse filtering) used to refine the proposed action (Alternative B). Please see Section 2.3, Alternatives considered but Eliminated from further analysis.

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
	intention to re-enter these project areas in the future to treat the remaining untreated acreage?		
HB-5.4	Road Development: The scoping notice advises that fifteen miles of abandoned, closed or decommissioned roads will be reopened plus five miles of new temporary roads would be constructed, all to be decommissioned after use. I, and a lot of other forest users, are opposed to decommissioning in most cases. If future entry into the project area is needed for treatment, it doesn't make sense to go to the expense of decommissioning only to have to reopen for future access. Rather than decommissioning, these reconstructed and newly constructed roads to facilitate the project can be closed to vehicles, reduced to a lower maintenance level or converted to trails to allow access for public recreation. The specifications used to decommission roads makes access by foot very difficult, impossible for some over these old routes, limiting recreational access. Decommissioning further exasperates concern of the future of the ONF for recreational access and a source of wood fiber. Summary: Decommissioning makes access by foot difficult, and is not economical if roads are needed to thin stands in the future (re-entry).	2b, c	Road decommissioning activities are proposed to mitigate effects of temporary road construction, reconstruction and use on resources. Particularly, decommissioning ensures that the project is in compliance with the Aquatic Conservation Strategy objectives and that the purpose and need of the project is met while minimizing short- and long-term impacts to resources. Strategic planning at the Forest level determines the rotation of entries and harvest schedules and is based on current and future ages of stands in direct relation with Forest Plan standards and guidelines. No FS system roads are proposed for decommissioning. No temporary roads that will be utilized in this project are proposed for addition to the FS road system.
HB-5.5	The National Forests in Western Washington are becoming increasingly important for public recreation. Many industrial forestland owners are closing their land to public access or allowing access only through fee permits to lands that have historically been open to the public. Public lands are the only alternative for many recreational users.	2a	This issue is outside the scope of the proposed action. Recreation and access was assessed as related to the areas potentially affected by the proposed project activities within the project area. See the Recreation and Scenery section 3.7.
HB-5.6	The failure of Congress to appropriate adequate funding for maintenance of infrastructure in our National Forest forces the propensity of the forests management to close public facilities and roads. However, it is difficult to hold a very high level of empathy for the budget dilemma this imposes on the forests' management in view of the fact that the forests have the assets and mechanism to use those assets to accomplish considerable maintenance. I am speaking of stewardship contracts. Why isn't this tool being used more aggressively on the Olympic Forest?	2a	Comment noted. Question is Forest-wide and beyond the scope of this project. While the contractual instrument used to execute the proposed action is not a NEPA requirement or part of the NEPA decision to be made, stewardship is one option that the Responsible Official may consider to implement this decision.
HB-5.7	The Olympic Forests' 1990 LRMP presented a reasonable view of the management direction and desired future condition of the forest several decades in the future. However, as noted above, the implementation the NWFP five years into the implementation of the 1990 LRMP, the twenty-fifth year of the LRMP modified by the NWFP provides only a very perverted perspective of what the	2a	Comment noted. This comment refers to a larger process question regarding the legacy of implementation of the Northwest Forest Plan and its effects on the desired future condition as envisioned in 1990. This comment will be noted, but falls beyond the scope of this project due to its larger context.

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
	Olympic National Forest is going to contribute to the Peninsula communities in regard to unencumbered recreational opportunities and wood fiber for neighboring communities forest economy. One can only speculate, and it does not look encouraging. Does the Forest's staff have any insight into what the future status of the forest might be under the current management guidelines and direction?		
IF-6.1	it would seem that this project should take advantage of the direction in the NWFP and try different ways to manage these areas "with the goal of achieving desired ecological and economic objectives." We would suggest at the very least this include treating stands more intensively than the usual thinning from below prescriptions. We would strongly urge you to include small gaps from 1 to 5 acres in size (beyond just the 200 acres in the southeastern part the scoping notice already points out). There are 9,545 acres of AMA within this planning area, representing approximately 27 percent of the area, and we would like to see all of these acres analyzed for "innovative approaches at the stand and landscape level for integration of ecological and economic objectives".	2a	The treatments proposed in AMA are different than those proposed for LSR, in the spirit of the AMA guidelines. Chapter 2 (Section 2.4.2.6) provides a summary of the types of treatments and prescriptions that are specific to AMA and LSR.
IF-6.2	It would seem that this project should take advantage of the direction in the NWFP and try different ways to manage these areas "with the goal of achieving desired ecological and economic objectives." We would suggest at the very least this include treating stands more intensively than the usual thinning from below prescriptions. We would strongly urge you to include small gaps from 1 to 5 acres in size (beyond just the 200 acres in the southeastern part the scoping notice already points out). There are 9,545 acres of AMA within this planning area, representing approximately 27 percent of the area, and we would like to see all of these acres analyzed for "innovative approaches at the stand and landscape level for integration of ecological and economic objectives".	2a	See response to IF-6.1 above.
IF-6.3	there appears to be two large units identified as "SKIP" treatment. It's not clear what the "SKIP" treatment is nor is it clear why those particular areas were selected and what the purpose is. We would like to learn more about this.	3	Skips are described in the EA, Section 2.4.2.6.
IF-6.4	We believe some units identified as cable logging could be done with ground based logging, e.g. Unit D15 and others along the 2340230 road. There may be others but these we did look at	3	FS staff conduct extensive reviews of the proposed treatment areas to select the most appropriate logging system that minimizes resource impacts.

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
IF-6.5	The units identified for helicopter logging do appear appropriate given the topography and road locations. Nevertheless we would like to see the helicopter units remove as much volume per acre as is permissible. Finally, we ask that the Proposed Action pay particular attention to minimizing the use of high cost logging systems to increase the project's overall economic viability.	2c	Procedural. The project planning process provides a rigorous interdisciplinary review of logging systems proposed for each unit, including economic feasibility (see Section 3.8).
AFRC-7.1	We feel the objectives for the AMA acres outlined in this Scoping should be more true to the intent of the AMA. Direction to "accelerate the development late successional forest characteristics" as stated in Objective 3 is not found in the guiding documents we have found. Additionally Objective 4 would not be a "secondary" benefit but an integral aspect of successful implementation of treatments in AMA allocations. Treatments within AMA are a significant portion of this proposal, with 52% (2,433 acres) of the proposed project treatment acres. Within the planning area, AMA accounts for 26% of the total acres. Opportunities to implement "innovative approaches at the stand and landscape level for integration of ecological and economic objectives" on all of the 9,545 acres of AMA allocation we would ask to be considered for inclusion in this analysis. This could be by expanding on the proposed 200 acres identified in the scoping notice or adding other management prescriptions.	2a	The AMA guidance document (USDA 1998) does discuss AMA objectives in the context of LSR objectives. From Chapter 4, pg. 49 of the AMA guide: "Principal opportunities for expanding our knowledge of the use of timber management were identified as follows: Exploring treatments that accelerate the development of late-successional features or provide other avenues for meeting LSR objectives more quickly or more effectively." See response to IF-6.1 for more information on treatments prescribed in AMA.
AFRC-7.2	Increasing the number of acres proposed for treatment can help the ONF develop "Approved NEPA shelf stock" for future projects and provide for a more cost effective NEPA process. This has been accomplished or is in process on several Forests in Region 6. Some sites we reviewed seemed to have very similar if not identical stand conditions immediately adjacent to or simply across the road from proposed units. Looking at these types of situations could potentially increase the treatment acres.	2c	Alternative C – Original Proposed Action included all potentially viable stands originally considered for treatment in this project. Alternative C was not analyzed in detail. See Section 2.3 for a description of this alternative.
AFRC-7.3a	A key aspect to meeting Objective 4 of the Proposed Action and in reality the ability to meet Objectives 1-3 is that treatments are economically viable. This can be achieved through appropriate treatment prescriptions, the selection of appropriate harvest systems, and types of road classifications (temporary/permanent) for roads used to access harvest units. As analysis and finalization of the Proposed Action move forward we	2c	Economic viability of the proposed action (and alternatives) is discussed in the EA Section 3.8.

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
	would ask you consider these issues, in order to increase the project's overall economic viability. Some additional details for consideration: • Prescriptions: o Removal of low volumes per acre in thinning operations can lead to harvest costs outweighing the value of the timber removed. Particularly as the harvest method costs increase (ground vs. cable vs. helicopter). o Wider spacing of the residual stems in thinning can aid in both operational efficiency and also the safety of crews working on the ground, cable and helicopter logging systems. o Consider opportunities to include hardwood removals where appropriate. This can help support Item 4 of the proposed action by helping to maintain the infrastructure of hardwood processors. □ Expanded treatment prescriptions in AMA could evaluate hardwood removals in development of forest structure		
AFRC-7.3b	• Harvest Systems: o Selection of appropriate harvest systems for specific units. 2 See Table 1 Lower Skokomish Vegetation Management Scoping Notice • We believe there may be portions of cable and helicopter units better suited to lower cost harvesting systems. Please see attached image of the D29E unit area. This 1994 image was obtained from Google Earth and shows potential road access into the northern portions of this unit. Additionally based on site review the lower portions of D29E and some cable units we	2c	Procedural. The project planning process provides a rigorous interdisciplinary review of logging systems proposed for each unit, including economic feasibility which takes logging systems into account (see Section 3.8).

Table D-2. Comments received during scoping and Forest Service responses.			
Comment No.	Comment	Code	Response
	reviewed, appear they may be suited to ground based harvesting systems. o Maximizing opportunities for mechanical harvesting and yarding can enhance economic viability. o Seasonal timing restrictions, particularly in the case of helicopter operations, can create economic challenges to a successful project. Expanding operating windows to the maximum as practically allowed, including options for winter operations, should be evaluated. o Selection of prescriptions and residual stem spacing appropriate for the type of harvesting. • Downhill yarding in a thinning will be less expensive and should have less residual stem damage with a wider spacing. • Maximizing volume per acre removal for helicopter units can lower the harvesting cost/mbf. This can also reduce the need to return for additional removals in the near term when volume per acre may not be substantial enough to support helicopter operations.		
AFRC-7.3c	• Roads: o Roads are an important part of the infrastructure providing access to the forest for a variety of stakeholder uses including forest management and recreation needs. o Opportunities to invest in this infrastructure through the maintenance and improvement of systems roads should be evaluated. This maintenance can lead to reduction and elimination of potential sediment delivery sources. o The use of new temporary roads and existing non-system roads will help to reduce logging costs. When BMPs are used, these roads can be relatively low standard roads and then decommissioned as planned.	2c	Procedural concern. Field reconnaissance identifies existing road beds (non-system) and NFS roads to determine feasibility of treating stands. Economic costs associated with reconstructing or otherwise improving roads is considered during planning to realize the economic viability of the project as a whole.

D.2 Responses to Comments from the 30-day Comment Period on the Preliminary EA

Table D-3 summarizes the comments received on the Queets Vegetation Management Project Draft EA during the 30-day comment period. The comment period began on and ended on Monday July 7, 2014. FS responses to these comments are included in TableD-4 and E-1. Comment letters were labeled with the initials of the individual or organization from which they were received. Each comment within each numbered letter is listed after a decimal point, (e.g., letter 1, comment 3 is noted as comment 1.3). Comment letters in their entirety are available at the project website and in the project record.

Table D-3. List of Commenters during the 30-day comment period.

Comment No.	Commenter, affiliation, abbreviation used in Table D-4	Date Received
1	Dan Boeholt, Individual, DB	Dec. 8, 2015
2	Andrew Warber, Individual, AW	Dec. 8, 2015
3	Lori Lennox, Individual, LL	Dec. 9, 2015
4	John Hubler, Individual, JH	Dec. 9, 2015
5 and 6	John Rhodes, Individual, JR (2 comments submitted on same day)	Dec. 9, 2015
7	Matthew Roth, McFarland Cascade, MC	Dec. 21, 2015
8	Dick Artley, Individual, DA	Dec. 24, 2015
9	Mike Anderson, The Wilderness Society, TWS	Jan. 4, 2016
10	Shelley Spalding, Great Old Broads for Wilderness, GOBW	Jan. 6, 2016
11	Connie Gallant, Olympic Forest Coalition, OFCO	Jan. 5, 2016
12	Harold Brunstad, Individual, HB	Jan. 6, 2016

Table D-4. Response to Comments received during the 30-day comment period on the Preliminary EA.		
Comment Number	**Comment (actual text from comment)**	**Response**
DB-1.1	I support the Skokomish Thinning Project, but do not pile the roads with debris upon finishing. Block the access and leave the roads open for public and wildlife usage.	Temporary roads will be decommissioned/rehabilitated after project implementation as described in the EA to stabilize and block them from motorized vehicle access. Decommissioning will not preclude public access by foot. Guidelines for slash removal will be refined in the brush disposal plan and will include consideration of opportunities for public access by foot. No NFS roads are proposed for decommissioning as part of Alternative B (the proposed action).
AW-2.1	Thinning the National forest is great for our wildlife and helps to prevent wildfires. Piling roads with debris and making them impassable to man and beast is wrong and needs a better solution.	See response to comment 1.1 above.
LL-3.1	I approve of this project with the request that any already established, unused but accessible spurs and roads that will be used in getting timber cut and removed NOT be destroyed or dug up in the manner that the Pacific District South has done. Blocking is one thing, but destroying to the point that 1. wildlife and pedestrians cannot use it and 2. where it is costing large amounts of money to either the Forest Service or to the logging contractor (which means less $$ to the USFS). What with the horrible USFS recreation budget cuts and already limited parking and access points, these old and new spurs do and can provided wonderful dispersed parking and camping spots. If anyone needs to see how this is done correctly you just need to go to the Cowlitz Ranger District in the Gifford Pinchot National Forest and drive the 23 road to the 21 road and then the 56 road and on up to the Yakima Indian reservation. Or all around that area. USER FRIENDLY, not USER KEEP OUT! Thank you for the opportunity to comment.	See response to comment 1.1 above.
JH-4.1	In encourage the thinning/logging operation on FS lands, but leave all roads open for public vehicle access!	See response to comment 1.1 above.
JR-5.1	Do not destroy the roads or pile stumps and logs so thick and high that people and animals can't walk the roadway. Don't be wasteful and fall trees deliberately to fall them such that they cover the road making hiking very hazardous. Grasses will eventually grow and become feed for animals. The remaining road will allow fire fighting units in to fight forest fires when needed.	See response to comment 1.1 above.
JR-6.1	Please do not destroy the roads like you did on the Olympic peninsula by piling slash so high people and animals can't hike or walk through it. See attachment.	See response to comment 1.1 above.
MC-7.1	We would like to see more of a collaborative effort with Industry in identifying logging methods for some of the proposed stands in the planning area. During a site visit, we noticed some of the stands designated for helicopter and Cable operations didn't seem to have much volume per acre. Or in the case of unit D29E which is designated Helicopter, it looks like the lower portions near the 23 road can be accessed with a ground based system. These types of low volume stands tend to have higher operational costs, making it harder to justify the expense. We would request removing the Helicopter units, or reconsider opening up some of the adjacent roads and adding temp roads to access these stands, which may help improve the benefit to cost ratio detailed in Section 3.7 economic viability. We would also like the Forest service to reconsider the Seasonal limitations for Helicopter logging on unit D20. Given unit D20 close proximity to the rest of the planned helicopter units, which can operate Sept 24 thru 2/28. If you allowed an "out of season" operation waiver for D20 that would greatly enhance the unit's appeal to potential purchasers, which would provide a greater economic return to the ONF.	Recognizing that treatment acres will be reduced by 25% to 30% (EA p. 16) due to areas set aside for protection (stream buffers, etc.), an average of 10 MBF per acre was estimated for the entire stand acreage analyzed in the EA. The actual volume removed on treated portions of the stands should average about 15 MBF per acre. Part of stand D29 is designated for ground based yarding adjacent to the 23 road below stand D29E. A stream in the center of the stand and slopes greater than 30% precluded expanding the area of ground based yarding. Acknowledging that helicopter is the most expensive yarding system, all other options were considered prior to proposing helicopter yarding for a stand.

Table D-4. Response to Comments received during the 30-day comment period on the Preliminary EA.		
Comment Number	**Comment (actual text from comment)**	**Response**
DA-8.1	Issue #12 ----- Please post your responses to public comments on this online as well as maintaining a hardcopy in the Project File. Comment: Members of the public who submit comments on a draft NEPA document make the effort to read the NEPA document closely and take the time to compose comments that reflect their issues. Unless you respond to these comments and allow the public to read your responses they don't know if their comments were read and "considered." Plus, such responses show you aren't ignoring the public. Request for changes to be made to the final NEPA document: Post your responses to ALL public comments online so the 322 million Americans\ national forest owners might read them if they choose. Hiding your responses to comments in the Project File clearly violates United States' law. This is abuse. Will you pay the bills if a person has an accident driving to the district? Its insane to keep the responses off the net. You clearly have something to hide. Failure to post your responses to ALL public comments online will violate 36 CFR 215.6(d) because the Responsible Official did not "address comments received from the public during the comment period in an appendix to the environmental assessment." Ignoring public comments also violates: 40 CFR 1503.4(a) because the objector does not know how the Responsible Official responded to the objector's comments, and 40 CFR 1502.9(b) because the Final environmental impact statement does not respond to comments.	The original comment letters and messages, including attachments, and these responses are posted on the project website: http://www.fs.fed.us/nepa/nepa_project_exp.php?project=43401
DA-8.2	Issue #15 ---- Increases in National forest logging do not stabilize or enhance the economy of small communities located near them. Request for changes to be made to the final NEPA document: Either: 1) remove the following statement from the P&N: "4. Contribute directly and indirectly to the viability of local community economies." (page 12) OR 2) offer the sale as an SBA sale and say so in the final NEPA document,OR 3) include the text or links to the text of the following papers (referenced above) in an Appendix to the NEPA document. Line-officers must not withhold such important information from the public. Congress promulgated laws to prevent zealous federal officials from behaving in such a manner to feather their nest. "The Economic Impact of Trails-Forest Recreation's Growing Inpact""Seeing Forests for their Green: Economic Benefits of Forest Protection, Recreation, and Restoration","The Economic Impact of Preserving Washington's Roadless National Forests" A 1998 presentation to the National Trails Training Partnership by U.S. Undersecretary of Agriculture Jim Lyons. Failure to do so will violate The final EA violates 40 CFR 1500.1(b) because environmental information is not available to citizens before decisions are made.	Land management planning goals and objectives, as well as standards and guidelines for specific land management allocations are created pursuant to the National Forest Management Act, as amended, and the agency's implementing regulations contained in 36 CFR §219. This element of the purpose and need statement is based in the forest goals outlined in the Forest Plan. 1. The purpose and need statement clearly states that economic contributions of the project from wood fiber are a secondary project benefit. The primary purpose and need of the project is to support development of late successional conditions. The Olympic AMA allocation the NWFP ROD stated emphasis is to "...test innovative approaches at the stand and landscape level for integration of ecological and economic objectives, including restoration of structural complexity to simplified forests and streams and development of more diverse managed forests....". The economic feasibility section clearly shows the cost-benefit ratio of implementing the preferred alternative. This alternative shows the greatest net potential value. 2. While the contractual mechanism for implementation is not part of the decision to be made; some units may be offered as SBA sales as deemed appropriate within protocol by the contracting officer ; 3. References provided by the commenter are included in Appendix E.
DA-8.3	Issue #17 ----- The range of alternatives in the pre-decisional EA is inadequate. There are "reasonable" alternatives to the Proposed Action that you conveniently overlook. Analyzing a single action alternative as has been done here is clearly intended to hardwire selection of the proposed action for implementation in violation of the NEPA. Request for changes to be made to the final NEPA document: Analyze at least 1 citizen generated alternative to the Proposed Action in detail.	The LSVMP EA documents consideration of 4 alternatives, including: the no action alternative and the proposed action, and 2 alternatives considered but eliminated from detailed study. The alternatives considered, but eliminated from detailed study are rightfully considered as part of the range of alternatives considered in keeping with Council on Environmental Quality guidance in their document: "40 Most Asked Questions." Question 1a of this document states: 1a. Range of Alternatives. What is meant by the "range of alternatives" as referred to in Sec. 1505.1(e)

Table D-4. Response to Comments received during the 30-day comment period on the Preliminary EA.		
Comment Number	**Comment (actual text from comment)**	**Response**
		A. The phrase "range of alternatives" refers to the alternatives discussed in environmental documents. It includes all reasonable alternatives, which must be rigorously explored and objectively evaluated, as well as those other alternatives, which are eliminated from detailed study with a brief discussion of the reasons for eliminating them. Section 1502.14. A decision maker must, in fact, consider all of the alternatives discussed in an EIS. Section 1505.1(e). The Forest Service Handbook contains further discussion on the range of alternatives at FSH 1909.15; Section 14: As established in case law interpreting the NEPA, the phrase "all reasonable alternatives: has not been interpreted to require that an infinite or unreasonable number of alternatives be analyzed, but does require a range of reasonable alternatives be analyzed whether or not they are within the Agency jurisdiction to implement. (40 CFR 1502.14 (c)). And at FSH 1909.14.4: The range of alternatives considered by the responsible official includes all reasonable alternatives to the proposed action that are analyzed in the document, as well as other alternatives eliminated from detailed study. Alternatives not considered in detail may include, but are not limited to, those that fail to meet the purpose and need, are technologically infeasible or illegal, or would result in unreasonable environmental harm. The alternatives considered but eliminated from detailed study and the reasons for doing so are given in the EA, Section 2.3. When the interdisciplinary team reviewed the scoping comments, the Responsible Official determined there were no relevant or key issues that drove an additional alternative.
DA-8.4	Issue #18 ----- The pre-decisional EA contains no economic analysis to determine if the USFS will spend more money planning, preparing and administering the sale than they receive from the timber purchaser who buys the sale. Request for changes to be made to the final NEPA document: Include a complete economic analysis. This would include and disclose ALL predicted agency costs (including overhead costs) and timber revenues. This will respond to the beloq-cost timber sale issue that's still with us. Failure to do so violates FSH 1909.17, 36 CFR 219.3, FSM 1971 and FSM 1972.	Forest Service project analysis and design is guided by law, policy, and direction. The following economic section is guided by several direction documents. Overall direction begins with the Office of Management and Budget (OMB) Circular No.A-94 Revised (Oct. 1992). This "Circular provides general guidance for conducting benefit-cost and cost-effectiveness analyses. It also provides specific guidance on the discount rates to be used in evaluating Federal programs whose benefits and costs are distributed over time" (OMB, 1992). Further Forest Service direction in the form of Forest Service Handbooks and Forest plans provide more specific instruction. Forest Service Handbook (FSH) 2409.18 Ch. 30 provides direction on how to integrate financial and economic analysis into NEPA and project planning. It requires that a financial analysis of each timber sale alternative is completed during project analysis and design. It provides additional analytical methods that can be completed as needed based on the complexity of the project. Such methods include economic efficiency, socio-economic impacts, trade-offs, and sensitivity analyses. This section includes an economic efficiency analysis, which incorporates the financial analysis, as well as an economic impacts analysis. This analysis is consistent with FSH

Table D-4. Response to Comments received during the 30-day comment period on the Preliminary EA.		
Comment Number	**Comment (actual text from comment)**	**Response**
		direction and extends beyond what is required in order to provide additional economic information commonly requested by the public. Forest Service Handbook (FSH) 1909.17 is the economic and social analysis handbook. Ch. 10 provides detailed instructions on evaluating economic efficiency. An economic efficiency analysis measures the benefit/cost ratio and economic net present value (NPV). Benefit/Cost ratio can be used to determine the most economically efficient alternative while NPV will compare all monetarily-value cost and benefits. This was completed in accordance with handbook direction. Forest Service planning costs are not included in the economic efficiency analysis since they are considered sunk (OMB A-94).
DA-8.5	Issue #20 ----- Ranger Yoshina Federal officials working for any agency who knowingly take action that will place public health and safety in jeopardy by "concealing" important information violate 18 U.S.C. § 1001. Request for changes to be made to the final NEPA document: Assure it states "herbicides that contain glyphosate will not be applied." The decision document should also say this. Also eliminate the words glyphosate and commercial names for herbicides that contain glyphosate.	The herbicides and treatments that will be applied within the LSVMP area are authorized under the Beyond Prevention ROD (which amended the Forest Plan) and associated effects analyses presented in the Beyond Prevention FEIS.
DA-8.6	Issue #23 ----- Ranger Yoshina, if you care about maintaining aquatic species' health you would indicate in the final EA that all newly constructed temporary roads will be obliterated after use by returning the ground to the natural angle of repose and eliminate the running surface. If you were really concerned about aquatic species' health you wouldn't propose any road construction. Request for changes to be made to the final NEPA document: Please indicate all temporary roads will be fully recontoured after use and tell the public this will be done in the draft decision document, or provide scientific information authored by independent scientists in the response to comments that indicates there are other methods more effective at long term sediment elimination than full obliteration. Also, please assure the final NEPA document includes a road obliteration monitoring plan to assure the sediment is being reduced as expected. The resulting draft decision documents should indicate the USFS will provide funding for the monitoring and accomplish the monitoring.	Temporary roads will be decommissioned/rehabilitated after project implementation as described in the EA Table 2-4, PDC AQUA-38, AQUA-42 through AQUA-46. BMP monitoring will be conducted as described in the EA Section 2.4.2.7.
DA-8.7	Issue #24 ----- This time Mr. Yoshima please respond to the opposing views contained in the Opposing Views Attachments to these comments as is required by law. Request for changes to be made to the final NEPA document: Please provide meaningful responses to each opposing view contained in the attachments to these comments online so all potential interested Americans might read them.. Mr. Yoshima, if you feel the any opposing view is not "responsible" then I ask you to explain why. At Appendix E-2 of your EA your IDT rejects the information in Opposing Views Document #1 and #2 by saying: "The science presented in the citations provided by Mr. Artley do not provide any new or additional information that is inconsistent with, or that refutes the science used in the preparation of the preliminary EA." Failure to do so will violate 40 C.F.R. § 1502.9(a) and 1502.9(b) and. 42 USC § 4372(d)(4) because "Final environmental impact statements shall respond to comments as required in part 1503 of this chapter. The agency shall discuss at appropriate points in the final statement any responsible opposing view which was not adequately discussed in the draft statement and shall indicate the agency's	A summary of the FS review of the references listed in the Opposing Views attachments provided by the commenter can be found in Appendix E, Table E-1, pg. E-101.

Table D-4. Response to Comments received during the 30-day comment period on the Preliminary EA.		
Comment Number	**Comment (actual text from comment)**	**Response**
	response to the issues raised." Failure to respond to responsible opposing views (from any source) also is inconsistent with court precedent:	
DA-8.8	Issue #25 ----- Your Purpose & Need is written so narrowly that it excludes all reasonable alternatives to the Proposed Action. Such a narrow Purpose & Need allows you to reject all other alternatives by claiming they would not satisfy the P&N.	See responses to comments 8.2 and 8.3.
DA-8.9	Issue #26 ----- The Proposed Action will clearly cause the resource degradation and destruction described in the ATTACHMENTS to these comments.	References provided in attachments were reviewed. Responses can be found in Appendix E, pg. E101. The references did not provide any new information that resulted in modifications to the effects analyses or conclusions as presented in the EA, Chapter 3.
DA-8.10	Issue #30 ----- You have consciously selected literature for the References section that excludes science describing how logging will adversely affect non-timber natural resources in the sale area. Request for changes to be made to the final NEPA document: Include some source documents from the Opposing Views Attachments in the References section of the final EA. Also, cite some the specific quotes related to the issue that are presented in the source literature in the Opposing Views Attachments. The public deserves to be informed of this information so they can make an informed decision to support or oppose the timber sale based on complete data.	Best available science was used for all analyses. See response to comment 8.9.
DA-8.11	**Comment:** stop justifying resource damage by telling the public the impact is only "short-term" in your Proposed Action effects write-ups. You all know "short-term" impacts sometimes inflict long lasting adverse effects. In most cases the IDT claims of "short-term damage" are not supported by best science.	The analyses presented in the EA considered the environmental consequences of the proposed actions at temporal scales defined for each resource area. Please see Chapter 3, environmental consequences for information regarding the temporal scale of effects considered for each resource.
TWS-9.1	Thank you for the opportunity to comment on the preliminary environmental assessment (EA) for the Lower Skokomish Vegetation Management Project. As you know, The Wilderness Society has been actively involved in restoration of the Skokomish watershed through the Skokomish Watershed Action Team (SWAT). We greatly appreciate the Olympic National Forest's outstanding collaborative restoration work in the Skokomish watershed, including 200 miles of road decommissioning accomplished during the past two decades.The Wilderness Society's comments on the EA are limited to three issues that pertain to our restoration work in the Skokomish watershed. First, we think that the design criteria in the final EA/decision notice should clarify that all roads used in the Project - including previously decommissioned roads - will be decommissioned at the conclusion of the Project. The EA is somewhat unclear on this point. On p. 18, the EA lists three types of road developments: 3.1 miles of previously decommissioned roads, 10.4 miles of unclassified non-system roads, and 5.2 miles of new temporary roads. On p. 91, the EA suggests that all three types of roads will be decommissioned once the Project is completed. However, on p. 32 the design criteria for road decommissioning (AQUA-38) mentions unclassified non-system and temporary roads, but not previously decommissioned roads. The statement on p. 18 regarding road remediation should be clarified as well ("After thinning is complete, all temporary roads and unclassified roads (non-system roads) used as temporary roads (newly constructed and reconstructed) and landings would be rehabilitated as described in the PDC (Table 2-4)").	The previously decommissioned roads proposed for use in this project are considered temporary roads. All temporary roads, new, on pre-existing roadbeds, or previously decommissioned NFS roads, would be decommissioned/rehabilitated following their use for implementation of the project. The text was updated in table 2-4 and in Section 2.4.2.2 to clarify this point.
TWS-9.2	Second, the EA highlights continued evidence of excessive soil compaction and other soil damage resulting from past logging in this part of the Skokomish watershed. For example, 203 acres in the proposed harvest units already exceed the forest plan standard of 20% detrimental soil condition, and another 328 acres currently have between 15-20% detrimental soil conditions and will likely exceed that standard after the proposed thinning (p. 72). It also points out the presence of sensitive soils in the	During project implementation, a combination of Project Design Criteria in Table 2-4 of the EA (Specifically, Soil-02, Soil-04, and Soil-06), seasonality of logging operations, and slash matting of all ground based skid trails, will be used to minimize potential long term soil disturbance within the project area. The option of excluding areas

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	Project area, including 70 acres in proposed harvest units and 9 acres on proposed skid trails (p. 70-71). We urge the Forest Service to be very careful to avoid additional soil compaction and other detrimental soil impacts in the Skokomish watershed. One potential way to minimize soil impacts is to require the use of harvester-forwarder equipment for ground-based logging activity. We have seen positive results from use of this type of equipment elsewhere in the Northwest as a way to reduce soil impacts and operate on steeper slopes than conventional logging systems. Another option would simply be to avoid logging and skid trails on the 79 acres of sensitive soils, which represent less than 2 percent of the Project's thinning acreage.	of sensitive soils was discussed, but it was determined that the spatial variability and general location of these soils in relation to other less sensitive areas would greatly increase the complexity of implementation and administration, and that adherence to the soil PDCs outlined within the NEPA document, will effectively mitigate any long term detrimental effects to these sensitive areas. While we acknowledge that harvester forwarder equipment can be effective in reducing soil impacts, Forest Service contracts cannot specify the type of equipment used for logging operations. However, effects will be mitigated through the PDCs referenced above. Additionally, areas identified as having sensitive soils have all been restricted to summer/dry operations only, ensuring that this area will not be disturbed when the soils are at or near saturation. During operations, the purchaser will be required to skid logs over a bed of slash, reducing overall ground pressure and minimizing persistent compaction and rutting.
TWS-9.3	Finally, we are curious about a statement in the cumulative effects section on p. 93 of the EA that an additional 25.5 miles of road decommissioning are planned in the South Fork Skokomish watershed. Our understanding in the SWAT is that the Forest Service has now completed all of the necessary road decommissioning work in the Skokomish watershed. Please clarify that statement.	All of the high priority NFS road decommissioning projects have been completed in the South Fork Skokomish watershed. No additional large-scale road decommissioning or road closure projects are anticipated on National Forest System lands in the watershed within the foreseeable future.
GOBW-10.1	I am writing on behalf of the Polly Dyer Cascadia Broadband, a local chapter of the Great Old Broads for Wilderness, to provide comments on the Lower Skokomish Vegetative Management Plan (LSVMP). The organization is an advocate of well-planned restoration projects. We recognize that there are thousands of acres of dense and structurally simple forest on the Olympic National Forest that, through carefully designed habitat restoration thinning projects, have the potential to improve diversity and development of more complex, older forest conditions. Although 4 Alternatives were originally proposed, the Preliminary Environmental Assessment only considered one action alternative and includes a no-action alternative. Alternative A No Action is not the preferred alternative; thus we will focus our comments on Alternative B, the preferred alternative.	Comment noted.
GOBW-10.2	We do not support building any new roads in Riparian Reserves when so many system roads are needing attention and/or decommissioning and so few funds are available for these treatments. * Decommissioning of temporary roads should include pull-back of sidecast	New temporary road construction in Riparian Reserves totals about 0.6 miles. Temporary road construction would occur only during summer low-flow season. The Fisheries and Water Quality analysis documents the effects of temporary road construction in RR in the EA (pp. 87, 90, and 92).In addition, this analysis also includes a discussion about how the project activities meet the NWFP Aquatic Conservation Strategy and hence meet the project purpose and need. PDCs AQUA-14, AQUA-15, and AQUA-44 discuss treatment of sidecast.
GOBW-10.3	* Trees that are 78 years old in 2014 will be 80+ years by the time they are thinned. Alternative B should only thin trees that are younger than 80 years at the time of the thinning. This would be the case if all	The proposed treatment will generally remove smaller trees and leave the larger trees (EA p.21) while retaining and protecting legacy trees that have characteristics of older trees (EA. p.44). Within the project

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	thinning was being done as "thinning from below" - taking only smaller trees; leaving larger trees to provide more mature forest habitat. . Trees older than 80 years or 20" DBH are beginning to develop old growth characteristic and should be retained in LSR and AMA.	area, legacy trees are generally substantially older than 80 years and larger than 20 inches DBH. Within the LSR, thinning will be completed within stands before 80 years of age as specified in the NWFP, however there are no age limitations for treatment of AMA stands.
GOBW-10.4	* Under Alternative B, about one third of the thinning would occur in Riparian Reserves. Riparian no-cut buffers for fish bearing streams range from 200' measured from the outer edge of the channel migration zone for the three largest rivers to 100 feet measured from the outer edge of the streambank for all other streams. While we can support the 200' no-cut buffers for the three larger streams, there is no scientific justification for changing the location of measurement for no-cut buffers in other fish bearing streams from the channel migration zone to 100 feet from the outer edge of the streambank.	Rationale for buffer widths is provided in the EA pg. 89 and 101. Buffers are designed to meet the ACS objectives (EA, pg. 103) to maintain or restore conditions in Riparian Reserves.
GOBW-10.5	Although there is mention of a possible Stewardship Project, that seems unlikely as this timber sale is predicted to have a deficit "benefit-to-cost" ration according the economic analysis	Comment noted. Contract options will be considered and determined following the NEPA decision.
GOBW-10.6	The Climate Change analysis does not discuss the changes to habitat resulting from soil compaction; more sunlight in the forest during hotter, drier conditions; disruption to wildlife and plant that are attempting to adapt, etc. This topic need a much more detailed and extensive analysis, which would include identifying areas within the project area that will best sustain native biodiversity and adaption even as changing climate alters current distribution patterns.	The project proposes to reduce stand densities to accelerate development of late-successional habitat conditions. This project falls within the types of options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation. The proposed action reflects the rationale behind these recommendations because it is designed to improve overall tree growth and tree species composition which will lead to increasing biomass production and providing habitat for native late-successional species over the long-term.
OFCO-11.1	Olympic Forest Coalition is providing comments on the Lower Skokomish Vegetation Management Project (LSVMP). Our organization advocates protection of forest ecosystems, and supports well-planned restoration projects that address needed conditions, especially those based on watershed analyses, which ONF has conducted in this watershed.1 We recognize that there are thousands of acres of young, dense, and structurally simple forest on the Olympic National Forest, and the opportunity to improve diversity and the development of complex, late successional forest condition through carefully-implemented habitat restoration thinning projects. As such, we support the Forest's focus on thinning structurally simple forest stands per the 1994 Northwest Forest Plan (NWFP). Our concerns relative to forest harvest are the impact of forest roads on aquatic ecosystems, the impacts of roads and tree removal on T&E species such as Northern spotted owls and marbled murrelets, fish and amphibian species, on slope stability and sediment transport, and the protection of forest ecosystem function including habitat, carbon storage and sequestration, clean air and water. We support activities to create the forest structure that would result in a net gain for healthy, functional habitat conditions beneficial to many late-successional species in the uplands as well as in riparian areas, including marbled murrelet, Northern spotted owl, marten, Northern goshawk, native fish species and northern flying squirrel, as well as all the other species which are or should be thriving in our forests. Where removal of commercially-sized trees will promote late-successional characteristics of diverse plant communities and seral stages, protect existing habitat for T&E and sensitive species, maintain slope and streambank stability, provide woody debris to aquatic, riparian, and terrestrial habitats, and improve road stability while eliminating road sediment transport, we can cautiously support thinning. OFCO supports careful implementation of the extensive Project Design Criteria in Table 2.4. If the outcome of the LSVMP is to achieve desired goals of late-successional forest restoration, and protect	Comment noted.

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	the aquatic and terrestrial ecosystems during and after project completion, it will be critical to implement the PDCs on the ground and for staff to monitor and conduct compliance on the operations. We appreciate the level of detail undertaken in the development of this proposal and EA, and the amount of field time to provide up-to-date site-specific review to inform this proposal.	
OFCO-11.2	Commercial Thinning: OFCO opposes timber harvest that does not promote ecological outcomes supportive of upland and riparian habitat as required by the Northwest Forest Plan. A few of the stands proposed for thinning (EA Table B-4) are reported to be close to 80 years old. Thinning in these older stands is of concern to OFCO because at that age, trees may have a slower response and slower development of desired habitat structure. We request that particular attention be paid to these few units—if not outright removal—in order to document the actual age of the trees, the response of the stand to any treatment, and to establish a strong baseline for effectiveness monitoring.	See response to comment 10.3 above.
OFCO-11.3	Under Alternative B, about one quarter of the thinning would occur in Riparian Reserves (1528 of 4494 acres). Riparian no-cut buffers for fish bearing streams range from 200' measured from the outer edge of the channel migration zone for the river reaches to 100 feet measured from the outer edge of the streambank for all other fish-bearing streams, and 50 feet for non-fish and intermittent streams. We support the 200' to 50' no-cut buffers as long as they are applied to the outer edge of annual winter flow – which may be wider than the scoured channel, and is determined by litter lines, flow evidence over plants, and minor scour. Actions which maximize restoration and protection of Aquatic and Riparian Reserves, including careful thinning, should be conducted only if these reserves are indeed structurally simple and lacking biologically diversity and downed and standing dead wood. Many species are dependent upon large down and dead wood within the forest. We request that the Forest Service require a percentage of thinned wood, especially in riparian zones, to meet a metric of greater than 4,000 cubic feet per acre, where it is lacking. The design of skips and gaps and the application of Variable Density Thinning practices to more closely approximate natural variability can enhance the characteristics of the stands, but must be applied primarily to improve habitats and protect wildlife and aquatic resources. Retention of western red cedar, western white pine, and deciduous species while thinning the dominant tree species – Douglas fir and western hemlock and increasing the amount of larger standing snags and downed dead wood, and the ground cover of coarse woody debris is very desirable.	The proposed treatment is designed to promote the development of late-successional conditions as detailed in the Purpose and Need. Stand ages were determined using stand exam data gathered for this project (which included sampling of tree ages), and historic records of treatment provided the year of previous clearcut harvest and burning. Older trees can be slower to respond to thinning, however there is no research that ties a slower response to a specific tree age of 80 years. Some studies of older trees have shown a lag in response following thinning, however growth was increased compared to the unthinned condition. The response following thinning is more dependent upon tree vigor and crown condition than tree age. The Olympic Habitat Development Study is located on the ONF and included stands 35 to 70 years in age. Two of the sites included in the study were about 70 years old at time of treatment, and there was no difference noted in the response of these stands compared to the younger stands. Findings include increased growth of overstory trees (Roberts and Harrington 2008), midstory trees (Comfort et al.2010) and understory vegetation (Harrington et al. 2005). Planned monitoring is detailed in the EA on Section 2.4.2.7, p. 27.
OFCO-11.4	Roads: The Skokomish watershed was terribly damaged by road building when the Shelton Cooperative Sustained Yield Unit was in effect. We understand that 200 miles of roads have been decommissioned, and that 13.8 miles of these roads and unclassified roads would be temporarily re-opened for this proposal, and 5.4 miles of new temporary road will be used for the project. We encourage the Forest Service to reduce road miles wherever possible, to incorporate unidentified unclassified road segments into the road system, and to apply all the design criteria and mitigation measures that ensure no sediment transport into aquatic ecosystems and that slope stability is analyzed to ensure protection of aquatic and wildlife resources. Any new and reopened roads must be decommissioned before completing the contract. We strongly encourage acting where opportunities exist to decommission or remove additional system and non-system roads, improve drainage on additional system roads, and to implement other restoration and habitat improvement work with receipts generated by the project. All new temporary and reconstructed roads must be decommissioned post-harvest as part of the project activities,	All of the high priority road decommissioning projects have been completed in the South Fork Skokomish watershed. No additional large-scale road decommissioning or road closure projects are anticipated on National Forest System lands in the watershed within the foreseeable future. All temporary roads, new, on existing roadbeds, or previously decommissioned NFS roads, would be decommissioned/rehabilitated following their use for implementation of the project as described in the PDCs and in Section 2.4.2.2. A main objective of decommissioning is to stabilize roads and create conditions allowing for revegetation either naturally or through planting of native seed and/or native shrub and tree seedlings (PDCs AQUA-46, BOT-07, -08, -09, and -10). While it is generally recognized that mycorrhizae inoculations can facilitate revegetation and decomposition, it was not

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	including pulling culverts, removing historic sidecast, stabilizing and reconnecting water drainage, de-compacting road surfaces, using mycorrhizal fungi to promote the growth of desired native vegetation, and addressing invasive species. Page 35 PDC AQUA 38 and 40 – Temporary road decommissioning: We recommend that road decommissioning treatments apply mycorrhizal fungi inoculation to chipped piles or pads of materials. This will accelerate breakdown of material while providing benefits to soil and increased growth of native species.	considered or planned for use in this project as similarly treated sites in past projects suggests that current road rehabilitation/decommissioning efforts are successful at meeting these objectives.
OFCO-11.5	Shutting down haul and operations in wet weather is noted in the EA, and we support that. If proposed road locations do not meet the criteria of slope stability, drainage conveyance away from aquatic ecosystems, appropriately-sized water crossings, or wind impact analysis, and are not able to distribute road sediment to the forest floor rather than streams or wetlands, these roads should be removed from the proposal, and appropriately decommissioned. New roads should not be constructed until funding is available for decommissioning.	Comment noted.
OFCO-11.6	Summer construction of roads must not disturb nesting marbled murrelets, or create openings used by predators such as corvid species.	Operating seasons for treatment activities were prioritized in terms of their impacts to known murrelet and owl sites, as well as large, intact areas of suitable nesting habitat. The operating seasons are discussed in Section 2.4.4 of the EA and units are listed in Table 2-5. Areas of high concern will have project activities that take place outside of the nesting season.
OFCO-11.7	Monitoring: Page 26: Monitoring: We support and appreciate the requirement for compliance monitoring of all parts of the contract. This is extremely important for documenting the outcome of the PDRs. We strongly support the inclusion of effectiveness and validation monitoring that reviews the thinned stands 3 to 5 years following project implementation to assess for wind damage; the necessity for the creation of CWD; and the necessity for artificial reforestation of created gaps, temporary roads, and landings within the project area, and post project review assessing whether short-term prescription objectives were met (leave tree density, CWD cover, snag density and understory tree density), the effectiveness of PDCs for the protection of soils, leave trees and existing CWD and snags, and the effectiveness of mitigations measures such as the rehabilitation of skid trails and temporary roads.	Comment noted.
OFCO-11.8	Slash and Fuels Management: Page 37 – Fuel 04: As above – reduce burning to reduce carbon release, ascertain if application of mycoremediation to break down slash in the fall will achieve breakdown by summer. We also recommend piling branches within stands and RAs to promote use by small mammals, birds, and amphibians.	Fuels treatments are described in the EA at pg. 25: The amount of slash removed from units is dependent on proximity to roads and the fuel conditions within each unit. Guidelines for slash removal distances can be found in the PDC Table 2-4 and will be further refined in the brush disposal plan at project implementation. Yarding of material back into units is not recommended due to the increased fire danger that it poses and long response times to reach any potential ignitions.
OFCO-11.9	Invasive Species: Page 41 - - - NNIS 06: We appreciate the Forest Service's requirements for weed-free materials.	Comment noted.
OFCO-11.10	Marbled Murrelets: Page 43: WL 01 – A sufficient no-thin buffer must be placed around the Suitable Nest Trees (SNTs). Intermingled branches may not constitute a sufficient buffer around a SNT. While removing trees will encourage the growth of branches in length and diameter, improving characteristics used by marbled murrelets, the removal may also impact that use. What is the approximate distance of the no-thin buffer around SNTs? How are these issues balanced, and upon what criteria are decisions made as to which trees to harvest or retain, other than intermingled branches, which may only extend 50 feet?	As stated in Chapter 3, given the current structural condition of these stands, it would be very unlikely that marbled murrelets would be nesting in stands proposed for thinning, despite the presence of trees classified as SNTs. In the unlikelihood that did occur, PDCs would protect any nesting marbled murrelets from harassment or harm. The SNT buffers for the ONF, were developed in close coordination between researchers and specialists in the USFS and USFWS, along

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	Page 45: WL 07 – The distance of 100 feet for a buffer around Suitable Habitat is 1/3 of that recommended in the State DNR's Marbled Murrelet Conservation Strategy. What is the scientific justification for this difference in width? Current surveys documenting occupancy and use of the Lower Skokomish planning area by both marbled murrelets and spotted owls is important in order to plan sales that will not disrupt these threatened and endangered species. In the interim, planning to study the responses to these thinning proposals and activities would provide valuable data to validate this practice, and from which to plan and support future restoration.	with opportunities for input from biologists and researchers with DNR and other agencies or organizations. The buffer distance is also again reviewed by the USFWS as part of the consultation for this project. The approximate distance of the interlocking canopy buffer would differ depending on stand characteristics, but would generally average around 25 feet. The interlocking buffer protects existing platforms while providing increased sidelighting to maintain live branch retention and mistletoe brooms on SNTs, which are important for platform development. The Marbled Murrelet Science Team developed recommendations for a long-term conservation strategy for murrelets specifically for DNR lands in Washington. These lands have different goals and objectives from National Forest System lands and the Team's recommendations were formulated with those in mind.
OFCO-11.11	Northern Spotted Owls: The short-term effects of the proposal in AMA stands on dispersal habitat – on snags, tree density and downed woody debris supporting Northern flying squirrels, truffles, and thus on NSPOW is of concern, especially since the use of these stands by flying squirrels isn't known, and since barred owls are becoming so well-established. We recommend the Forest Service monitor this response, and encourage that the Forest Service advocate for more funding to conduct needed research.	The EA, Sections 2.4.2.5 and 2.4.2.7, describes the inventory of snags and CWD levels that would occur within given timeframes after the commercial thinning. This also includes assessment of the effectiveness of PDCs for protecting these features. Where post-thinning inventories reveal a large disparity between the current condition and the desired future condition, snag and CWD creation could be used to make progress toward the long-term goals.
OFCO-11.12	Soils: The sensitive condition of some of the watershed's soils and reported impacts to soils damaged in past historic harvest operations or from proposed road construction and compaction, are of serious concern. We encourage attention to the care of soils – they are crucial to maintaining hydrology, root penetration, slope stability, habitats for sensitive species, site productivity, and for carbon sequestration. Conducting activities on frozen soils is unpredictable as they are not typical in the Skokomish, and rain events occur regularly. Use of existing skid trails and roads with post project restoration is vital here.	During project implementation, the purchaser will be required to operate in accordance with several site specific PDCs that limit the potential for long term soil disturbance during operations. Soil-02 references the importance of restricting operations during periods of extensive rain/snow melt as well as requiring methods such as slash matting skid trails during operations. This dramatically reduces ground pressure and greatly increases the soils inherent bearing strength. Soil-04 and Soil-06 require that skid trails and landings re-utilize disturbance prisms left from prior harvesting, and that the creation of new skid trails/landings be minimized or restricted. AQUA-38, 39, and 40 require all skid trails and landings be rehabilitated to restore long term soil productivity. This is accomplished through a combination of prism scarification, slash placement, and seeding and mulching, with the goal of returning disturbed areas as close as possible back to their reference state, post-harvest. The vast majority of the ground based logging polygons within the project area have been restricted to summer season only, ensuring that soils within these units will not be disturbed at saturation, when they are most vulnerable to long term detrimental soil effects.
OFCO-11.13	Carbon Sequestration and Storage: Section 3.9, Climate Change, should be more attentive to the role of soil in carbon sequestration, and how soils can be protected and improved.	Comment noted. Timber management projects can influence carbon dioxide sequestration in four main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), (3) by manipulating existing forest cover (managed forests), and (4) through transferring carbon from the live biomass to the harvested wood product carbon pool. Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide,

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		respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects like the proposed action that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. Soil is one of many ecosystem components that actively sequester carbon. Soils will be protected and improved during and following implementation of this project following the PDCs as described in Table 2-4 of the EA.
OFCO-11.14	Temperature and Microclimate: Thinning may indeed have a short term impact on microclimate, but the additional growth of trees and understory should improve overall basin temperature, hopefully improving the condition in the Lower Skokomish River, which is on the State 303(d) list for temperature exceedance.	Comment noted.
OFCO-11.15	Stewardship Contracting We appreciate the Stewardship components allowing receipts to be retained by the Olympic National Forest and to apply those receipts to restoration work within the Lower Skokomish watershed.	Comment noted.
HB-12.1	I support implementation of the proposed action Alternative B. However, I do have concerns regarding post harvest recreational access in the project areas. An observation I have made on the closing of many vegetation management projects that have been completed on the Pacific Ranger District is the level of obliteration occurring to skid trails, newly constructed temporary roads and reconstructed closed and decommissioned roads to facilitate access to these projects. These road prisms in addition to skid trails provided access to forest areas off the maintained roads for many forest users that may be subjected to limited hiking mobility due to a physical impairment or just old bodies. The level of obliteration that often occurs is unnecessary and unnatural to the forest environment. Additionally, it creates an unnecessary cost for operators including any reentries for future projects. This issue has been an expressed concern of other recreational users as well. I am opposed to the decommissioning of any forest system roads as a result of this projects that have not been subjected to a stand alone NEPA review. Although identified as not within the scope of this project, my comments submitted in response to the subject project scoping notice still persist in regard to the long-term viability of the Olympic Forest as a source of wood fiber and recreation.	See response to comment 1.1 above.

Appendix E: Additional Contributions Received During Scoping With Forest Service Responses

These can be found online at the project website:

http://www.fs.fed.us/nepa/nepa_project_exp.php?project=43401