Lang Dam Project

Environmental Assessment

McKenzie River Ranger District, Willamette National Forest
Lane County, Oregon

Legal Location: T16S, R4E Sections 23-26 and 35-36; T16S, R5E Sections 19 and 27-35; and T17S, R5E Sections 4-5; Willamette Meridian

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Chapter 1: Purpose and Need

1.1 Introduction

The McKenzie River Ranger District is proposing to provide a sustainable supply of timber; actively manage stands to improve stand conditions, diversity, density and structure; and manage Riparian Reserves to control stocking and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives on approximately 630 acres on the Willamette National Forest.

To accomplish this project, the district proposes to harvest about 8.1 million board feet (MMBF) from 20 managed stands ranging in age from 40 to 120 years old. In these stands, proposed treatments include about 331 acres of commercial thinning and 25 acres will be retained as skips. In addition, 40 acres will be harvested as openings (gaps) and dominant tree releases (DTRs) ranging from 1/4 to 3 acres in size.

Accessing harvest units will require about 2.2 miles of temporary road construction, which will utilize previously impacted areas when possible. There will also be approximately 11.5 miles of road maintenance.

The total Lang Dam project area encompasses 7,195 acres and is located off of Forest Service Road 19 approximately 4 miles east of the community of Blue River, Oregon (Figure 1). The project area is in the Elk – McKenzie River, Cougar Creek – South Fork McKenzie River (SFMR), Cougar Reservoir - SFMR, and East Fork - SFMR 6th field watersheds (Figure 2). The legal description for the project area is: T16S, R4E Sections 23-26 and 35-36; T16S, R5E Sections 19 and 27-35; and T17S, R5E Sections 4-5; Willamette Meridian, Lane County, Oregon.

This environmental assessment was prepared to determine whether effects of the proposed activities may be significant enough to prepare an environmental impact statement. By preparing this environmental assessment, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations.

Compliance with the State Historic Preservation Office and National Historic Preservation Act, executive orders such as environmental justice, Northwest Forest Plan determinations, and laws such as the Endangered Species Act, the Clean Water Act, etc. are addressed in Appendix A: Compliance with Forest Plan, Laws, and Regulations.

For more details on the proposed action, see the “Proposed Action and Alternatives” section of this document in the beginning of Chapter 2.
Figure 2 Lang Dam Project Area with 6th Field Watersheds
1.2 Purpose and Need for Action

The purpose of the proposed project is to, (1) Provide a sustainable supply of timber products; (2) actively manage stands to improve stand conditions, diversity, density, and structure; and (3) manage Riparian Reserves to control stocking and acquire desired vegetation characteristics needed to more quickly attain Aquatic Conservation Strategy objectives.

Provide a Sustainable Supply of Timber Products

*Why Consider Taking Action:* The proposed project is needed to help ensure the Willamette National Forest continues to supply a reliable supply of timber products as directed by the laws and guidance below and in doing so contributes to the stability of local, regional, and national economies and achieves the annual Probable Sale Quantity (PSQ) target for the Forest.

Several laws direct and allow the Forest Service to provide the sustainable harvest of trees from the Nation’s forests including Multiple-Use Sustained-Yield Act of 1960 and the National Forest Management Act of 1976. One of the strategic goals of the Forest Service is to provide and sustain benefits to the people of the United States and the world as a whole. To accomplish this goal, one of the objectives is to provide a reliable supply of forest products over time consistent with achieving the desired conditions on National Forest System (NFS) lands and to maintain or create processing capacity and infrastructure in local communities. ([USDA Strategic Plan FY 2014-2018](#)). Additionally, the Willamette National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan, includes goals to produce an optimum and sustainable yield of timber that helps maintain the stability of local and regional economies, and contribute valuable resources to the national economy on a predictable and long-term basis.

Probable Sale Quantity (PSQ) is an estimate of probable harvest levels that could be maintained on a forest annually (Northwest Forest Plan 1994). PSQs represent neither minimum levels that must be met nor maximum levels that cannot be exceeded. Rather, PSQs represent the best assessment of the average annual amount of timber harvest that could occur on a forest without decline, over the long term, if the schedule of harvests and regeneration are followed (Northwest Forest Plan 1994). PSQ can vary and change over time depending on acres available for harvest, expected acre yields and Forest direction.

*Existing Condition:* The current PSQ annual target for the Willamette National Forest is 111 million board feet (MMBF) as amended by the Approval of PSQ Estimates for Northwest Forest Plan Forests (1998).

*Desired Condition:* Through implementation of the proposed action, the McKenzie River Ranger District will contribute approximately 11 MMBF to the Willamette National Forest PSQ target in fiscal year 2017.

Actively Manage Stands to Improve Stand Conditions, Diversity, Density and Structure

The proposed project is needed to improve stand conditions, diversity, density, and structure in the project area, providing benefits to vegetation, wildlife, and overall health of the forest.

*Why Consider Taking Action:* Sixty-eight percent of stands proposed for harvest in the project area are overstocked or showing signs of reduced growth or mortality from competition. Overstocked stands occur when trees are closely spaced, resulting in a competition for resources. Closely spaced trees competing for resources generally result in decreased individual tree growth. Overstocked stands can also cause increased tree/stand stress, resulting in increased susceptibility to insect and disease outbreaks. Additionally, overstocked stands can increase the potential for high severity wildfires.

The proposed project will help improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release. Thinning the overstocked stands will make more growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards...
larger diameter stands. Stand vigor will also be increased as released trees develop into larger trees sooner, accelerating the development of some late successional characteristics. Tree species, age, and structural diversity will be maintained or enhanced.

The Stand Density Index (SDI), which is a quantitative measure of tree competition in a stand, ranges from 234 to 503 and averages 331 for all stands being considered for treatment in the Lang Dam project area. In Douglas-fir, the maximum SDI (SDImax) is 595 (Reineke 1933). As a stand reaches an SDI of about 149, or approximately 25 percent of SDImax, trees in the stand start to compete with each other. As SDI increases to around 357, or 60 percent SDImax, trees reach a point at which they start dying due to competition, or self-thinning (Long, 1985). Additional information about SDI is available under the heading Stand Vigor and Growth located in Section 3.1, Forest and Stand Structure.

Existing Condition: Sixty-eight percent of stands proposed for harvest in the project area are overstocked, or showing signs of reduced growth from competition with an average SDI of at least 298, or 50 percent of SDImax.

Desired Condition: Healthy, vigorous stands with an average SDI below 207, a level where you maximize individual tree growth before transitioning into maximizing stand growth which starts around an SDI of 208.

Manage Riparian Reserves to Control Stocking and Acquire Desired Vegetation Characteristics Needed to Attain Aquatic Conservation Strategy Objectives

Why Consider Taking Action: Treatment of stands in Riparian Reserves will accelerate the ability of Riparian Reserves to provide adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian-dependent wildlife.

Existing Condition: Due to replanting at stocking levels much higher than natural after previous clear cut harvest and dense stocking in fire regenerated stands, portions of Riparian Reserves within the project area units consist of dense, overstocked, conifer-dominant stands with very little structural and species diversity and understory development. This lack of complexity and diversity is outside the natural range of variability and may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian-dependent wildlife.

Desired Condition: Maintain conditions in currently functioning portions of Riparian Reserves. In overstocked, conifer-dominant portions lacking structural and species diversity, use silvicultural tools to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy Objectives (Appendix C).

1.3 Decision Framework

The responsible official for this proposal is the District Ranger of the McKenzie River Ranger District on the Willamette National Forest. The District Ranger will review the proposed action, alternatives, and the environmental consequences in order to make the following decisions:

- Whether to implement the proposed action;
- What specific design features are needed;
- What specific project monitoring requirements are needed to ensure design features are implemented and effective; and
- What if any modifications will be made to the proposed action.
The decision will be based on:

- How well the selected alternative achieves the project purpose and need; and
- How well the selected alternative responds to analysis issues.

### 1.4 Forest Plan and Management Direction

This Draft Environmental Assessment (EA) is tiered to the following EISs and plans, which are incorporated by reference:

- The Willamette National Forest Land and Resource Management Plan Environmental Impact Statement, as amended (USDA Forest Service 1990; referred to as the “Forest Plan”)
- The Northwest Forest Plan and Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species with the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management 1994a; referred to as the “Northwest Forest Plan”)
- The Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA Forest Service and USDI Bureau of Land Management 2001)
- The Environmental Impact Statement and Record of Decision for Preventing and Managing Invasive Plants (USDA Forest Service 2005).

The Forest Plan “guides all natural resource management activities and establishes management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resources management” (Forest Plan, I-1). The Forest Plan provides management direction through the designation of specific management areas and standards and guidelines specific to these designations.

The Forest Plan for the Willamette National Forest provides management direction through the designation of specific management areas, standards and guidelines specific to designated areas. The Northwest Forest Plan amended the Willamette Forest Plan by establishing new and additional management areas, standards and guidelines. When there is overlap of management allocations, the more restrictive standards and guidelines of both allocations apply (Northwest Forest Plan 1994a p. A-6).

Table 1 displays Forest Plan management areas, Northwest Forest Plan land management areas and proposed action unit acres for the proposed action. See Figure 3 for a map of Forest Plan Management Allocations in the Lang Dam project.

#### Table 1 Land Management Areas (MA) in Project Area and Proposed Treatment Acres in Alternative 2

<table>
<thead>
<tr>
<th>Northwest Forest Plan</th>
<th>Land and Resource Management Plan</th>
<th>Project Area (acres)</th>
<th>Proposed Treatment (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(16a) Late Successional Reserves</td>
<td>(11a) Scenic-Modification Middleground</td>
<td>65</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(11c) Scenic-Partial Retention Middleground</td>
<td>69</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(11e) Scenic-Retention Middleground</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(11f) Scenic-Retention Foreground</td>
<td>57</td>
<td>0</td>
</tr>
<tr>
<td>(16b) Late Successional Reserves</td>
<td>(9b) Wildlife Habitat-Pileated Woodpecker</td>
<td>109</td>
<td>0</td>
</tr>
<tr>
<td>(17) Adaptive Management Area</td>
<td>(11c) Scenic-Partial Retention Middleground</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(5a) Special Interest Area</td>
<td>551</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(7) Old Growth</td>
<td>89</td>
<td>0</td>
</tr>
</tbody>
</table>
Northwest Forest Plan | Land and Resource Management Plan | Project Area (acres) | Proposed Treatment (acres)
---|---|---|---
(9c) Wildlife Habitat-Marten | 189 | 0
(9d) Wildlife Habitat-Special Area | 187 | 0
(11a) Scenic-Modification Middleground | 2,249 | 115
(11c) Scenic-Partial Retention Middleground | 1,326 | 420
(11f) Scenic-Retention Foreground | 1,253 | 108
(WA) Water | 179 | 0
Non-FS Land | 866 | 0
Total Acres | 7,195 | 645

MA-15 Riparian Reserves (overlapping acres) | 2,443 | 209
NSO Critical Habitat Unit (overlapping acres) | 1,628 | 0
Inventoried Roadless Area (IRA) (overlapping acres) | 1,134 | 0

**Forest Plan**
The following discussion will focus on the relevant management allocations where treatments are proposed.

**Scenic-Modification Middleground (11A)**
These are areas that have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a modest level of scenic quality. This area will also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

**Scenic-Partial Retention Middleground (11C)**
The goal of these areas is to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a moderate level of scenic quality. This area will also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

**Scenic-Retention Foreground (11F)**
These areas that have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes will be managed for a high visual quality. This area may also be managed for other resource goals including maintenance of wildlife habitats, recreation opportunities, watershed protection, and timber production.

**Northwest Forest Plan**

**Adaptive Management Area (MA 17)**
This is an allocation from the 1994 Northwest Forest Plan that is designed to develop and test new management approaches to integrate and achieve ecological, economic, and other social and community objectives. All of the harvest units for the Lang Dam project fall within the Adaptive Management Area.

**Riparian Reserves (MA 15)**
These are areas where the conservation of aquatic and riparian-dependent, terrestrial resources receive primary emphasis. All streams, wetlands, ponds, lakes and unstable areas are included and managed for the purpose of protecting the health of the aquatic system and its dependent species. There are 209
total acres of Riparian Reserves in the Lang Dam Project area and 120 acres of commercial harvest in the riparian reserves.

![Figure 3 Northwest Forest Plan management allocations in the Lang Dam project area](image)

**1.5 Tribal Consultation**

Tribal consultation for the Lang Dam project began in August 2014. The McKenzie River Ranger District consulted with the Klamath Tribes, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians, and the Confederated Tribes of Warm Springs. On August 4, 2014 the Tribes received a consultation package that included information about the proposed project location, proposed actions, and the purpose and need for the project. Additionally the consultation invited the Tribes to provide any comments or concerns regarding the proposed project. One comment was received from the Warm Springs tribe expressing support of the project as long as cultural sites are protected.

**1.6 Public Involvement Efforts**

Public involvement efforts during the development of the draft EA included scoping letters and publication of the project on the Willamette National Forest Schedule of Proposed Actions website. Below is a timeline illustrating public involvement efforts for the Lang Dam project:

- February 5, 2013: Project published in the Willamette National Forest Schedule of Proposed Actions
- September 29, 2014: Scoping letter and background information mailed to members of the public, organizations, and state/federal agencies that have expressed interest in receiving information on District projects
December 5th 2016: Initiation of 30-day comment period for Draft Environmental Assessment was published in The Register Guard and a notice of opportunity to comment was mailed to members of the public, organizations, and state/federal agencies that have expressed interest in receiving information on District projects.

The scoping letter and relevant background information was mailed to approximately 150 individuals, interest groups and organizations, elected officials and other state and federal agencies. A total of eight letters were received. The initiation of comment letter and relevant background information was mailed to the same individuals as the scoping letter. A total of two letters were received. All correspondence and comments are available in the Project Record at the McKenzie River Ranger District office.

1.7 Consultation with other Agencies

United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)

Upper Willamette River Chinook Salmon and Bull Trout

Endangered Species Act (ESA) informal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) for Upper Willamette River spring Chinook salmon and Columbia River bull trout was initiated in September 2016 and anticipated to be completed by April 2017.

Northern Spotted Owl

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl was completed in the fiscal year 2015 Likely to Adversely Affect (LAA) Biological Opinion (FWS reference 01EOFW00-2014-F-0221) signed October 4, 2014.

Oregon State Historic Preservation Office

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project. In accordance with this PA, an appropriate inventory was conducted in 2013 and 2014. All known cultural sites in the Area of Potential Effect (project area) were protected by avoidance, resulting in a determination of “Historic Properties Avoided” on January 26, 2016. Documentation was provided by SHPO and copies have been retained in the Forest and District Heritage files.

1.8 Issues Derived from Public Comments

To help focus the planning efforts, the interdisciplinary team (IDT) used comments from the tribal consultation, the public and other agencies to identify issues for this project. A standardized content analysis process was conducted to analyze the letters received during the public scoping period. Content analysis was designed to extract comments from each letter received, evaluate similar comments from different or unique letters, and identify topics or issues of concern. Planning regulations direct agencies to narrow the scope of environmental analysis by concentrating on issues that are key to the proposed action and to briefly discuss other issues.

During content analysis, the Interdisciplinary Team (IDT), with involvement and approval from the Responsible Official, identified the key issues and non-key issues discussed below.
No key issues were found to develop alternatives to proposed action. See Alternatives Considered but Eliminated. Planning regulations direct agencies to narrow the scope of environmental analysis by concentrating on the issues that are truly important to the proposed action and to briefly discuss other non-key issues. Issues are usually divided into key and non-key issues. Key issues are used to generate additional action alternatives to the Proposed Action. None of the comments received were considered key issues or alternative generating issues.

Non-Key Issues
The Council on Environmental Quality (CEQ) NEPA regulations require delineation of the Non-Key Issues summarized in Table 2 Sec. 1501.7 directs us to “…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec 1506.3)…” The following is a list of reasons that identified issues as Non-Key:

- #1 - Issue is outside of the proposed action
- #2 - Issue is already decided by law, regulation, Forest Plan or other high level decision
- #3 - Issue is adequately addressed is all alternatives

Table 2 Non-Key Issues and Reasoning (note: the above numbers are used in this table under Reasoning)

<table>
<thead>
<tr>
<th>Non-Key Issues</th>
<th>Reason</th>
<th>Rational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consider that logging will not promote diversity as it will deprive stands of dead wood features that are essential to structural diversity and habitat.</td>
<td>Reason #3</td>
<td>The Action Alternative addresses down wood needs. Skips, or un-thinned areas in harvest units, will be left in stands for natural snag and down wood recruitment. Post-harvest prescribed burning will also contribute to the development of down wood. The No Action Alternative addresses natural snag and down wood development to compare and contrast snag and down wood development in the Action Alternative.</td>
</tr>
<tr>
<td>We oppose the logging of any unit requiring road construction for access.</td>
<td>Reason #3</td>
<td>There is no permanent road construction proposed for in the Lang Dam project. Approximately 2.2 miles of temporary roads will be constructed. After the timber sale and post-harvest activities are completed, the roads will be de-compacted, sub-soiled, and re-seeded to obliterate them from the landscape. In addition, existing compaction created by old harvest entry will be improved by additional treatments proposed in Units 60 and 190. See the Soils Section in Chapter 3 for further discussion.</td>
</tr>
<tr>
<td>We oppose logging in riparian reserves. This will deprive the riparian reserves of needed wood recruitment. The Forest Service needs to provide for a high level of wood recruitment throughout the riparian reserves, not just instream.</td>
<td>Reason #2 and #3</td>
<td>Careful thought and analysis was used when developing Riparian Reserve management strategies. Riparian Reserve prescriptions were developed on a unit by unit basis to meet the distinct needs of the stream habitat and surrounding vegetation. There will be no thinning of the Riparian Reserves in 4 of the 21 units. The remaining units will have 120 acres of Riparian Reserve thinning with 89 acres of skips in the Riparian Reserves. Required no-harvest buffers on streams, skips within the harvest units and artificial snag creation address some of the down wood issues at the project level scale. Thinning prescriptions for the proposed action were designed by a certified silviculturalist and the interdisciplinary team to meet</td>
</tr>
<tr>
<td>Non-Key Issues</td>
<td>Reason</td>
<td>Rational</td>
</tr>
<tr>
<td>----------------</td>
<td>--------</td>
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</tr>
<tr>
<td>Both project objectives and various resource needs. Thinning in the Riparian Reserves also adheres to the Northwest Forest Plan. See the Hydrology and Aquatic Resources Section for further discussion.</td>
<td>Reason #3</td>
<td>Approximately 26 of the 630 harvest acres in the proposed project do contain trees with ages approximately 100-117 years old. Stand Density Index (SDI) is a qualitative measure of tree competition in a stand. The SDI of this stand is 291 and stand exams have yielded over 200 trees per acre. These stands are over-stocked and not designated as Late Successional Reserve (LSR). The inclusion of these stands is aligned with the Purpose and Need of this project to actively manage stands to improve stand conditions, diversity, density and structure. See the Section 3.1, Forest and Stand Structure section for more information about stand densities.</td>
</tr>
</tbody>
</table>

**Comments from the American Forest Resource Council (AFRC)**

<p>| Reason #1 and #3 | This project will commercially thin 467 acres, this includes acres in the riparian reserve, and create 89 acres of gaps, skips, DTR's in the Adaptive Management Area. The overall objective for the AMA is to learn how to manage on an ecosystem basis in terms of both technical and social challenges, and in a manner consistent with applicable laws. The intent is to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives. The intent of the silvicultural treatments is to encourage structural complexity and biological diversity in forests and riparian areas that have been degraded by past management activities and natural events. Using prescribed fire and silvicultural approaches would provide managers with a variety of tools to promote forest health. Development of a variety of forest structural conditions including late successional forest conditions and desired riparian habitat conditions as well as provide a stable timber supply will meet the overall objective for Adaptive Management Areas. |
| Reason #2 and #3 | Harvesting is proposed on 120 of the 209 Riparian Reserves in the project area. All activities must meet the requirements of the Northwest Forest Plan including the Aquatic Conservation Strategy Objectives. |
| Reason #2 and #3 | One purpose and need of the Lang Dam project is to provide a sustainable supply of timber to support local markets. Forest Service Manual Direction (2430-2432) and Handbook 2409.18, Chapters 10-30 require that financial and economic efficiency information be made available to the decision maker prior to substantial investment of capital resources into timber sale projects. The proposed action will be economically viable. |
| All timber sales should be economically viable. Supporting local mills and local government should be the primary goal for all timber sales on federal land. |</p>
<table>
<thead>
<tr>
<th>Non-Key Issues</th>
<th>Reason</th>
<th>Rational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow flexibility in the type of harvesting systems of accomplish resource objectives.</td>
<td>Reason #1 and #2</td>
<td>As long as equipment can be shown to meet or exceed the requirements outlined in the EA analysis, it is possible for flexibility in harvesting systems. Certain restrictions, including times and seasons of operation, are necessary to meet federal laws, such as the Endangered Species Act.</td>
</tr>
<tr>
<td>Provide for flexibility in the EA that will allow an operator to make road improvements that will permit winter haul. Proper road design and layout should pose little to no negative impact on water quality or slope stability.</td>
<td>Reason #3</td>
<td>Refer to chapter 2.4 (Project Design Features included in Alternative 2, Design Features 14 and 16) for a description of when wet weather or winter haul can occur. All season haul will be permitted as conditions allow and if all maintenance and structural requirements are met to assure that activities meet Clean Water Act requirements for streams within the project area. Road maintenance will protect the existing road infrastructure, improve safety of the road, and decrease sedimentation on roads used for project implementation.</td>
</tr>
</tbody>
</table>

**Comments from the Rocky Mountain Elk Foundation**

<table>
<thead>
<tr>
<th>When obliterating or decommissioning temporary roads, consider seeding native species and planting native shrubs that produce fruit, buds and browse.</th>
<th>Reason #3</th>
<th>Native seeding of landings, temporary spurs and decommissioned roads is part of the required post-treatment prescription for the project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitate natural meadows and openings by the removal of encroaching conifers.</td>
<td>Reason #1</td>
<td>There are no natural openings or meadows in the planning area.</td>
</tr>
</tbody>
</table>
Chapter 2: Alternatives

This section describes and compares the alternatives considered for the Lang Dam project. It includes a description and map of each alternative considered. This chapter also presents the alternatives in comparative form, defining the differences between each alternative in order to provide a clear basis for choice by the decision maker.

2.1 Alternatives Considered But Eliminated

1. Timber harvest in the McLennon Mountain Inventoried Roadless Area (IRA).

The Interdisciplinary Team originally considered harvest treatments in a portion of the McLennon Mountain Inventoried Roadless Area (IRA). As a result of comments received during public scoping period, the team decided to eliminate proposed treatments in the IRA.

2. The creation of early seral forests in the purpose and need and include an analysis of age-class distribution in the document.

Creation of young early seral forests was considered during development of this project. An analysis of age distribution for the project area shows a fairly even distribution of age classes and does not reflect an outstanding need for the creation of early seral forests at this time. The assessments on the ground did show an immediate need for thinning to increase stand health and vigor and to diversify stands that are primarily single-storied and very homogenous. A detailed description of the analysis is included in Section 3.1 – Forest Stand and Structure. There will be 64 acres of gap and dominant tree release (DTR) creation scattered throughout the harvest acres to help achieve this purpose and need. The project area will be revisited in the future when the creation of regeneration forests may be more appropriate.

Two alternatives have been analyzed for this project: Alternative 1 - No-Action and Alternative 2 - Proposed Action.

2.2 Alternative 1 – No Action

Alternative 1- No-Action assesses the current management situation of the affected environment as well as the future conditions should an action not be implemented. The No-Action alternative should not be confused with a baseline. Whereas a baseline is essentially a description of the affected environment at a fixed point in time, the No-Action alternative considers what effects would occur to forest ecosystems and resources in the project area if no action is taken.

The purpose and need would not be met under Alternative 1, as no timber harvest would be implemented.

2.3 Alternative 2 – Proposed Action

The Forest Service proposes to implement Alternative 2. The proposed action was developed to fully meet the purpose and need of this project by treating 630 acres of stands. This alternative is consistent with management direction set forth in the Willamette National Forest Plan Commercial harvest in approximately 630 acres of 40-120 year old stands yielding approximately 11 million board feet of timber. Including skips and harvest, approximately 26 acres are in stands over 80 years old and 592 acres are in stands under 80 years old. Harvest treatments proposed include thinning, gap creation, dominant tree release, and skips. Table 4 provides a summary of forest age classes and treatment acres for
Alternative 2. Table 3 illustrates the proposed treatments, connected actions, and the purpose and need they address. A detailed description of proposed treatments and project activities is included in Appendix B. A detailed list of treatments for individual units is listed in Appendix E. Specific features and types of treatment and their effects to the environment are discussed in the Environmental Impacts of the Proposed Action and Alternatives section of this document.

Alternative 2 will consist of the following:

- Commercial harvest in approximately 630 acres of 40-120 year old stands yielding approximately 11 million board feet of timber. Including skips and harvest, approximately 26 acres are in stands over 80 years old and 592 acres are in stands under 80 years old. Harvest treatments proposed include thinning, gap creation, dominant tree release, and skips. Table 3 provides a summary of forest age classes and treatment acres for Alternative 2.

- Utilize harvest systems comprised of 37% skyline logging, and 63% ground-based logging.

- Utilize approximately 11.5 miles of existing roads and approximately 2.2 miles of temporary roads. Temporary roads will be obliterated after use; no new permanent (system) roads will be constructed.

- Decommission approximately .3 miles of road and store approximately 3 miles of roads to place in a hydrologically stable conditions.

- Treat approximately 532 acres of activity generated fuels using a combination of post-harvest underburning and burning of machine and hand piles.

### Table 3 Summary of Proposed Treatments and Connected Actions in Alternative 2

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Unit of Measure</th>
<th>Proposed Action</th>
<th>Purpose – Need Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timber Harvest Treatments</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinning outside Riparian Reserves</td>
<td>Acres</td>
<td>331</td>
<td>1, 2</td>
</tr>
<tr>
<td>Thinning in Riparian Reserves</td>
<td>Acres</td>
<td>120</td>
<td>3</td>
</tr>
<tr>
<td>Gaps</td>
<td>Acres</td>
<td>40</td>
<td>1, 2</td>
</tr>
<tr>
<td>Dominant Tree Release</td>
<td>Acres</td>
<td>25</td>
<td>1, 2</td>
</tr>
<tr>
<td>Skips outside Riparian Reserves</td>
<td>Acres</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Skips in Riparian Reserves</td>
<td>Acres</td>
<td>89</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Acres</td>
<td>630</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td><strong>Estimated Gross Volume</strong></td>
<td>MMBF</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

**Connected Actions**

**Post-Harvest Fuels Treatments** in Timber Harvest Units

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Unit of Measure</th>
<th>Proposed Action</th>
<th>Purpose – Need Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pile and Burn (mechanical and/or hand treatments) ²</td>
<td>Acres</td>
<td>57</td>
<td>2</td>
</tr>
<tr>
<td>Post-Harvest Underburn ³</td>
<td>Acres</td>
<td>475</td>
<td>2</td>
</tr>
</tbody>
</table>

**Harvest System**
<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Unit of Measure</th>
<th>Proposed Action</th>
<th>Purpose – Need Addressed^4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Skyline</td>
<td>Acres</td>
<td>199</td>
<td>-</td>
</tr>
<tr>
<td>Ground</td>
<td>Acres</td>
<td>333</td>
<td>-</td>
</tr>
</tbody>
</table>

**Transportation**

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Unit of Measure</th>
<th>Proposed Action</th>
<th>Purpose – Need Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Road Construction</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Temporary Road Construction</td>
<td>Miles</td>
<td>2.2</td>
<td>-</td>
</tr>
<tr>
<td>Roads Maintained</td>
<td>Miles</td>
<td>11.5</td>
<td>-</td>
</tr>
<tr>
<td>Road Decommissioning</td>
<td>Miles</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>Road Storage</td>
<td>Miles</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Stream Culvert Replacement</td>
<td>-</td>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

**Post-Harvest Planting**

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Unit of Measure</th>
<th>Proposed Action</th>
<th>Purpose – Need Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting in Gaps</td>
<td>Acres</td>
<td>~17</td>
<td>3</td>
</tr>
<tr>
<td>Natural Regeneration in Gaps</td>
<td>Acres</td>
<td>~22</td>
<td>3</td>
</tr>
</tbody>
</table>

^1: Post-harvest fuels treatments methods may change depending on feasibility and funding.

^2: Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device).

^3: These acres are possible underburn acres due to tree size and location; not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

^4: 1- Provide a sustainable supply of timber products; 2- Actively manage stands to improve stand conditions, diversity, density, and/or structure; and 3-Manage Riparian Reserves to control stocking and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Table 4 Summary of Forest Age Classes and Treatment Acres in Alternative 2

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>&lt;80 years old</th>
<th>80-120 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Harvest Units (including skips)</td>
<td>592</td>
<td>38</td>
</tr>
<tr>
<td>Acres Proposed for Harvest</td>
<td>489</td>
<td>26</td>
</tr>
</tbody>
</table>
Figure 4 Map of Lang Dam Project Area and Proposed Units in Alternative 2
Treatments Proposed in Riparian Reserves for Alternative 2

The treatments proposed in Riparian Reserves for Alternative 2 are described and displayed below in Table 4. All units were surveyed by fisheries, hydrology, wildlife, cultural and botany specialists. Each unit was gridded to capture streams, springs, wetlands and other waterbodies that may not be mapped on the GIS layer. Based on stream and riparian characteristics, a recommendation was made for no-treatment buffers and other potential treatments (e.g., down wood creation) for each waterbody. After surveys were conducted individually, specialists met as a team to discuss findings and develop an integrated Riparian Reserve management plan for each unit. Due to differences in stand conditions, unit-specific management prescriptions are grouped into three treatment types:

**Full Stream Influence Zone Protection:** The stream influence zone is the extent of a stream’s riparian area that directly influences stream function and is typically defined as one site potential tree height (180 feet in the Headwaters McKenzie River Watershed). The portions of these Riparian Reserves in the stream influence zone are currently functioning and meeting Aquatic Conservation Strategy (ACS) Objectives. Therefore, no management in one site potential tree height (180 feet) is recommended. Thinning in the upland portion of Riparian Reserves (180-360 feet) of ponds and fish-bearing streams, however, is recommended to improve vegetation species diversity and late forest structure for wildlife.

**Thinning for Vegetation Diversity:** Due to replanting at stocking levels much higher than natural after previous clear cut harvest and dense stocking in fire regenerated stands, portions of the Riparian Reserves within the project area are overstocked, conifer-dominant, lacking structural and species diversity, and not currently meeting ACS Objectives. Thinning was recommended to improve vegetation conditions outside of the primary shade zone on perennial waterbodies to protect water quality and outside of the primary wood recruitment zone (discussed in detail in Section 3.12 Water Quality and Aquatic Resources) to protect potential in-stream wood inputs. Thinning will accelerate development of large wood and late forest stand structure and increase species diversity, which will improve the ability of Riparian Reserves to provide adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian-dependent wildlife.

**Dead and Down Wood Creation:** Due to replanting at stocking levels much higher than natural after previous clear cut harvest and dense stocking in fire regenerated stands, portions of the Riparian Reserves within the project area are overstocked, conifer-dominant, lacking structural and species diversity, and not currently meeting ACS Objectives. Near perennial waterbodies, thinning was recommended to improve vegetation conditions outside of the primary shade zone to protect water quality and outside of the primary wood recruitment zone to protect potential in-stream wood inputs. On intermittent streams and springs, thinning was recommended within the primary wood recruitment zone to improve vegetation diversity but dead and down wood objectives will be met by falling and leaving at least eight trees per acre and creating two snags per acre.

For more information on how these management prescriptions comply with ACS Objectives, see Appendix C.
<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Stream Class</th>
<th>Riparian Reserve Boundary&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Thinning Treatment</th>
<th>Ground-Based Equipment Buffer&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Fuels Treatment Buffer&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Dead and Down Wood Habitat Creation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Stream Influence Zone Protection:</strong> No harvest within one site potential tree height of waterbody. Thinning in upland portion to improve vegetation diversity for wildlife.</td>
<td>20, 30, 60, 80, 90, 120,</td>
<td>Fish-bearing streams (Class 1 &amp; 2)</td>
<td>360 feet</td>
<td>No Harvest within 180’</td>
<td>180 feet</td>
<td>No fuels treatment of underburn within 180’</td>
<td>From 0-360 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial Non Fish-bearing Streams (Class 3)</td>
<td>180 feet</td>
<td>No Harvest within 180’</td>
<td>180 feet</td>
<td>No fuels treatment of underburn within 180’</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent Streams (Class 4)</td>
<td>180 feet</td>
<td>No Harvest within 180’</td>
<td>180 feet</td>
<td>No fuels treatment of underburn within 180’</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ponds</td>
<td>360 feet</td>
<td>No Harvest within 180’</td>
<td>180 feet</td>
<td>No fuels treatment of underburn within 180’</td>
<td>From 0-360 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wetlands and Springs</td>
<td>180 feet</td>
<td>No Harvest within 180’</td>
<td>180 feet</td>
<td>No fuels treatment of underburn within 180’</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Thinning for Vegetation Diversity</strong> Thinning to improve vegetation diversity for wildlife while protecting shade and wood recruitment zones.</td>
<td>40, 60, 70, 80, 90, 100, 110, 120, 150, 160, 170, 180</td>
<td>Fish-bearing streams (Class 1 &amp; 2)</td>
<td>360 feet</td>
<td>Unit 40 no harvest within 180 feet; &gt;80% canopy closure from 180’-360’</td>
<td>180 feet</td>
<td>No fuels treatment of underburn within 180’</td>
<td>From 0-360 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perennial Non Fish-bearing Streams (Class 3)</td>
<td>180 feet</td>
<td>Unit 170; no harvest within 60’; &gt;50% canopy closure from 60’-180’. <strong>Unit 180</strong>, no harvest within 60’; &gt;40% canopy closure from 60’-180’</td>
<td>110 feet</td>
<td>No fuels treatment of underburn within 60’</td>
<td>From 0-180 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent Streams (Class 4)</td>
<td>180 feet</td>
<td>Units 20, 50, 70, 80, 100, 130, 150, 160, 170, 180</td>
<td>110 feet</td>
<td>No fuels treatment of underburn within 60’</td>
<td>From 0-180 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
</tbody>
</table>

---

*Table 5: Treatments Proposed in Riparian Reserves with Alternative 2*
<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Stream Class</th>
<th>Riparian Reserve Boundary&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Thinning Treatment</th>
<th>Ground-Based Equipment Buffer&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Fuels Treatment Buffer&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Dead and Down Wood Habitat Creation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponds</td>
<td></td>
<td></td>
<td></td>
<td>180, 190; no harvest within 60'; &gt; 40% canopy closure from 60'-180'</td>
<td></td>
<td></td>
<td>8 TPA, create 2 snags/acre</td>
</tr>
<tr>
<td></td>
<td>Units 80, 90, 100, 150, 160, 180; no harvest within 30'; &gt; 30% canopy closure from 30'-180'</td>
<td></td>
<td></td>
<td>90 feet</td>
<td>No fuels treatment of underburn within 60'</td>
<td></td>
<td>From 0-180 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
<tr>
<td>Wetlands and Springs</td>
<td>180 feet</td>
<td></td>
<td>N/A</td>
<td>110 feet</td>
<td>No fuels treatment of underburn within 60'</td>
<td></td>
<td>From 0-180 feet: fall and leave at least 8 TPA, create 2 snags/acre</td>
</tr>
</tbody>
</table>

<sup>1</sup> One site potential tree height is 180' as identified in the Upper McKenzie Watershed Analysis.

<sup>2</sup> No ground-based equipment within 50 feet of no-harvest buffer. For units with 180' no-harvest buffer, the equipment buffer is the same as the no harvest buffer.

<sup>3</sup> In addition to fuels treatment buffer, there will be no fireline construction within Riparian Reserves.
2.4 Project Design Features included in Alternative 2

The design features in Table 6 were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices.

Table 6 Design Features Included in Alternative 2

<table>
<thead>
<tr>
<th>Objective</th>
<th>Design Feature</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest and Stand Structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Meet stocking requirements as identified in the National Forest Management Act (NFMA) planting will be used in addition to natural regeneration to ensure full stocking</td>
<td>Plant at 15’ x 15’ spacing, or about 194 trees per acre. The species mix should contain Douglas-fir, western white pine, sugar pine, and western red cedar. Stratify the mix with Douglas-fir quantities higher in the lower elevations and western red cedar higher in the moister sites. Sugar pine and western red cedar will vary with sugar pine more prominent in warmer drier sites.</td>
</tr>
<tr>
<td>2</td>
<td>Maintain structural diversity</td>
<td>During presale, protect identified trees with raptor nests and those with unusual structure such as broken tops.</td>
</tr>
<tr>
<td>3</td>
<td>Minimize damage during harvest.</td>
<td>Protect residual stand and reserve trees to the best extent possible from treatment damage.</td>
</tr>
<tr>
<td><strong>Fire and Fuels</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Reduce post-harvest fuels</td>
<td>Follow Forest Plan Standards and Guidelines for acceptable fuel loading (FW-252).</td>
</tr>
<tr>
<td>5</td>
<td>Maintain effective ground cover and downed wood following fuels treatments</td>
<td>Follow Forest Plan Standards and Guidelines for prescribed burning (FW-081 and FW-253).</td>
</tr>
<tr>
<td>6</td>
<td>Identify management objectives from the Forest Plan related to fuels, prescription parameters, contingency, safety hazards and mitigations, and public notification prior to and during implementation.</td>
<td>Use the nationally approved Interagency Prescribed Fire Burn Plan for any activity involving prescribed fire.</td>
</tr>
<tr>
<td>7</td>
<td>Maintain forest structure and wildlife objectives</td>
<td>Follow burn prescription parameters so overstory mortality should be 10 percent or less.</td>
</tr>
<tr>
<td>8</td>
<td>Maintain forest structure and wildlife objectives</td>
<td>Except machine piles, or when within 200’ of a road or private property, up to two unburned slash piles per acre should be left for wildlife habitat. The average size of piles will be less than 6 feet tall and between 5 and 7 feet in diameter.</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Soils, Watershed and Fisheries</td>
<td>Use previously compacted areas whenever possible prior to disturbing new areas. Examples of previously compacted areas include: existing landings, old primary skid roads, legacy haul roads, and/or tractor fire lines.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>Minimize erosion and sedimentation</td>
<td>Construction or maintenance of roads will not be done when soils are saturated or run-off occurs. A stable fill will be constructed across all streams when crossed by new temporary roads and will be removed following operations. Approximately 2.2 miles of temporary roads will need to be constructed for this project. This will also require the construction of three temporary stream crossings. These temporary crossings will be extensions of the 1900399 road.</td>
<td>Units 70, 80, 90, 100, and 110.</td>
</tr>
<tr>
<td>Minimize erosion and sedimentation</td>
<td>Native surfaced roads will be restricted from hauling when soils are saturated or run-off occurs.</td>
<td>Entire Project Area</td>
</tr>
<tr>
<td>Minimize potential impacts to fish.</td>
<td>Best Management Practices (BMP’s), including placement of sediment barriers, provision of flow bypass, and other applicable measures, will be included in project design as necessary to control off-site movement of sediment.</td>
<td>Entire Project Area</td>
</tr>
<tr>
<td>Minimize potential impacts to fish.</td>
<td>Any project activity, such as culvert replacement, that must occur in fish-bearing streams will comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions so that the in-stream work will occur July 1st – August 15th. If a waiver to these dates is required, the district fisheries biologist will need to review the proposal and seek a waiver from ODFW, NMFS, and the USFWS if it is warranted.</td>
<td>Entire Project Area</td>
</tr>
<tr>
<td>Prevent sedimentation</td>
<td>All haul roads will be maintained in stable condition. Wet weather haul will be monitored by the Timber Sale Administrator, the District Road Manager, Fisheries Biologist, and/or Hydrologist. When necessary, haul may be suspended during rainfall to prevent off-site movement of sediment into drainage courses. Haul may also occur when the road surface is either covered with a relatively continuous snow pack or is frozen. Dust abatement of road surfaces will be used if roads become excessively dusty during the summer as determined by TSA.</td>
<td>Entire Project Area</td>
</tr>
<tr>
<td>Reduce contamination to aquatic areas</td>
<td>If lignin sulfate is used for dust abatement, one application will occur during the dry season (July/August/September) at a dilution rate of 50 percent lignin sulfate and 50 percent water. Lignosulfonate will remain on the road surface and not go over road edge. During blading, small berms could be created or wattles used at stream</td>
<td>Entire Project Area</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>16</td>
<td>Crossings to assist with keeping palliatives on the road surface. A 1 foot no-application buffer on the edge of gravel will be used if road width allows. Lignosulfonate will not be applied when raining and when possible, a 3 day forecast of clear weather will follow application.</td>
<td>Entire Project Area</td>
</tr>
<tr>
<td>17</td>
<td>Ground-based equipment used for yarding, processing, fuel treatment, or other project activities will operate only when soils are relatively dry where water is not pooling. Stop work if trenching, or rutting detected. Operations will be suspended before rainfall or precipitation results in off-site movement of sediment into drainage courses.</td>
<td>Ground-based portions of harvest units</td>
</tr>
<tr>
<td></td>
<td>Snow/frozen soil may be operated on in the following conditions:</td>
<td>Ground-based portions of harvest units</td>
</tr>
<tr>
<td></td>
<td>1. 0 inches of frozen soil–Need at least 18 inches of settled snow</td>
<td>Ground-based portions of harvest units</td>
</tr>
<tr>
<td></td>
<td>2. 4 inches of frozen soil–Need at least 9 inches of settled snow</td>
<td>Ground-based portions of harvest units</td>
</tr>
<tr>
<td></td>
<td>3. 6 inches of frozen soil–No snow cover necessary</td>
<td>Ground-based portions of harvest units</td>
</tr>
<tr>
<td>18</td>
<td>Ground-based equipment and skid roads should not be permitted within 50 feet of all streams (fish-bearing to intermittent). These widths are required unless a change is approved by the district hydrologist or district fish biologist.</td>
<td>Ground based portions of harvest units</td>
</tr>
<tr>
<td>19</td>
<td>Full suspension will be required when yarding over perennial stream channels. Full suspension is preferred over intermittent streams (class 4). However, where full suspension is not obtainable, partial suspension will be required, and yarding will be limited to when the stream is dry. Bump logs to protect the stream channel will be utilized as appropriate</td>
<td>All harvest units</td>
</tr>
<tr>
<td>20</td>
<td>Where cable yarding requires corridors through a riparian area, corridors will be laid out to result in the least number of trees cut. Trees located in no-harvest riparian buffers that must be cut to facilitate yarding corridors will be felled towards the channel (if feasible) and left on site.</td>
<td>Cable yarding portions of harvest units</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>21  Provide adequate drainage and avoid unnecessary soil disturbance</td>
<td>All skid trails and landings should be water-barred to provide adequate drainage. Water bar location should occur where local terrain facilitates effective drainage of the skid trail or landing while avoiding unnecessary soil disturbance. An example will be to construct water bars every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be keyed-in to the cut bank and have a clear outlet on the downhill side. Where available in concentrations, slash can be scattered on skyline corridors, skid trails and landings.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>22  Reduce compaction</td>
<td>Primary skid trails will be sub-soiled to a depth of 3-6 inches at the completion of project activities. Primary skid trails in gaps, as well as all temporary roads and landings should be sub-soiled to a depth of 18-24 inches or to bedrock.</td>
<td>All ground based units, All temporary roads</td>
</tr>
<tr>
<td>23  Prevent sedimentation</td>
<td>All areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance will be seeded with native grasses, or weed free mulch unless agreed to otherwise.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>24  Prevent sedimentation</td>
<td>Sub-soiling, scarification, and water barring may be limited or suspended on feller buncher/processor/forwarder roads when the skid road is sufficiently covered with slash to form an effective mat to minimize compaction and erosion.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>25  Reduce soil disturbance and the risk of erosion in Riparian Reserves</td>
<td>Firelines for underburning will not be constructed in Riparian Reserves. Fire will only be allowed to back into the no fuels treatment buffers identified in the Riparian Reserve treatments tables.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>26  Reestablish hydrologic and geologic processes</td>
<td>Temporary roads will be made hydrologically stable and decommissioned after completion of project activities. Decommissioning of temporary roads may include all of the following: removal of any added rock, blocking the entrance, removal of culverts, out-sloping the road surface, pulling back displaced material onto the road way, installation of water bars, re-vegetation of the road prism, and sub-soiling of compacted surfaces.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>27  Protect key riparian features and integrity</td>
<td>All existing down wood will be retained in Riparian Reserves to maintain aquatic objectives.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>28  Ensure sufficient water flow in streams</td>
<td>Water sources used by project operations will be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality. Water used for fire treatments and dust abatement will be drafted from various water sources outside of Listed Fish Habitat. At all drafting locations, 90 percent of stream flow will be maintained to reduce risk to aquatic species and water quality.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>29 Protect and enhance riparian features</td>
<td>Riparian Reserve treatments and buffers (see Table 4)</td>
<td>All harvest</td>
</tr>
<tr>
<td>30 Provide downed wood and emulate residual material seen following wildfire</td>
<td>All existing down logs regardless of decay class will be retained on site</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>31 Provide downed wood and emulate material seen following a natural disturbance</td>
<td>Up to 3 trees per acre of the residual trees may be cut to enhance downed wood in decay classes 1 and 2. Tree diameters will be of the average size merchantable trees in the unit. Full tree lengths are preferred. TSOs will work with purchasers to minimize disturbance of existing down wood See Table 7 for unit specific recommendations.</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>32 Provide a visual screen along heavily travelled roads to reduce impacts to elk, deer and other wildlife</td>
<td>Where operable, limit skid trails entering roads and skyline corridors to a spacing of no less than 200 feet along roads. In 50 feet, directionally fall away from the road to protect the non-merchantable trees and brushy hiding cover.</td>
<td>Units adjacent to Forest Service roads 1900399 (Units 100, 110, 120, 130), 1900408 (Units 20, 30, 40, 50, 140), 1900410 (Unit 151), 1900411 (Units 151, 160, 170)</td>
</tr>
<tr>
<td>33 Maintain high quality early seral habitat conditions</td>
<td>Minimize planting of created gaps over 0.2 miles from a road.</td>
<td>All Thinning Units</td>
</tr>
<tr>
<td>34 Enhance snag levels in the landscape</td>
<td>Up to 4 trees per acre, of the average size in the unit, may be used for snag creation after harvest with site specific recommendation by the district wildlife biologist. See Table 6 for unit specific recommendations.</td>
<td>All Thinning Units</td>
</tr>
<tr>
<td>35 Provide snags and emulate effects of mortality following fire and to provide downed wood in the landscape</td>
<td>Retain existing snags where possible, except those needed to be fallen for safety or operational purposes. Those cut during operations should remain as down wood. Danger trees felled during operations will be left on site for large woody material.</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>36 Reduce impacts to bats</td>
<td>During layout, look for snags and trees that have cavities or sloughing bark that could be used as natal or roost sites by bats. If these are found, retain them, where possible, by incorporating them into skips or leave trees.</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>37 Reduce disturbance to nesting birds and during popular hunting periods</td>
<td>Snag creation activities will have seasonal restrictions applied as needed with a separate Biological Evaluation completed shortly before implementation. Implementation will not occur during the Cascade Elk Rifle season.</td>
<td>All harvest units with snag and/or large down wood placement and/or enhancement See Table 7 &amp; Table 8.</td>
</tr>
<tr>
<td>38 Reduce disturbance to nesting birds</td>
<td>When possible, conduct prescribed burning during the fall when conditions allow.</td>
<td>Units with underburn</td>
</tr>
<tr>
<td>39 Reduce disturbance during nesting season of cavity nesters</td>
<td>Conduct roadside hazard felling outside the critical seasonal restriction period for cavity nesters which is from April 1-June 30. This may be waived on a</td>
<td>All roadside hazard tree maintenance</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>Minimize effects to species of concern</td>
<td>If previously undocumented goshawk or other raptor nests are found during layout or sale administration, project modifications including contract modifications to remove acreage will be made as needed to protect the nest site and reduce harm to birds.</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>Maintain Johnson’s Hairstreak (butterfly) habitat</td>
<td>Mark for retention any identified western hemlock trees which contain dwarf mistletoe</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>Protect habitat for the Crater Lake Tightcoil</td>
<td>Prevent ground/habitat disturbance within 10 meters (~30 feet) of perennially wet areas during project activities.</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>Minimize potential conflict between hunters and contractors</td>
<td>A seasonal operating restriction will restrict all operations behind closed gates during the Cascade Elk Rifle season, which is typically the third week of October. All non-emergency vehicle traffic will be restricted on gated closed roads beginning the Friday before that week through the end of the following Friday.</td>
<td>All Harvest Units</td>
</tr>
<tr>
<td>Protect any discovered Threatened, Endangered, or Sensitive (TES) species</td>
<td>If TES wildlife species are found in future field work or during activities associated with this project, and potential for adverse effects exists, project modifications will be pursued. All contracts will include provisions to provide required protection measures in the event of TES species discovery.</td>
<td>All Harvest Units</td>
</tr>
</tbody>
</table>

**Botany**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Design Feature</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the introduction/spread of weeds</td>
<td>All road construction and logging equipment shall be cleaned prior to working in the area.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>Reduce the introduction/spread of weeds</td>
<td>Equipment should work in non-infested areas and then move to infested areas (USFS will provide map). If the purchaser elects to move from an infested area to a non-infested area, equipment shall be washed prior to leaving the infested area.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>Reduce the introduction/spread of weeds</td>
<td>Clean fill (soil or rock free of slash and debris) will be used for construction of temporary roads. Sources of rock and fill material needs to be free of invasive plants. Rock quarries that may be used will be surveyed for invasive plants prior to use. If invasive plants are found, they will be treated as necessary prior to use.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>Reduce the introduction/spread of weeds</td>
<td>Gaps will be placed to avoid infested areas. Botany will work with pre-sale during project implementation.</td>
<td>All harvest units with gap creation</td>
</tr>
<tr>
<td>Reduce the introduction of weeds</td>
<td>Use weed-free rock for all road construction and maintenance</td>
<td>Entire project area</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>50 Reduce area for weeds to germinate</td>
<td>Minimize soil disturbance (minimize fireline construction, reuse old skid roads) to meet project objectives.</td>
<td>All harvest units</td>
</tr>
<tr>
<td>51 Reduce the introduction of weeds</td>
<td>Disturbed areas (culverts, road shoulders, closed/obliterated roads, landings, skid trails) should be re-vegetated with weed free native seed to compete with invasive plants as soon as possible. Weed free mulch will be used if necessary. Monitor sites and reseed or replant as necessary.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>52 Reduce the introduction of weeds</td>
<td>Roads to be closed or decommissioned will be treated for invasive plants prior to closing.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>53 Protect known special habitats</td>
<td>Buffers identified in the Botany and Invasive Plants Section 3.9 will be implemented. Presale will work with the district botanist.</td>
<td>20, 30, 60, 70, 80, 90, 100, 110, 120, 150, 160, 170, 180</td>
</tr>
<tr>
<td>54 Reduce the potential for spread of invasive plants.</td>
<td>One or a combination of Integrated Pest Management practices (i.e. manual, mechanical, chemical, mulch) will be used to treat invasive plant species found in the project area. Existing infestations should be treated prior to project implementation to minimize seed spread.</td>
<td>All harvest units</td>
</tr>
</tbody>
</table>

**Roads**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Design Feature</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 Protect against sediment</td>
<td>Best Management Practices (BMPs), including placement of sediment barriers, provision of flow bypass, and other applicable measures, will be included as necessary to control off-site movement of sediment.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>56 Protect against sediment</td>
<td>For any perennial stream crossing culvert replacement, a specific dewatering plan shall be included with the contract design provisions.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>57 Protect against sediment</td>
<td>All road reopening, reconstruction and temporary road building will occur when soils are relatively dry to avoid potential surface erosion of exposed soil.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>58 Protect against sediment</td>
<td>All temporary roads shall be made hydrologically stable if not being used for extended periods of wet weather.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>59 Protect against sediment</td>
<td>Apply rock surfacing to all native surfaced roads prior to wet season which is identified as between November 1 and May 31. Aggregate depth on temporary roads should not exceed 4 inches. Temporary spurs that have had rock applied shall be subsoiled to a depth of 20 inches upon completion of project.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>60 Protect against sediment</td>
<td>On segments of decommissioned roads in between fill removals, either build waterbars to divert surface drainage or de-compact the road surface to a depth of 18-24&quot; to ensure infiltration of surface runoff.</td>
<td>Entire project area</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>61</strong> Protect road infrastructure</td>
<td>All required road maintenance will be completed prior to project implementation without an agreement signed by the contracting officer.</td>
<td>Entire project area</td>
</tr>
<tr>
<td><strong>62</strong> Protect road infrastructure</td>
<td>At the completion of harvest and associated activities, reopened roads shall be closed (stored) and new temporary roads shall be decommissioned. Closed roads and decommissioned roads shall be placed in a hydrologically stable condition and closed to vehicle travel to reduce potential for surface erosion and sedimentation.</td>
<td>Entire project area</td>
</tr>
<tr>
<td><strong>Heritage Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>63</strong> Protect previously unidentified heritage resources</td>
<td>Project activities planned outside of the area defined in the heritage resource inventory schema must be coordinated with the Zone Archaeologist prior to initiation.</td>
<td>Entire project area</td>
</tr>
<tr>
<td><strong>64</strong> Protect previously unidentified heritage resources</td>
<td>If cultural resources are encountered during the course of this project, earth-disturbing activities in the vicinity of the find must be suspended, in accordance with federal regulations, and the Zone Archaeologist notified to evaluate the discovery and recommend subsequent courses of action. This action will be included in all project contracts.</td>
<td>Entire project area</td>
</tr>
<tr>
<td><strong>65</strong> Protect previously unidentified heritage resources</td>
<td>Changes to current unit configuration will require coordination with the Zone Archaeologist to protect known or unknown heritage resources.</td>
<td>All harvest units</td>
</tr>
<tr>
<td><strong>66</strong> Protect previously identified heritage resources</td>
<td>All National Register of Historic Places eligible and potentially eligible sites must be avoided during all project activities. Presale crew(s), road engineer(s), and the FMO/AFMO must coordinate with the Zone Archaeologist to ensure protection of the known cultural sites: 06180100747</td>
<td>See: Zone Archaeologist</td>
</tr>
<tr>
<td><strong>Scenic Quality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>67</strong> Minimize visual impacts</td>
<td>Low or flush cut stumps at an angle facing away within 100ft. of trails and recreation sites. Tree marking on trees within 100ft. of trails and recreation sites will be on the side of trees facing away from these recreation assets. Timber sale boundary markers will be removed within 100ft. of trails and recreation sites such as parking areas and trail heads after harvest activities have concluded.</td>
<td>Units 190, and 220.</td>
</tr>
<tr>
<td><strong>Recreation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>68</strong> Protect Trail</td>
<td>Recreation specialist will identify anchor trees that are integral to trail stability and mark these as leave trees adjacent to trails.</td>
<td>Units 190, 220 adjacent to trails 3309, 3321 and 3506</td>
</tr>
<tr>
<td><strong>69</strong> Inform the Public</td>
<td>Postings will be provided to recreation specialists as soon as possible prior to harvest activity.</td>
<td>Units 190, 220 adjacent to trails 3309, 3321 and 3506</td>
</tr>
<tr>
<td>Objective</td>
<td>Design Feature</td>
<td>Location</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>70 Maintain Public Access</td>
<td>Trails that will be affected by harvest activity will be open to public use after 5PM (1700hrs) on weekdays and will remain accessible at all times on weekends. During the months of August and September trails will remain open to public use at all times. No haul is allowed on weekends.</td>
<td>All trails affected by harvest activity</td>
</tr>
<tr>
<td>71 Protect Trail</td>
<td>Integrate recreation specialist during layout phase to mark leave trees along trail to maximize canopy cover over trail and minimize sunlight penetration into trail corridor. This will help reduce the amount of seasonal vegetation growth and associated maintenance to keep trails clear.</td>
<td>Units 190, 220 adjacent to trails 3309, 3321 and 3506</td>
</tr>
<tr>
<td>72 Protect Trail</td>
<td>Gaps upslope of trails will be placed at least 200 feet away from trails. A Recreation specialist will be integrated into design and layout to determine best location for gaps downslope of trails.</td>
<td>Units 190, 220 adjacent to trails 3309, 3321 and 3506</td>
</tr>
<tr>
<td>73 Protect Trail</td>
<td>One end log suspension will be used to reduce impact to trail tread for skidding that takes place over trails. Skidding corridors will be at least 150ft apart.</td>
<td>All trails affected by harvest activity</td>
</tr>
</tbody>
</table>

### Air Quality

<table>
<thead>
<tr>
<th>Objective</th>
<th>Design Feature</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>74 Monitor and control air quality in communities and Class 1 Airsheds</td>
<td>Follow Oregon Smoke Management Plan and Forest Plan Standard and Guides</td>
<td>All harvest units</td>
</tr>
<tr>
<td>75 Approve burning of units/piles given current fuels and weather conditions and monitor smoke during prescribed burn/pile burn</td>
<td>Survey fuels for estimate of particulate matter and obtain approval from ODF Smoke Management Forecaster.</td>
<td>All harvest units</td>
</tr>
</tbody>
</table>

### Transmission Lines

<table>
<thead>
<tr>
<th>Objective</th>
<th>Design Feature</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>76 Protect improvements of cooperators</td>
<td>Project activities in the vicinity of transmission lines and their access facilities will be coordinated with the BPA.</td>
<td>Entire project area</td>
</tr>
</tbody>
</table>

1 Discretionary design features that are funding-dependent
2.5 Mitigation and Enhancement Included in Alternative 2

Table 7 Wildlife Tree Mitigation and Enhancement Recommendations Included in Alternative 2.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Snag Creation per acre and Priority</th>
<th>Unit</th>
<th>Snag Creation per acre and Priority</th>
<th>Unit</th>
<th>Snag Creation per acre and Priority</th>
<th>Unit</th>
<th>Snag Creation per acre and Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>2/moderate</td>
<td>80</td>
<td>2.5/high</td>
<td>140</td>
<td>1/low</td>
<td>190</td>
<td>None</td>
</tr>
<tr>
<td>30</td>
<td>4/high</td>
<td>90</td>
<td>1/low</td>
<td>150</td>
<td>None</td>
<td>220</td>
<td>3/high*</td>
</tr>
<tr>
<td>40</td>
<td>1/low</td>
<td>100</td>
<td>1/low</td>
<td>151</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>2.5/high</td>
<td>110</td>
<td>2.5/high</td>
<td>160</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>2.5/high</td>
<td>120</td>
<td>2.5/high</td>
<td>170</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>1/low</td>
<td>130</td>
<td>2.5/high</td>
<td>180</td>
<td>2/moderate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Mitigation (will occur). Wildlife Tree Mitigation in units other than 220 is optional and may occur if funding is available, considering the priority shown. Additional Wildlife Tree Mitigation will occur in 120 acres of riparian reserves (Table 6).

Tree mitigation and enhancement techniques may include topping, girdling and/or inoculation, Table 7 also includes mitigation measures from recommended Riparian Reserve thinning that includes snag creation to benefit wildlife (also shown in Table 6). Snag creation will take place as a priority mitigation measure in Class 3 and 4 riparian reserves as well as wetland and spring Riparian Reserves.

Table 8 Down Wood Enhancement Recommendations Included in Alternative 2

<table>
<thead>
<tr>
<th>Unit</th>
<th>Recommended trees per acre cut to enhance large down wood</th>
<th>Unit</th>
<th>Recommended trees per acre cut to enhance large down wood</th>
<th>Unit</th>
<th>Recommended trees per acre cut to enhance large down wood</th>
<th>Unit</th>
<th>Recommended trees per acre cut to enhance large down wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1/low</td>
<td>80</td>
<td>2/low</td>
<td>140</td>
<td>1/low</td>
<td>190</td>
<td>None</td>
</tr>
<tr>
<td>30</td>
<td>3/low</td>
<td>90</td>
<td>1/low</td>
<td>150</td>
<td>None</td>
<td>220</td>
<td>None</td>
</tr>
<tr>
<td>40</td>
<td>None</td>
<td>100</td>
<td>1/low</td>
<td>151</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>2/moderate</td>
<td>110</td>
<td>1/low</td>
<td>160</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>2/moderate</td>
<td>120</td>
<td>1/low</td>
<td>170</td>
<td>2/moderate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>1/low</td>
<td>130</td>
<td>2/moderate</td>
<td>180</td>
<td>1/low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.6 Monitoring Included Under Alternative 2

Operations: Contract administrators will monitor treatments during implementation to ensure contractors are in compliance with their contract. Contract elements monitored will include harvest specifications, bole damage to residual trees, down wood and snag retention, skid trail spacing and use of designated skid trails.

Fuels Treatments: McKenzie River District fire and fuels personnel will monitor fuel loading prior to and post application of fuels treatments. Fuels treatment results will offer data to use in the future.

Road Management: McKenzie River Ranger district engineering personnel will monitor road management through contract administration and routine road maintenance inspections.

and consistent documentation of the use and effectiveness of the practices. Post-implementation best management practices monitoring may include review of aquatic management zones, erosion prevention and control measures, cable and ground-based yarding operation effects, and site treatment.

**Forest Plan Implementation Monitoring**: The Forest Supervisor’s Staff performs annual project monitoring at each Ranger District and compiles the results in the yearly Forest Monitoring Report. Implementation of treatments from this project will be subject to Forest Plan Implementation monitoring. Other implementation monitoring elements may include temporary road decommissioning, snag and large down wood abundance, and any seeding or planting of vegetation.

**Reforestation**: Ensure stand is sufficiently stocked within five years. Forest Service Manual directs us to conduct first and third year stocking surveys to determine if the site can be certified.

**Dead Wood Habitat Monitoring**: McKenzie River Ranger District wildlife personnel will monitor snag and large down wood habitat levels in units prior to wildlife tree and down wood enhancement activities and after prescribed burning, if applicable. This will determine existing habitat levels and compare those with the amounts needed for mitigation and enhancement activities. Monitoring may also be conducted after underburning to evaluate the level of tree mortality and snag creation from fire.

### 2.7 Comparison of Alternatives

Table 9 summarizes and compares treatments and connected actions that will occur under each alternative.

#### Table 9 Comparison of Alternatives

<table>
<thead>
<tr>
<th>Proposed Activity</th>
<th>Unit of Measure</th>
<th>Alternative 1</th>
<th>Purpose – Need Addressed&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Alternative 2</th>
<th>Purpose – Need Addressed&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timber Harvest Treatments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinning outside Riparian Reserves</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>331</td>
<td>1, 2</td>
</tr>
<tr>
<td>Thinning in Riparian Reserves</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>120</td>
<td>2, 3</td>
</tr>
<tr>
<td>Gaps</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>40</td>
<td>1, 2</td>
</tr>
<tr>
<td>Dominant Tree Release</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>25</td>
<td>1, 2</td>
</tr>
<tr>
<td>Skips outside Riparian Reserves</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Skips in Riparian Reserves</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>89</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>630</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td><strong>Estimated Volume</strong></td>
<td>MMBF</td>
<td>0</td>
<td>-</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td><strong>Connected Actions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Post-Harvest Fuels Treatments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pile and Burn (mechanical and/or hand treatments&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>57</td>
<td>2</td>
</tr>
<tr>
<td>Post-Harvest Underburn&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>475</td>
<td>2</td>
</tr>
<tr>
<td>Proposed Activity</td>
<td>Unit of Measure</td>
<td>Alternative 1</td>
<td>Purpose – Need Addressed&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Alternative 2</td>
<td>Purpose – Need Addressed&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------</td>
<td>---------------</td>
<td>--------------------------------------</td>
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<tr>
<td><strong>Harvest System</strong></td>
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<td></td>
</tr>
<tr>
<td>Helicopter</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Skyline</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>199</td>
<td>-</td>
</tr>
<tr>
<td>Ground</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>333</td>
<td>-</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Road Construction</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Temporary Road Construction</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
<td>2.2</td>
<td>-</td>
</tr>
<tr>
<td>Roads Maintained</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
<td>11.5</td>
<td>-</td>
</tr>
<tr>
<td>Road Decommissioning</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>Road Storage</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Stream Culvert Replacement</td>
<td>Miles</td>
<td>0</td>
<td>-</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td><strong>Post-Harvest Planting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting in Gaps</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>~17</td>
<td>3</td>
</tr>
<tr>
<td>Natural Regeneration in Gaps</td>
<td>Acres</td>
<td>0</td>
<td>-</td>
<td>~22</td>
<td>3</td>
</tr>
</tbody>
</table>

<sup>1</sup> Post-harvest fuels treatments methods may change depending on feasibility and funding. Post-harvest fuels treatments will occur in timber harvest units; therefore the acreage of post-harvest fuels treatments are not included in the total acres of treated units.

<sup>2</sup> Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device.

<sup>3</sup> These acres are possible underburn acres due to dbh and location, not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

<sup>4</sup> 1- Provide a sustainable supply of timber products; 2- Actively manage stands to improve stand conditions, diversity, density, and/or structure; and Manage Riparian Reserves to control stocking and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.
Chapter 3: Environmental Impacts of the Proposed Action and No Action Alternative

This section of the Draft EA considers the environmental consequences of implementation of the various alternatives. The following discussion of effects follows CEQ guidance for scope (40 CFR 1508.25(c)) by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. For this analysis, in general, direct and indirect effects have been discussed in the context that most readers are accustomed to: those consequences which are caused by the action and either occur at the same time and place, or are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

The analysis of direct, indirect, and cumulative effects on each resource includes defined analysis area boundaries, as well as the length of time effects are expected to last. These are specific to each resource and therefore may vary in physical and temporal scale.

Interdisciplinary Team

The interdisciplinary team (IDT) includes Forest specialists for each discipline (see Table 46, for team members and their qualifications). Specialists on the IDT prepared technical reports to address the affected environment and expected environmental consequences of the proposed action and alternatives of the Lang Dam project. All reports are maintained in the project file, located at the McKenzie River Ranger District in McKenzie Bridge, Oregon. In some cases, this chapter provides a summary of the report and may only reference technical data upon which conclusions were based. When deemed appropriate, those parts of specialist reports that are not included in this Draft EA are incorporated by reference (40 CFR 1502.41).

Role of Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the IDT specialists. The conclusions of the IDT specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of this document. Referenced material is a consideration of the best available science.

Cumulative Effects

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects
of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

Appendix D provides a summary of past, present, and reasonably foreseeable activities in the project area that could contribute potential cumulative effects to the environment along with the Lang Dam project.

### 3.1 Forest and Stand Structure

**Summary of Effects**

Stands proposed for treatment are in a condition that will respond and benefit from thinning, based on stocking levels, average stand diameters and crown ratios. Thinning and adding diversity with gaps, dominant tree release, and skips will improve the growth and maintain the health of residual trees by reducing the competition between trees, develop the understory and diversify the species composition by opening up the tree canopies. Skips within these stands, within riparian reserves, and other sensitive areas, as well as selected areas of wildlife tree and large down wood creation where needed, will add another element of stand diversity.

Thinning, DTR, and gaps will promote the development of a diverse, multilayered stand structure providing conditions that favor the establishment of shrubs, hardwoods, and conifer in the understory, and by releasing saplings and intermediate-crown class trees in the stand. Increased growth of the understory will provide a more contiguous bed of green, high moisture content, less flammable vegetation on the forest floor. Thinning, DTR and gaps will promote crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in open stands. As the crowns differentiate, the risk of fire spreading from crown to crown goes down.

Thinning, DTR, gaps, and skips will maintain or enhance stand level, plant species diversity, composition and structure.

Gaps, and DTR treatments will help to provide for acres of stand initiation. Stand initiation acres will provide for long term (80-100 years) sustainable timber production.

Commercial harvest in both alternatives will shorten the duration stands spend in successional stages, moving stands more quickly through stem exclusion resulting in fewer snags on those harvested acres from suppression mortality.

**Scale of Analysis**

The scale used to evaluate direct, indirect and cumulative effects on Forest and Stand Structure associated with the Lang Dam project is the project area. The project area consists of 7,195 acres in the Elk – McKenzie River, Cougar Creek – South Fork McKenzie River (SFMR), Cougar Reservoir - SFMR, and East Fork - SFMR 6th field watersheds. By using the project area, it is possible to evaluate potential
impacts in an area large enough to encompass other disturbances, both human and natural, and it is a logical analysis area to assess stand conditions based on plant associations.

**Affected Environment**

The Lang Dam project area consists of approximately 7,195 acres along the South Fork McKenzie River in the McKenzie River Ranger District. Overstory tree species composition is dominated by Douglas-fir in all the stands. Western red-cedar, incense-cedar, grand fir, sugar pine, western hemlock, big leaf maple, red alder, and black cottonwood are present in varying amounts, but make up less than five percent of the overstory in all stands. The understory tree layer is generally poorly developed with low to moderate amounts of western hemlock, incense cedar, and western red cedar (5-80 trees per acre ~ 2”dbh). Understory shrub and herbaceous communities are moderately developed in some stands and disproportionate in others. Major species include Salal, Oregon grape, Pacific rhododendron, bracken fern, and hazel on drier sites; and sword fern, vine maple, and vanilla leaf on wetter sites. Productivity, measured by site class (a way of defining an areas potential for dominant tree height over a given time frame where lower numbers, typically on a 1-5 scale represent better growth potential), is moderate in most of the area (site class 3), but some higher productivity sites exist in the northern portion of the project area (site class 2). There is a floodplain along the South Fork McKenzie River and along the northern portion of the project area, primarily north of the 1900-408 road, where a larger component of hardwoods, such as big leaf maple, red alder and black cottonwood exist.

The stands, in the Lang Dam project, are primarily in the Western Hemlock and Grand Fir plant association series. In addition, the stands are primarily single story and the distribution of leaf area is heavily weighted towards the overstory strata. The canopy tends to be relatively uniform in terms of crown class differentiation and horizontal spatial patterning, except for small gaps caused by laminated root rot. Few legacy snags exist in the harvest units. Laminated root rot and competitive mortality is creating a low level of small snags, less than 12 inch DBH, in most units. In addition to root rot pockets, some stands contain wetlands, streams, or hardwood pockets which break up the relatively uniform, dense canopy of Douglas-fir. Most stands are bordered by a mix of late-successional forest and managed stands of varying age classes.

**Stand Age Classification**

Stand age of Forest Service managed lands in the project area was determined using data from the Forest Service’s FSVeg database in addition to stand exam data collected 2015. Data shows that virtually the entire approximately 7,195 acres in the project area, including non-FS ownership, is managed as forest, with exceptions of the East Fork of Cougar Reservoir and small areas (2-5 acres) associated with Cougar Dam operations. Stand age in the project area is distributed into four categories: Stand Initiation, Stem Exclusion, Understory Re-Initiation, and Old Growth.

**Stand Initiation - Young Managed Plantations (0-30 years old)**

Stands in this category are the younger second growth plantations originating from regeneration harvest which took place in this area in the late 1980’s and 1990’s. These stands are in the stand initiation development stage as described in Oliver and Larson (1996). Most stands were re-established by planting conifer seedlings after the regeneration harvest at stocking level to ensure survival of fully stocked sites. Other plants – trees, shrubs, and herbs grow from seed, sprouts, advance regeneration, and other mechanisms are also invading the sites and compete for the open growing space. Growth is usually rapid with competition for the available growing space. Generally, these stands have low to moderate amounts of downed woody debris and standing snags. Stand initiation represents approximately only approximately 465 acres, or approximately 7.8 percent of the forested lands administered by the Forest Service in the project area (Figure 5).
Stem Exclusion - Second Growth Plantation (31-80 years old)

Stands in this category are the older second growth plantations originating from early clearcut harvest treatments in the 1940’s to the early 1980’s and wildfires in the early part of the decade (see Fire and Fuels Section). Self-thinning which is a point where inter-tree competition causes mortality is common in most stands of this type due to high densities. In addition to mortality, competition from high density is causing crown recession in the overstory trees and crown ratios average 43 percent. However, crown ratios of dominant and co-dominant trees are above 40 percent and height to diameter ratios are generally below 70 percent. This stand type can be characterized as a dense, closed-canopied, even-aged stand. Based on the stand development classifications developed by Oliver and Larson (1996), these stands are classified as stem exclusion. The stem exclusion stage occurs after canopy closure, as the stand begins to differentiate into size classes. Shading and competition for nutrients and water by larger trees leads to death of smaller trees and much or all of the understory vegetation. Some of timber stands established after wildfires have a scattered overstory of remnant old-growth. Past logging utilization practices, fuels treatments, and safety regulations govern the amount of downed woody debris and standing snags retained in the plantations. Generally, these stands have low to moderate amounts of downed woody debris and are absent of standing snags. Stem exclusion represents approximately 1,804 acres, or 30.4 percent of the forested lands administered by the Forest Service in the project area (Figure 5).

Understory Re-initiation - Mature (81-180 year old)

Stands in this category are characterized as a fairly uniform, single-canopied, even-aged stand. These stands are in the understory re-initiation development stage. During the understory re-initiation stage, crowns recede and scattered overstory trees begin to die, and herbs, shrubs, and tree regeneration (usually shade tolerant species such as western hemlock, western red cedar, and true firs) appear on the forest floor. Many of these stands originated from wildfires that occurred in the late 1800s and early 1900s. The lack of legacy structural components such as snags and coarse downed woody debris left over from the previous stands suggest a fire regime of re-burns or multiple underburn fires over the last 2 centuries. Understory re-initiation represents approximately 2,234 acres, or 37.6 percent of the forested lands administered by the Forest Service in the project area (Figure 5).

Old Growth - Old Growth (greater than 180 years old)

Stands in this category are characterized as old growth (Oliver and Larson, 1996) and would generally meet the definition of old growth, and in some cases the PNW-447 (USDA, 1986) old growth criteria. The stands have large, live trees, often dominated by late-seral Douglas-fir; large, dead, standing and downed trees; multi-layered canopy; and a heterogeneous understory. The old-growth stage occurs when overstory trees die sporadically and understory trees begin growing into the overstory, creating multiple canopy layers and gradual shift towards a stand dominated by shade-tolerant species. Many of these stands have been previously salvage logged to remove wind throw and mortality. Old Growth represents approximately 1,434 acres, or 24.2 percent of the forested lands administered by the Forest Service in the project area (Figure 5).
Figure 5 Current Stand Age Classification in the Lang Dam Project Area, excluding private land.

Figure 5 illustrates the current stand age classifications in project area and Table 10 provides the acreages of each stand age classification and the acres proposed for harvest in each category.

### Table 10 Harvest Units and Stand Age Classification

<table>
<thead>
<tr>
<th>Stand Age Classification</th>
<th>Project Area (acres)</th>
<th>Alternative 2 (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand Initiation (0-30 years old)</td>
<td>465</td>
<td>0</td>
</tr>
<tr>
<td>Stem Exclusion (31-80 years old)</td>
<td>1,804</td>
<td>592</td>
</tr>
<tr>
<td>Understory Re-Initiation (81-180 years old)</td>
<td>2,234</td>
<td>26</td>
</tr>
<tr>
<td>Old Growth (180 years old)</td>
<td>1,434</td>
<td>0</td>
</tr>
</tbody>
</table>

1: Does not include non-forest areas such as waterbodies, meadows, and rock outcrops. Also does not include private land.

**Stand Density and Competition**

Harvest is proposed in both previously managed stands and fire regenerated (naturally regenerated) stands with the proposed action. High density stands with low and declining vigor are common in the Lang Dam project area. Ninety-two percent (Table 10) of stands proposed for harvest are second growth stands classified as being in the stem exclusion development stage (Oliver and Larson, 1996). Stands in this stage have dense crowns which block out the light to the forest floor and limit additional tree regeneration in the understory. Shade-tolerant understory trees that are present persist but grow very slowly. Intermediate or suppressed trees that do not tolerate shade well suffer from competition and have an increased mortality rate. The remaining eight percent are classified as being Understory Re-
Initiation (Oliver and Larson, 1996) where growing space has opened up due to stem exclusion, allowing for a understory plants and trees to start growing.

Stand age is a metric that is easy to understand. However, it does not provide a complete picture about stand development, composition, or characteristics. Stand density as a surrogate for other factors such as stand vigor and growth, competition, and mortality better represents if a need exists for management because it is transferable between both plantations and fire regenerated stands, independent of age.

Stand Exams
Existing stand conditions were measured in 2015 using the Forest Service Common Stand Exam program.

Forest Vegetation Simulator (FVS)
The April 2016 version of Forest Vegetation Simulator (FVS) (USDA Forest Service 2008, Pacific Northwest model with Western Cascade variant, revised April 2016) was used to analyze stand exam data. FVS, is a model used to predict the potential outcome of different management activities in a stand. Current stand densities and sizes are entered and the model predicts how stand conditions, densities, and mortality are likely to occur or change over time with different management activities.

Stand Density Index
Stand Density is an important factor in considering forest health. Stand density is directly related to stand-growth potential, stand vigor, and the ability of stands to ward off insect and disease. Stand Density Index (SDI), which was developed by Reineke in 1933, is a quantitative measure of tree competition or density in a stand. At its most basic level SDI is based on the average number of trees per acre and the average size of those trees. SDI allows current stand data to be normalized for a stand of trees with an average diameter of ten inches. The maximum SDI or SDImax for the Lang Dam project is set at 595 which was identified by Reineke as the maximum for Douglas-fir. In FVS, current stand conditions are modeled to predict potential future conditions under different management scenarios (alternatives).

Mortality is modeled from two sources in FVS – external and internal. External sources of mortality are caused by agents such as insects, diseases, and fire. Internal sources of mortality include background mortality and density-dependent mortality (Dixon 2009). Background mortality, which is normally expected mortality in a healthy stand occurs at low levels and is not necessarily related to stand density. Density-dependent mortality means that as stocking levels increase in a stand, inter-tree competition may occur and over time, the stand will “self-thin” (big trees crowd out small trees). As density-dependent mortality increases, vigor and growth decrease.

Density-dependent mortality is predicted in stages based on the percent SDI relationship between a stand’s existing SDI value and the SDImax. In general the lower the existing percent SDI (current SDI / SDImax) the lower the likelihood of density-dependent mortality. Lower percentages of SDImax, from 25-35, are more suited to maximize individual tree growth, while percentages of SDImax ranging from 35-60 percent will maximize stand growth as a whole. As shown in Table 11 below, stands which reach an SDI of about 149, or approximately 25 percent of SDImax, enter a stage known as the “Onset of Competition”. Trees in the “Onset of Competition” stage are still maximizing individual tree growth while competing for growing space. “Full Site Occupancy”, the next stage is when percentages of SDImax range from 35-49.9, this is the stage where the stand growth as a whole is maximized. Stand growth slows as the “Limit of Tree Vigor” is reached around the 50-59.9 percent SDImax. As SDI increases to around 357, or 60 percent SDImax, trees reach a point known as “Zone of Imminent Mortality” (Long, 1985) where larger dominant and codominant trees die due to competition. Stands in the Lang Dam project area have SDIs ranging from 234 to 503 and average 331 (Table 11). Stands with a higher SDI in the Lang Dam project area are showing signs of reduced vigor and growth. Some density dependent mortality has begun due to overcrowding and competition between trees for nutrients and light.
Table 11 Key SDI Values

<table>
<thead>
<tr>
<th>Stage</th>
<th>% of SDI_{max}</th>
<th>SDI Value based on 595 SDI_{max}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of Competition</td>
<td>25-34.9</td>
<td>149-207</td>
</tr>
<tr>
<td>Full Site Occupancy</td>
<td>35-49.9</td>
<td>208-297</td>
</tr>
<tr>
<td>Limit of Tree Vigor</td>
<td>50-59.9</td>
<td>298-356</td>
</tr>
<tr>
<td>Zone of Imminent Mortality</td>
<td>60+</td>
<td>357+</td>
</tr>
</tbody>
</table>

One way to compare how the alternatives best meet the future desired condition of a project is to compare the percentage of maximum SDI values between alternatives. As stated earlier, the stands in the Lang Dam project consist of predominantly Douglas-fir, which has an SDI_{max} of 595 (Reineke, 1933). In particular, attention should be paid to the desired condition to have “healthy, vigorous stands with an average SDI below 207 a level where you maximize individual tree growth before transitioning into maximizing stand growth which starts around and SDI of 208” which is achieved by maintain stands in the “onset of competition” and “full site occupancy” stages. Table 12 shows the total acres of the SDI stages, based on FVS modeling, which would result in each alternative.

Table 12 Acres of SDI Stages by Alternative

<table>
<thead>
<tr>
<th>Stage</th>
<th>No Action</th>
<th>Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of Competition</td>
<td>0</td>
<td>604</td>
</tr>
<tr>
<td>Full Site Occupancy</td>
<td>233</td>
<td>41</td>
</tr>
<tr>
<td>Limit of Tree Vigor</td>
<td>273</td>
<td>0</td>
</tr>
<tr>
<td>Zone of Imminent Mortality</td>
<td>139</td>
<td>0</td>
</tr>
</tbody>
</table>

Previously Managed Stands

Approximately 592 acres of previously managed stands, both from regeneration harvest and partial cuts, are proposed for treatment in the proposed action. Over about the last 70 years there has been approximately 2,450 acres of timber harvest on lands managed by the Forest Service in the project area. Approximately 513 acres of Forest System lands in the project area have been pre-commercially thinned. Approximately 947 acres of Forest System lands in the project area were modified with regeneration-type timber harvest, which is now in plantations less than approximately 70 years old.

In previously managed stands, the average age of the stand is 50 years old with the range between 40 and 77 years old. Many of the stands are just starting to enter the stem exclusion stage or are already well in the stem exclusion stage with SDI’s averaging 335. Little understory development and species diversity appears to be in the stands. Many of the existing plantations in the analysis area are becoming ready for intermediate thinning treatments. Over the next decade, tree diameters in younger plantations will continue to become large enough for commercial thinning.

Fire Regenerated Stands

Approximately 26 acres of fire regenerated (naturally regenerated) stands are proposed for harvest in the proposed action. The project area has been shaped by wildfires over the last several centuries, as well as timber harvest over the past 80 years. The stands proposed for treatment have been commercially thinned in previous entries. The project area includes fire-regenerated stands which have been thinned in previous entries, as well as some stands that have not been previously thinned.

In the fire regenerated stands proposed for treatment, the average age is 98 years old with a range of 96 to 100 years old. Because these stands have been managed, they do have the start of understory development as light has been allowed to enter the stands in the past. The fire regenerated stands proposed for harvest in the Lang Dam project have an average SDI of 293 (Table 13) which is almost 50 percent of SDI_{max}.
Stands Averages

Table 13 illustrates average stand characteristics stands both over and under 80 years of age, and an average of all stands proposed for harvest in the project.

Table 13 Average Stand Characteristics of stands considered for harvest.

<table>
<thead>
<tr>
<th>Stand Type</th>
<th>Total Trees Per Acre</th>
<th>Trees per acres available for harvest</th>
<th>Quadratic Mean Diameter</th>
<th>Average Stand Height</th>
<th>Canopy Cover Percent</th>
<th>Average Age</th>
<th>Basal Area</th>
<th>Stand Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 80 years old</td>
<td>431</td>
<td>154</td>
<td>16</td>
<td>94</td>
<td>70</td>
<td>50</td>
<td>189</td>
<td>335</td>
</tr>
<tr>
<td>Over 80 years old</td>
<td>464</td>
<td>74</td>
<td>21</td>
<td>113</td>
<td>47</td>
<td>98</td>
<td>163</td>
<td>293</td>
</tr>
<tr>
<td>All</td>
<td>435</td>
<td>189</td>
<td>16</td>
<td>96</td>
<td>68</td>
<td>55</td>
<td>186</td>
<td>331</td>
</tr>
</tbody>
</table>

1: Based on trees seven inches and greater DBH, because seven inches is the minimum DBH of a tree considered for harvest in the Lang Dam project.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Stands left untreated would continue to grow for another 200-500 years barring a natural disturbance, but at slower rates as trees compete with each other for growing space. Growth rates would continue to decline, and natural processes that affect tree vigor and cause changes in stand structure would continue. The effects of overstocked stands include decreased growth, increased rates of mortality, higher risk for insect and disease attacks, and higher risk for stand replacing fires. Diameter growth would be low or would decline, and live crown ratios would get smaller. Trees in these stands would become less vigorous and more susceptible to insects and diseases. Competition-induced mortality would increase, thus increasing small diameter <15” snags and down wood. The down material would increase fuel loadings, fire risk and vulnerability of the stands to insect infestations. The competition-induced mortality would not be available for commercial wood products. Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation. The diameter and product value of trees harvested in the future would be reduced without treatment. The no action alternative would result in no compaction or potential loss of growth associated with temporary roads.

Low light levels in un-thinned stands would suppress development of shade-tolerant trees and limit understory vegetation. Decline in underrepresented species, like sugar pine (*Pinus lambertiana*) and western red cedar (*Thuja plicata*), would continue. Shade tolerant species, like western hemlock, would eventually dominate the stand in absence of timber harvest and/or other disturbances. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir and sugar pine. The diameter and product value of trees harvested in the future would be reduced without treatment. The no action alternative would result in no compaction or potential loss of growth associated with temporary roads.

Alternative 2 Treatments

*Thinning*

Thinning will increase the health and vigor of the remaining trees and help increase the stands ability to adapt to environmental changes. Additional light, from reduced canopy cover, reaching the forest floor will help promote a second cohort of trees. Both shade-tolerant and intolerant species may be established; however, shade-tolerant species will thrive better over time as the overstory crown closes. The beneficial effects of a more open canopy will taper off over the next 15-20 years as the canopy cover
is estimated to increase 2 percent per year (Chan, 2006). By primarily harvesting Douglas-fir, which is
over represented in the project area because of planting densities, this second cohort is expected to
provide vertical, horizontal, age, and species diversity in the stand.

Conifer trees will be removed through commercial thinning across all size classes, but will primarily
consist of smaller diameter trees with an emphasis on retention of sugar pine and white pine; however
these species may be cut for operational purposes (see Figure 6). This prescription will also maintain or
increase vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as
well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Young uniform stands can be diversified by early thinning (DeBell et al. 1997, and Hayes et al. 1997) as
proposed for the plantations to be treated with the Lang Dam Project. Early commercial thinning has
been shown to be beneficial to the future development of understories, the promotion of natural
regeneration, and in enhancing biodiversity (Muir et al. 2002). With early thinning, overstory trees can
develop deep canopies and large-diameter branches in open stands (McGuire et al. 1991). Low overstory
density facilitates the establishment of understory trees (McGuire et al. 1991, Bailey and Tappeiner

To help provide diversity on the landscape, heavier thinning will likely promote rapid growth of trees
with characteristics normally associated with old trees in old-growth stands. Many old trees grow rapidly
when they are young (30-100 years), producing large stems and crowns. Evidence (Franklin et al. 1981,
Tappeiner et al. 1997) suggests that growth rates of some older forests indicate slow regeneration and at
low densities over a long period with little tree-to-tree competition. Old-growth stands typically have
multiple canopy layers, and thinning promotes a second cohort by allowing for natural regeneration to
occur (Tappeiner et al. 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have
undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic
release of established tolerant conifers (Winter et al. 2002a, 200b). Therefore, stand management can
follow multiple routes that emulate natural processes to move dense young stands towards structure
similar to old-growth forest.

A short-term adverse effect to understory vegetation and below ground fungi will be the mechanical
damage from logging. The removal of host trees and soil disturbance from the yarding operation impacts
below ground fungi (Courtney et al. 2004). This adverse effect is mitigated by the use of designated skid
trails with ground-based yarding systems and log-suspension capabilities of skyline and helicopter
yarding systems.

Older fire regenerated stands, or mature stands, which are commonly associated with stands over 80
years of age do show positive growth responses to thinning. Latham and Tappeiner (2002) showed that
trees over 150 years old will respond to thinning with basal area growth “significantly greater ... for 15 to
63% of the trees.” Mature stands often have long term benefits of a variety of thinning densities which
last 20-30 years (Latham and Tappeiner, 2002). Additionally 110 year old trees in heavy thinning stands
showed a positive growth response which was “30 percent greater than that of the controls....”
(Williamson, 1982).
Figure 6 Visualization of Stand Before and After Thinning

**Gaps**

Gaps are openings which will range in size from one to three acres outside of Riparian Reserves (see Figure 7). Gaps will be randomly placed unless it was necessary to strategically place the openings to meet other resource needs such as to minimize conflict with logging systems, to minimize visual concerns, avoid weed infection, or to treat an identified root rot pocket. In the stand, a thinning prescription will be applied to the area outside the gaps.

Gaps will retain up to four trees per acre. Trees designated as a leave tree in the gap will not be used for snag or large down wood enhancement projects. Retention trees meeting criteria for wildlife trees (i.e. having *Phellinus pini* conks or other elements of wood decay, crooked tops, etc...) will serve as a wildlife tree and offset the need for enhancement.

By implementing gaps, the project will provide numerous benefits for many species of wildlife over the next 10-20 years before regeneration reclaims the opening. For birds, gaps have been shown to provide habitat to shrubland birds not present in mature forest (Chandler et al. 2009) while generally providing more fruit and more resource abundance due to a lower canopy and increased fruiting (Blake and Hoppes 1986). Generally gaps provide more resources to herbs, shrubs, and broad-leaved plants which provide the foundation for food webs that contribute to many different trophic levels in Pacific Northwest conifer forests (Hargar 2007).

Figure 7 Visualization of Thinning with Gaps

**Dominant Tree Release (DTR)**

This prescription will provide for growth of a dominant tree or group of five to ten trees to promote larger trees scattered throughout the stands. This meets the purpose of improving stand conditions in terms of species composition, diversity, density, and structure. DTR may result in open grown trees that develop larger limbs lower to the ground, which could serve as wildlife habitat (McGuire et al. 1991), as well as greater taper, reducing tree susceptibility to wind damage in the future. The area around the dominant tree will be cut to a radius of 66 feet from the bole of an individual tree, or each tree in a group. Around an individual tree, the 66 feet equates to approximately ¾ acre when one tree is identified. When five to ten trees in a clump are identified, the opening size will vary depending on the number and spacing of trees retained but will likely range from an estimated 1/3 to ½ acre (see Figure 8). Sugar and white pine over 24" in size will be treated as a dominant tree. The lack of competition will
provide the tree(s) in the DTR a long term benefit of at least 50-100 years as it will remain a dominant
tree in the opening even as other trees encroach on the opening.

![Visual representation of dominant tree release](image)

**Figure 8 Visualization of Single vs Multiple Tree Dominant Tree Release**

**No Harvest – Skips**

By not treating an area, the area will provide diversity in a stand. These areas will be allowed to have
natural processes take place such as inter-tree competition, which will create snags and down woody
material. However, there will be an edge effect that could take place along the skips edge. Skips will be
dispersed between riparian and non-riparian areas. Depending on the location and positioning of the
skip, the edge effect could allow for more light to reach the trees along the edge and forest floor. This
extra light could lead to greater growth of some of the individual trees, forbs, and shrubs along the edge.

Implementation of skips will be with hard boundaries flagged on the ground along unit boundaries and
in units. Additionally, internal skips may include identifying a tree and not including for harvest any other
tree within a specified distance of that identified tree. Similar to the no action alternative, skips will
continue for another 200-500 years baring a natural disaster, but at slower rates as trees compete with
each other for growing space and resources.

**Effects of Alternative 2**

Alternative 2 will have the beneficial effects previously identified on treated acres (see Table 14).
Thinning and dominant tree release (DTR) on 493 acres will improve or maintain growth and health of
overstocked stands currently in stem exclusion. Thinning and DTR creation will open up the tree canopy
allowing more sunlight and precipitation to reach the forest floor. This will result in changes in the
microclimate (increased air and soil temperatures, relative humidity’s, and air movement), under the
main canopy for a short term (10-20 years) until the canopy closes back in (Chan, 2006). These changes
in microclimate stimulate an increase in favorable growing conditions for most plant species.

Alternative 2 will treat 532 acres with thinning, DTR, and gaps to promote the development of diverse,
multi-layered stands. The treatments will primarily aid by providing conditions that favor the
establishment of shrubs, hardwoods, and conifer in the understory and by releasing saplings and
intermediate-crown class trees in the stand. Thinning, DTR, and gaps will also promote crown
differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in
open stand. As the crowns differentiate, the risk of a fire spreading from crown to crown goes down.

Thinning, DTR, gaps, and skips will maintain or enhance stand level, plant species diversity, composition
and structure on 630 acre with Alternative 2. Species richness for herbaceous species and total species
richness across trees, shrubs, and herbaceous vegetation is greater in thinned stands than in un-thinned
and old-growth stands (Bailey et al. 1998).

Moving acres into stand initiation is accomplished with Alternative 2, where Gaps, and DTR will provide
for 65 acres. Those acres will provide for long term (80-100 years) sustainable timber production with
regeneration of a new cohort of trees which will provide timber in the future.

Through commercial harvest, fuel loading will increase on 532 acres with Alternative 2, the fuels added
will mostly be smaller in size from limbs and needles which typically decompose within 2-3 years.
However, larger branches and logs fuels can persist for at least 5 years. Increased growth of the
understory will provide a more contiguous bed of green, high moisture content, less flammable
vegetation on the forest floor. Please see the Fire and Fuels section for more information on fuel loading.
Commercial harvest may cause some stages of forest succession to be shortened due to accelerated growth and enhancement activities (Andrews et al. 2005). These stands will more quickly move from stand initiation to understory re-initiation. Increased horizontal and vertical diversity along with diversity in species composition and sizes will result with understory re-initiation.

Table 14 Comparison of Treatments (acres) by Alternative

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres of Thinning Outside Riparian Reserves</td>
<td>0</td>
<td>331</td>
</tr>
<tr>
<td>Acres of Thinning Within Riparian Reserves</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td>Acres of Gaps</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Acres of Dominant Tree Release</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Acres of Skips Outside Riparian Reserves</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Acres of Skips Within Riparian Reserves</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td><strong>Total Acres of Timber Harvest Units</strong> (includes skips)</td>
<td><strong>0</strong></td>
<td><strong>630</strong></td>
</tr>
</tbody>
</table>

Cumulative Effects

**Alternative 1**

With implementation of Alternative 1, no cumulative effects to forest stand and structure would occur because no actions would be taken.

**Alternative 2**

Effects to forest stand and structure from Alternative 2 overlap in time and space with effects from three past projects – 7-Thin Stewardship Reoffer (7-Thin), and Buck Thin, which are both currently active. 7-Thin consists of 80 acres of thinning and three acres of gaps, and Buck Thin includes 51 acres of thinning within the project area. Buck Thin also contained about 75 acres of thinning and 12 acres of gaps north of the project area, which is not considered in this analysis.

In conjunction with 7-Thin and Buck Thin, the Lang Dam project will cumulatively benefit the project area by helping to maintain or enhance plant species, increase structural diversity and composition, and promote crown differentiation. By adding the 532 acres associated with the Lang Dam project to the existing projects in the planning area, cumulatively, the Lang Dam project will have beneficial effects on 663 acres.

When looked at with 7-Thin and Buck Thin, treatments associated with Lang Dam will reduce the time 663 acres are in the stem exclusion stage of stand development, which will limit the number of snags attained through suppression mortality on those acres.

No cumulative effect to fuel loading is anticipated due to timing from harvest associated with the Lang Dam project. Fuel treatments on the Cascade Thin, Hartz Reoffer Thin, or Road 19 Salvage project will be completed on these projects prior to the implementation of Lang Dam.

**Connected Actions**

The following actions and effects will occur with implementation of Alternative 2.

*Post-harvest Tree Planting*
Active reforestation of the gaps in Alternative 2, will be required. Reforestation will be expected to occur within five years of harvest, and occur from both tree planting and natural regeneration. Alternative 2 will require approximately 17 acres of planting while relying on natural regeneration on approximately 22 acres. Post-harvest densities will be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity with the planting of species such as western white pine and western red cedar. Slash and other debris will be utilized as shade and as a deterrent to browse by ungulates. Trees planted in identified root rot pockets will be species that are less susceptible to root rot like western red cedar, sugar pine, white pine or red alder. Reforestation will help to ensure sustainability of the stands into the future. A mix of species which represent the historic composition will be planted, resulting in increased species diversity.

**Subsoiling**

Subsoiling will occur when a unit has compaction levels above Forest Plan Standards and Guidelines. Subsoiling is beneficial to Forest and Stand structure in order to reduce compaction and increase root growth, along skid trails and landings. Skid roads in planting areas are expected to be subsoiled to a depth of 18-22 inches to reduce the effects of compaction. The exception will be avoiding soils under retention tree canopies to reduce disturbance. Compaction from skid roads has not shown a reduction in residual tree growth (Miller et al, 2007). Some adverse effects may occur if residual trees inadvertently have roots pruned by the subsoiling.

**Temporary Road Construction and Decommissioning**

Temporary road construction and decommissioning will occur where temporary roads are necessary to facilitate project activities. The initial effects of the construction will be compacted soils which could affect Forest and Stand Structure; however those effects will be offset by decommissioning. The effects of decommissioning will be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction and root growth, so increased growth is likely along skid trails and landings that have treatment. Some adverse effects may occur if residual trees inadvertently have roots pruned during decommissioning.

**Fuels Treatments**

Fuels treatments are discussed in Section 3.10. A benefit of the fuels treatment to the Forest and Stand Structure is that when fuels treatments are complete, the likelihood of a reburn in the event of a wildfire is reduced. Also, when the selected fuels treatment is an underburn, a secondary benefit will be exposing mineral soil. The presence of mineral soil is proven to increase the survival of seedlings and the success of seeds to sprout and take root (Tappeiner et al. 2007).
3.2 Soils

**Summary of Effects**
No adverse effects to soil resources are expected to occur with the use of design features and proper project implementation.

**Scale of Analysis**
For the soil resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the “unit”, i.e. the stand polygon or activity area proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the “unit” affected. The summing of acres for various units, such as the total acres of skyline logging in a given alternative, is not an evaluation criterion for soils impacts. Impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives. The full Soil and Geology Report is in the project analysis file and available upon request from the McKenzie River Ranger District.

**Affected Area**
This project area is located in the Lower McKenzie drainage area and lies completely within the Western Cascades physiographic region. The project area lies at the boundary between the older “Tu” and the younger “Tfc” volcanic deposits (Walker and Duncan, 1989). These deposits are basaltic lava flows, flow breccias and pyroclastic deposits representing both early and later events of the Western Cascade volcanic sequence. The area has been heavily modified by mountain glaciation and stream erosion over the last million years. Resulting features such as gentle side slopes in the valley bottoms, the lack of very fine soil particles in most areas, and the fact that glacial scour removed deeper pockets of fine-grained soils on much of the steep terrain, indicate soils within the project area are quite stable.

These various volcanic land types are generally well drained where permeability is rapid in the surface soil and moderately rapid in the subsoil. Because of high infiltration rates in the broad valley bottoms, overland flow is generally uncommon. In the proposed units, side slopes range from near zero to about 30% on the gentler slopes to 40 to 80% on the steeper terrain. Offsite erosion is generally not a concern because of the vegetative ground cover, the high infiltration rates, and the gentle to moderate side slopes for many units.

Most of this project area was historically burnt by either natural or aboriginal fires that were likely prevalent and carried through much of the project area in the last several hundred years. Many areas have been frequently exposed to low and moderate intensity fire. Consequently, natural accumulations of down woody debris may not be prevalent in many parts of this project area. These conditions vary across the landscape, depending on aspect, elevation, and slope position.

The McKenzie River Ranger District primarily contains stable, productive soils. Active slope instability from debris chutes, slumps or earth flow complexes do not usually occur in this general area, and no unstable ground was found associated within the proposed units. However, Unit 130 does contain a debris chute tract located upslope from the harvest unit. This debris chute comes to rest near the unit’s north boundary. Field investigation also indicated that two units proposed for timber harvest within the Lang Dam project area does approach or exceed the Willamette National Forest FW-081 Standard of 20% of an activity area impacted by compaction (Unit 60 and Unit 190). Evidence of compaction from previous entries is still present in most plantation units with previous ground-based harvest. Despite this, all remaining units are sufficiently within the compaction standard and have existing compaction levels at generally less than 5%.
Environmental Consequences

The major impacts to soil productivity from harvest activity are discussed in the Forest Wide Standards and Guidelines for Soil and Water Quality protection and are addressed in Chapter IV of the Willamette Forest Plan, sections FW-079 to FW-114.

The total area of cumulative detrimental soil effects should not exceed 20% of the total acreage within the activity area, including roads and landings. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity. Anticipated effects to the soil resource will be within Forest-wide Standards and Guidelines (FW-081 to 086) (Table 12).

Table 15 Management Indicators for Assessing Effects to Soils

<table>
<thead>
<tr>
<th>Issue</th>
<th>Management Indicator</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>The removal of more than 50% of the topsoil or humus enriched soil horizons from an area of 100 square feet which is at least 5 feet in width</td>
<td>FW-081</td>
</tr>
<tr>
<td>Compaction</td>
<td>An increase in soil bulk density of 15% or more and/or by a reduction of macropore space of 50% over the undisturbed soil.</td>
<td>FW-081</td>
</tr>
<tr>
<td>Nutrient Loss</td>
<td>Insufficient duff retention or large woody material to ensure adequate nutrient cycling.</td>
<td>FW-085</td>
</tr>
<tr>
<td>Instability</td>
<td>An increase in size, density or number of slope failures.</td>
<td>FW-086</td>
</tr>
</tbody>
</table>

Direct and Indirect Effects

Alternative 1 - No Action

A No Action Alternative would result in no timber harvest or associated post-timber harvest activities. Stands would continue to mature. Many of the stands proposed for treatment at present are densely overstocked and have little understory vegetation because of the lack of sunlight to the forest floor. Over time in these stand conditions, growth of intermediate and suppressed trees would slow and tree mortality would rise. In areas of heavy stocking, stand resiliency would stagnate. Blow down and snow down would continue to increase fuel loading in the short to intermediate term. In general, plant diversity would diminish as well as soil biota from lack of sunlight.

Short-term to intermediate-term impacts from harvest, such as soil disturbance or displacement, dust (or mud), slash accumulation and disposal, increased compaction and nutrient loss would not occur. In areas already compacted or disturbed by the initial entries, subsoiling improvements with machinery would not occur. The soil building process would continue to return the soil to near pre-harvest conditions over the longer-term. No effects to slope instability are anticipated under the No Action alternative.

A No Action Alternative is not considered beneficial for long-term soil productivity. Activities which reduce stocking levels, improve stand vigor, eliminate excessive fuel loading, and allow for the subsoiling of previously compacted areas are favored.
Alternative 2

As stated above, the major short-term impacts to soil productivity from harvest activity may include displacement, compaction, nutrient loss and instability. All prescriptions or design features are designed to meet or exceed the requirements outlined in the National Best Management Practices for Water Quality Management on the National Forest System Lands (USDA, 2012).

**Compaction:** Field surveys indicated that two units in the Lang Dam project area approached or exceeded The Willamette National Forest Standard (FW – 081) of 20% of an activity area impacted by compaction: Unit 60 and Unit 190. Consequently, purchaser subsoiling is required mitigation to ensure that levels remain below the 20% standard.

The remaining units in the project area were sufficiently within the standards for compaction. Compaction is not anticipated to exceed the 20% value in any unit and should be below the 15% level (or lower) in most units. Activities which minimize further compaction as much as possible, or reduce existing compaction through mechanical means (subsoiling) will be required. To adequately protect the soil resource, the primary yarding objective for all units will be either ground-based systems with predesignated skid roads and directional falling as appropriate, or skyline yarding with one end suspension, except at tail trees and landings. Landings are primarily planned at old existing landings, road turnouts, and road junctions. Some new spur roads will be required in a few units to access suitable landing sites. These roads will be subsoiled, ripped and reseeded with native ground cover at the end of harvest operations. With entry into any ground-based unit, evident skid or haul roads will be utilized before any new skid road is approved. Ground-based skidding equipment shall stay on designated skid trails which will be subsoiled upon completion of harvest activities. Consequently, effects from existing compaction and harvest activities is not anticipated.

One of the goals with entry into all these units is to provide the opportunity to subsoil long-term existing skid roads (created during past timber sales) as much as is practical in order to reduce compaction to lower levels. Subsoiling may be curtailed in some areas in order to reduce the amount of root pruning of leave trees, to avoid excessive amounts of exposed soil, or to avoid stumps or large rocks. The use of designated skid roads, the reuse of the existing skid road system, and the subsoiling of primary landings and skid roads in critical units will be contractually required in order to reduce or maintain compaction levels and therefore compaction levels will not increase significantly at the completion of harvest activities.

**Displacement:** Little physical evidence can be found in any unit within the project area to indicate that timber management activities will result in significant, long-term detrimental soil displacement, off-site soil movement, or substantial loss of productivity. To adequately protect the soil and top-soil, the primary yarding objective for all units will be either ground-based systems with predesignated skid roads and directional falling as appropriate, or skyline yarding with one end suspension, except at tail trees and landings. The primary factor differentiating these two yarding systems will be side slope. Disturbance from yarding will be well within the Regional and Forest standard and significant adverse impacts are not anticipated. With appropriate suspension during logging, soil disturbance is minimal and off site erosion is essentially non-existent. Skyline operations in thinning units with smaller wood and intermediate supports usually impacts less than 1% of the unit area. During harvest, the retention of stream adjacent trees and the requirement of full suspension yarding over or away from stream courses will minimize or eliminate off-site erosion.

**Instability:** Slope instability is a geologic process that is not acutely active in this project area. Units or sections of units with instability were identified during field reconnaissance and will be excluded from timber harvest. Unit 130 does contain a debris chute tract that initiates upslope from the proposed unit. This debris chute came to rest near the north boundary of this unit. This area will be utilized during any harvest activities. Management of this unit will have no adverse effect on slope stability.
**Nutrient Loss:** Monitoring and field reconnaissance in recent years has shown that the duff retention percentages for under burns in partial cuts, thinning, or fuels reduction within stands, which maintain an intact live root mat and live canopy cover over most of the unit, could be less (to much less) and still achieve adequate soil nutrient protection. Within the managed plantations, slash will be scattered in the units, piled and burned, or perhaps broadcast or under burned. Extensive monitoring of grapple machine piling operations indicates that little or no additional nutrient loss due to compaction or displacement occurs, when properly implemented. Burning the piled slash may develop sufficient heat to affect the underlying soil. However, the hotter portions of the pile burning involve only a very small part of the acreage in any unit, usually less than 1% of the area. However, pile burning is usually done in the fall or winter months when duff and soil moistures are higher, and this helps reduce the downward heat effects to the soil. Consequently, pile burning is considered a minor effect because of the limited overall acreage involved.

Management activities will be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling (FW-085). Site specific needs will be considered in conjunction with wildlife objectives as outlined in FW-212a and FW-213a (as amended). Concentrations of larger down logs that were produced with the initial harvest should be left undisturbed as much as possible. Consequently, with the retention of adequate duff and woody debris, potential adverse impacts to long-term soil productivity and nutrient loss are not anticipated.

**Cumulative Effects**

Prescriptions for soil protection and considerations take into account past and predicted future land management activities. The major soils concerns - compaction, nutrient loss, displacement and instability - are most effectively reviewed, for both short and long-term effects, at the project level.

Potential cumulative effects from displacement, nutrient loss, and instability with past management were not observed in the field reconnaissance. If these factors are observed, the affected parts of the units will be dropped from the proposed harvest. The primary previous impact to the soil resource from management is compaction, the effects of which can remain apparent for decades. Existing compaction levels on a unit-by-unit basis have been documented and discussed. Theses soils design criteria are designed to limit the amount of additional compaction, and the subsoiling is intended to reduce compaction where levels will exceed standards and guides. Units 60 and 190 have subsoiling mitigation to ensure compaction is improved or reduced to acceptable levels (20% standard).

With proper project implementation, as specified in the design criteria, unacceptable cumulative effects on the soils resource are not anticipated from Alternative 2 (BMP W-5). Consequently, the utilization of soil protection measures and best management practices as defined in the Soils Report will generally preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines will be the primary trigger for a cumulative effects review, and no deviations are planned.

**3.3 Wildlife**

**Summary of Effects**

Stands proposed for treatment are in a condition that will respond and benefit from thinning, based on stocking levels, average stand diameters and crown ratios. Thinning and adding diversity with gaps, dominant tree release, and skips will improve the growth and maintain the health of residual trees by reducing the competition between trees, develop the understory and diversify the species composition by opening up the tree canopies. Skips within these stands, within riparian reserves, and other sensitive areas, as well as selected areas of wildlife tree and large down wood creation where needed, will add another element of stand diversity.
Thinning, DTR, and gaps will promote the development of a diverse, multilayered stand structure providing conditions that favor the establishment of shrubs, hardwoods, and conifer in the understory, and by releasing saplings and intermediate-crown class trees in the stand. Increased growth of the understory will provide a more contiguous bed of green, high moisture content, less flammable vegetation on the forest floor. Thinning, DTR and gaps will promote crown differentiation by allowing overstory trees to develop deep canopies and larger diameter branches in open stands. As the crowns differentiate, the risk of fire spreading from crown to crown goes down.

Thinning, DTR, gaps, and skips will maintain or enhance stand level, plant species diversity, composition and structure.

Gaps, and DTR treatments will help to provide for acres of stand initiation. Stand initiation acres will provide for long term (80-100 years) sustainable timber production.

Commercial harvest in both alternatives will shorten the duration stands spend in successional stages, moving stands more quickly through stem exclusion resulting in fewer snags on those harvested acres from suppression mortality.

**Scale of Analysis**

The geographic scale used to assess direct, indirect and cumulative effects for snags and down wood includes the project activity units and the South Fork McKenzie River and McKenzie River 5th field Watersheds that this project falls in.

The geographic scale used to assess direct, indirect and cumulative effects for early seral wildlife habitat, sensitive species, migratory land birds, and terrestrial Management Indicator Species (MIS) was the project activity units and the project area.

The geographic scale used to assess direct, indirect and cumulative effects for elk habitat includes the project activity units, and one Elk Emphasis Area, Cougar, which management activities will occur in. The Cougar elk emphasis area includes some private land. Two additional elk emphasis areas will have a small amount of harvest and are also discussed. These emphasis areas were used for the scope of analysis because of established ratings for elk habitat as described in the Willamette National Forest Plan Standards and Guidelines. Cumulative effects for each species or habitat type discussed below considered the past, present and reasonably foreseeable actions shown in Appendix D. Projects that modified forested habitats continue to have ongoing effects on many wildlife species, especially those dependent on late-successional forests.

**Northern Spotted Owl (Threatened)**

**Summary of Effects**

Alternative 2 will remove about 17 acres or less than one percent of the suitable owl habitat in the project area. About 440 acres of dispersal-only habitat will be moderately or heavily thinned, which makes up approximately 27 percent of the dispersal habitat in the project area. Removal of suitable habitat may affect, and is likely to adversely affect (direct and indirect), spotted owls because such harvest will remove suitable habitat and therefore decrease the amount of nesting, roosting, and foraging habitat for an owl pair.

No suitable spotted owl habitat will be removed with the Lang Dam project within the home range of any known spotted owl activity center. No Recovery Action 32 (RA32) habitat occurs within the proposed treatment areas. The Lang Dam Project will not cause a trend toward federal listing, nor jeopardize the continued existence of the spotted owl.
Scale of Analysis
The geographic scale used to assess direct, indirect, and cumulative effects for threatened northern spotted owls was a 300m, 0.5 and 1.2 mile radius buffer around all pair activity centers for the spotted owl within the project area. These habitat radii were used to determine available amounts of suitable and dispersal habitat.

Affected Environment
The northern spotted owl is a federally threatened species under the Endangered Species Act (ESA) that uses forest habitat in the project area. Effects of the various proposed actions for the Lang Dam project were addressed by the Willamette Planning Province Level I Terrestrial Team (2014) and evaluated by the U. S. Fish and Wildlife Service (USFWS) in the FY2015 Biological Opinion (BO) (FWS Reference Number 01EOFW00-2014-F-0221). This BO fulfills the Forest Service’s legal requirement with respect to Section 7 of ESA for the Lang Dam Project, and is consistent with the June 26, 2013, order by Judge Leon in Swanson Group Mfg. LLC et al. vs. Jewell et al. (Case 1:10-cv-01843-RJL, Document 63). This EA incorporates by reference this BO, as well as the Biological Assessment. The analysis of effects to spotted owls in this EA is consistent with regional direction provided October 22, 2013, and November 3, 2015 (Walter 2013, Peña 2015). A summary of the effects of the alternatives on the northern spotted owl is provided in this section.

Effects to the northern spotted owl are based on current survey information provided by the H J Andrews Spotted Owl Demographic Study Area (Forsman et al. 2011), past district wildlife survey data, and an evaluation of the project area for potential owl sites in unsurveyed habitat. Based on habitat suitability, habitat quantity, and the distance to the next nearest owl site, no additional potential owl sites were considered for this project. This methodology was used in absence of current district spotted owl surveys in all areas of suitable owl habitat, and is based on standard methods used in the Willamette Planning Province and supported by science (Willamette Planning Province 2015). Potential sites could support breeding spotted owl pairs, and management of such areas is recommended in the Recovery Plan (U.S. Fish and Wildlife Service 2011). Potential site designation is based on guidance in the Recovery Plan, decades of knowledge acquired from spotted owl surveys, and the best commercial and scientific information available. Spotted owl habitat associations and habitat requirements for reproduction were considered. Potential site centers and their nest patches were located in the best available habitat likely to facilitate spotted owl nesting by providing suitable nest trees and foraging habitat for rearing of young.

Northern Spotted Owl Habitat
Northern spotted owl habitat is classified as:

Suitable Habitat: Suitable habitat that provides for nesting, roosting, and/or foraging, consisting of “...forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90 percent); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly. This habitat is described as nesting and roosting habitat in the revised northern spotted owl recovery plan (USFWS 2011, p. A-10).” Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. Those units for the project which were considered to be suitable spotted owl habitat provide for foraging and roosting with marginal potential for nesting due to the relatively young growth form of the upper canopy and the absence or relatively low number of legacy trees over 250 years old.
**Dispersal-only Habitat:** Dispersal-only habitat provides for protection from avian predators and at least minimal foraging opportunities during dispersal and colonization periods. Dispersal habitat consists of, at a minimum, stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS, 2011, p. A-10). It is comprised of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (dbh) with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, and to roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that will provide some roosting and foraging opportunities during the colonization phase of dispersal, but not at a scale that will support nesting pairs (Willamette National Forest 2009). While dispersal habitat is often referred to in a general sense as stands that are 40-79 years old, growing site conditions, tree spacing, elevation, stand size and landscape juxtaposition, precommercial thinning history, and stand structure, all play a role in the habitat a stand may provide at a particular age after harvest or other disturbance event.

**Non-habitat:** Non-habitat refers to land which is capable of growing habitat, but does not currently function as either suitable or dispersal habitat.

The Lang Dam project area contains a mix of forest stand age classes and was classified into non-habitat, dispersal, and suitable spotted owl habitat based on aerial photos and field reviews conducted in 2015. Owl habitat mapping estimates there are currently about 2,628 acres of suitable habitat (37%), approximately 1,622 acres of dispersal habitat (23%), and approximately 2,077 acres of non-habitat (29%) in the Lang Dam project area (Table 16). In addition, there are approximately 701 acres of private land and 75 acres of U.S. Army Corps of Engineers lands throughout the Lang Dam project area which make up approximately 11 percent of the total project area. Aerial photography shows that most of the private lands have been logged and are thus are non-habitat for spotted owls Private and other agency land acres were not incorporated into the spotted owl analysis or numbers represented in Table 16 shown below.

**Table 16** Lang Dam Project Area Spotted Owl Habitat Type Distribution by Acres and Percent

<table>
<thead>
<tr>
<th>Lang Dam Project Area</th>
<th>Suitable Acres</th>
<th>Dispersal Acres</th>
<th>Non-Habitat Acres</th>
<th>Private and Other Agency Lands</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,628 or 37%</td>
<td>1,621 or 23%</td>
<td>2,077 or 29%</td>
<td>777 or 11%</td>
<td>7,104 (100%)</td>
</tr>
</tbody>
</table>

Recovery Action 32 of the 2011 Revised Recovery Plan for the northern spotted owl identified a need to maintain older, more structurally complex multi-layered conifer forests containing large diameter trees, high amounts of canopy cover, and decadence components such as broken topped trees, mistletoe, large snags, and fallen trees (U.S. Fish and Wildlife Service 2011). Guidance for identifying such stands was developed for the Willamette National Forest with review by USFWS and Bureau of Land Management (Doerr 2012). No Recovery Action 32 (RA32) habitat occurs within the proposed treatment areas, and thus none will be modified or removed for this project.

**Direct and Indirect Effects**

The Lang Dam project is not located in 2012 Critical Habitat for the northern spotted owl and thus, there are no effects to Critical Habitat.

**Known Owl Sites**

Two known owl sites occur in vicinity of the proposed Lang Dam harvest units.
Effects of habitat modification on individual northern spotted owl sites are assessed at three spatial scales: the home range, core area, and nest patch.

**Home Range:** A home range in the Oregon Cascades Province is a 1.2 mile radius circle (2,955 acres) around a known or potential spotted owl site (Thomas et al. 1990, Courtney et al. 2004). It is used by northern spotted owls to obtain cover and food, and for reproduction and rearing of young. Home ranges of multiple northern spotted owl pairs may overlap with habitat shared between adjacent resident northern spotted owl pairs and dispersing northern spotted owls. These areas are important for the survival and productivity as northern spotted owls are non-migratory.

**Core Area:** Within the home range, the core area (500 acres) is a 0.5 mile radius circle centered on the activity center, representing the area most heavily used during the nesting season (Bingham & Noon 1997). The core area is defended by territorial northern spotted owls and generally does not overlap the core areas of other northern spotted owl pairs.

**Nest Patch:** Within the core area, the nest patch (70 acres) is defined as a 300 meter radius circle around the activity center. This is based on habitat use of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest. The two key elements of habitat within a nest patch are: (1) canopy closure of dominant, co-dominant, and intermediate conifer and hardwood trees and (2) the amount of down wood. Modification of habitat within this area is considered likely to affect the reproductive success of nesting northern spotted owls and is used in determination of incidental take. No proposed units overlap nest patches.

The U.S. Fish and Wildlife Service (USFWS) have determined viability thresholds of 50 percent suitable habitat in the core area and 40 percent suitable habitat in the home range, respectively. Suitable habitat levels below these thresholds are thought to compromise the reproductive success of owls. More than half of the high quality spotted owl territories had core areas comprised of 50 to 65 percent older forest (Franklin et al. 2000). Bart (1995) calculated that spotted owl populations were stable when the average proportion of nesting, roosting, and forage habitat in the home range was 30 to 50 percent. Owls may successfully fledge young when suitable habitat drops below these percentages, but the likelihood of this decreases as suitable habitat declines. It should however be noted that this analysis was carried out before barred owls became a major issue to spotted owl populations, and that in 2016, there are few if any stable northern spotted owl populations.

**Environmental Consequences**

**Northern Spotted Owl Habitat - Direct and Indirect Effects**

**Alternative 1 – No Action**

Alternative 1 would have no effect on suitable or dispersal spotted owl habitat (see Affected Environment section above for habitat definitions). Non-habitat plantations would slowly develop into dispersal habitat within another 10-15 years as the stands thin themselves. Those stands which are currently dispersal habitat would develop into low quality foraging habitat within 40-50 years. Stands which currently have larger remnant trees of larger diameters could become low quality nesting habitat within that timeframe as well. The stands which are currently foraging habitat with some nesting opportunity would develop towards old growth conditions and start to become high quality suitable owl habitat fitting Recovery Action 32 stand characteristics in about 50-100 years.

**Alternative 2 – Proposed Action**

Alternative 2 will treat stands between 40-120 years which are non-habitat, dispersal or suitable foraging habitat for the northern spotted owl. Some of the older stands may have scattered remnant overstory trees with potential owl nesting structures, however these trees will not be harvested unless they pose a safety hazard to the logging or post-harvest underburning operation. Table 17 displays Alternative 2 proposed treatment acres by age class. Table 18 shows treated acres by spotted owl habitat type and
treatment type. It should be noted that more acres were analyzed and consulted on with the U.S. Fish and Wildlife Service for habitat modification and removal than the final actual acres proposed for the Lang Dam Project. Please refer to the Biological Opinion for additional information. Consultation acres and effects included the entire unit footprint. Project field surveys and planning resulted in areas within that original unit footprint that will be left unharvested for a variety of reasons such as riparian protections for water quality, botanical concerns, and/or landscape skips. Field surveys determined that the remaining portions of unit 210 and 220 that were logged in 2000 do not qualify as suitable foraging habitat since the remaining canopy falls below 60%. These two units are currently dispersal habitat for spotted owls. Thus, effects to owls have been reduced from an initial 84 acres of suitable habitat removal to 17 acres. Further reductions in effects to owl habitat are a result of where the proposed units lay on the landscape, and how they connect to other habitat types. In addition unit 210 has been dropped, and 12 acres of unit 220 have marked as skips.

<table>
<thead>
<tr>
<th>Thinning Units</th>
<th>Actual Acres of Thinning Units, Gaps, Skips and Dominant Tree Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>41-80 years</td>
<td>592</td>
</tr>
<tr>
<td>81-120 years</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>630</td>
</tr>
</tbody>
</table>

Note: Skips are not harvested, however, depending on their size and location within the unit, they may no longer provide spotted owl habitat.

**Treatments in Suitable Habitat:**
Alternative 2 will remove about 17 acres or less than one percent of the suitable owl habitat in the project area with unit 180, making the habitat unsuitable for spotted owls. In about 40 years post-harvest, the stand will develop into dispersal habitat. Retention of about 61 trees per acre with the proposed thinning treatment will allow this stand to provide higher quality dispersal habitat compared to what will occur in a regeneration harvest without leave tree retention. Suitable owl habitat will develop after 80 to 140 years post-harvest, and the stand could achieve characteristics that fit the Recovery Action 32 description due to the retention of legacy trees that will exist in the stands at that time.

Alternative 2 proposes post-harvest underburning of up to 588 acres to reduce activity generated fuels. During the underburns approximately 20% of the 3-9 inch slash will be consumed. (See Fire and Fuels Section 3.10). Post-harvest underburning may also result in a small amount of overstory tree mortality. Generally, an overstory mortality level of up to 10 percent is allowable and desirable for wildlife habitat because it helps create dead wood structures which are used by the spotted owl rodent prey base and other species. In reality, post-harvest underburning generally does not result in more than a few dead overstory trees, if any.

**Treatments in Dispersal Habitat:**
About 440 acres of dispersal-only habitat will be moderately or heavily thinned, leaving over 40% canopy cover (=moderate thinning) or under 40% canopy cover (=heavy thinning), which makes up approximately 27 percent of the dispersal habitat in the project area. Units proposed for moderate thinning which maintain an average of approximately 40 percent canopy cover are expected to close their canopies back to pre-harvest conditions within 7-10 years. However, habitat suitability for flying squirrels, the main prey of spotted owls in the central Oregon Cascades, may not recover even after 11-13 years post-thinning (Manning et al. 2012). Units with heavier thinning treatments and lower average canopy retention near 30 percent will need approximately 10-15 years to reclose their canopies back to pre-harvest conditions. Thinning of dispersal habitat will benefit overall forest structural development and improve long-term (>25 years) spotted owl habitat conditions. Post-harvest snag and large down
wood habitat enhancement in selected thinning units will improve stand structure conditions even more for spotted owls and their prey in the long-term.

Treatments in Non-Habitat:
Approximately 188 acres of forest stands that are currently non-habitat for spotted owls will be thinned. This is about nine percent of all the non-habitat forest stands in the Lang Dam project area. Thinning these stands will benefit spotted owls because after 7-15 years, forest structure will be improved over the current condition, and they will develop into dispersal habitat conditions faster than if they were left to develop naturally. Structural enhancements such as snag and down wood placement will further benefit spotted owl habitat quality. This will improve this habitat in the near future in about ten years, and longer term for 20-30 years.

No Treatments in RA32 Stands:
Recovery Action 32 of the 2011 Revised Recovery Plan for the northern spotted owl identified a need to maintain older, more structurally complex multi-layered conifer forests containing large diameter trees, high amounts of canopy cover, and decadence components such as broken topped trees, mistletoe, large snags, and fallen trees (U.S. Fish and Wildlife Service 2011). Guidance for identifying such stands has been developed for the Willamette National Forest with review by USFWS and Bureau of Land Management (Doerr 2012). No Recovery Action 32 (RA32) habitat occurs within the proposed treatment areas. One unit and a portion of unit 220 were dropped from the proposal after a 2015 field review determined they qualify as RA32 habitat.

Table 18 Treated Acres by Spotted Owl Habitat Type and Activity

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Suitable Acres</th>
<th>Dispersal Acres</th>
<th>Non-habitat Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvest</td>
<td>17</td>
<td>440</td>
<td>188</td>
</tr>
<tr>
<td>Post-Harvest Underburn</td>
<td>17</td>
<td>440</td>
<td>131</td>
</tr>
<tr>
<td>Total Treated Acres</td>
<td>17</td>
<td>440</td>
<td>188</td>
</tr>
</tbody>
</table>

Northern Spotted Owl - Cumulative Effects

*Alternative 1*
Alternative 1 would have no direct effects on spotted owl habitat, so there are no cumulative effects to be considered.

*Alternative 2*
The spotted owl habitat evaluation above incorporates past Forest Service activities in the Lang Dam project area in the analysis of the current condition, e.g. non-habitat and dispersal habitat acres in the project area accounts for past timber harvest. Other currently ongoing activities in the Lang Dam project area that could result in effects to spotted owl habitat are the Buck Thin and 7 Thin Timber Sale which will log about 134 acres in younger stands under 80 years of age which are dispersal habitat. The recently completed 410 Road Hazardous Fuels Reduction Project removed understory vegetation in approximately 94 acres of stands of mixed ages ranging from 40-100 years of age and thus qualified as dispersal and suitable owl habitat. The Lower 19 Road Hazardous Fuels Reduction Project is currently being analyzed and proposes understory treatments of 520 acres in the Lang Dam project area, most of which is suitable owl habitat. The Lower South Fork Floodplain Enhancement Project is another project that is currently in the planning stage that will remove approximately 33 acres of suitable owl habitat in the project area. Together with the proposed Lang Dam Project Alternative 2, these projects will result in impacts to 533 acres of suitable spotted owl habitat, or approximately 15 percent of the Lang Dam.
project area. The effects of the hazardous fuels treatments considered in this analysis will be negligible because only a few older trees or snags will be lost.

On a broader scale, Davis et al. (2016: entire) conducted the Northwest Forest Plan monitoring to show trends in spotted owl habitat over the first 20 years of implementation from 1994 to 2013. They found a net decrease of 1.5% in spotted owl nesting/roosting habitat on federal lands from 9,089,700 acres in 1993 to 8,954,000 in 2013 (abstract summary not paginated). Gross losses on federal lands were 473,000 acres from wildfires (-5.2% loss), 116,100 acres from timber harvest (-1.3% loss), and 59,800 acres from insect and diseases (-0.7% loss). Because the gross losses were greater than the net losses, it indicates that the process of forest succession is compensating for some of the habitat loss.

Dispersal habitat increased by 2.2 percent on federal lands, but dispersal capable landscapes decreased by 5 percent due to habitat losses on the surrounding non-federal lands. Large wildfires continue to be the major loss of spotted owl habitat on federal lands and most of these losses occurred within the conservation network of large reserves designed for spotted owl conservation.

The 20-year monitoring results show that within the Western Cascades of Oregon, there was a net gain of 27,100 acres of spotted owl nesting/roosting habitat (1.5% increase) on federal lands, despite gross losses of 101,500 acres (-4.3% loss) (Davis et. al. 2016, p. 21). The losses include 34,900 acres due to timber harvest, 63,000 acres due to wild fires, and minor losses due to insects and unspecified causes. Within the Western Cascades of Oregon, there was a net gain of 122,200 acres of spotted owl dispersal habitat (3.4% increase) on federal lands, despite gross losses of 121,500 acres (-3.7% loss) (Davis et. al. 2016, p. 31). The losses of dispersal habitat include 28,300 acres due to timber harvest, 89,300 acres due to wildfires, and minor losses due to insects and unspecified causes. Recruitment of dispersal habitat on federal lands in the Western Cascades of Oregon is more than compensating for habitat losses with the recruitment rate about twice the rate of dispersal habitat loss.

The analysis of dispersal-capable landscapes found no loss of landscape connectivity in the interior of federal lands within the Western Oregon Cascades (Davis et al. 2016). There has been no loss in landscape connectivity for spotted owls that exists along a wide corridor across the Cascade Range from the Canadian border south into northern California. However, substantial loss to dispersal capable areas has occurred along the south west area of the Willamette Province adjacent to the Willamette Valley and this loss extends south and west across a connection area between the Oregon Coast and Cascade Range south of the Willamette Valley. There also has been some areas of dispersal-capable landscape loss and a few small areas of gain along the eastern edge of the range of spotted owl in the east side Cascades area in the northern half of Oregon.

**Conclusion or Summary**

Based on the above-described effects of the Lang Dam Project, other recently completed and planned projects, and the new Northwest Forest Plan monitoring information, viability for the northern spotted owl will be maintained throughout the project area. The Lang Dam Project will not cause a trend toward federal listing, nor jeopardize the continued existence of the spotted owl. Alternative 2 will not preclude meeting recovery goals for spotted owls, and the landscape will still provide suitable and dispersal spotted owl habitat post-treatment.

**Northern Spotted Owl Critical Habitat (CH) - Direct and Indirect Effects**

The Lang Dam project is not located in 2012 Critical Habitat for the northern spotted owl and thus, there are no effects to Critical Habitat.

**Known Owl Sites - Direct and Indirect Effects**

**Alternative 1**

Because Alternative 1 does not implement any actions, there would be no effects on any known owl sites.
Alternative 2

About 26 percent of the Lang Dam project area is annually surveyed as part of the HJ Andrews Owl Demography Study. The project area has two known spotted owl sites, however neither has had a nesting owl pair for over ten years. The site in the west of the project area had a non-nesting pair in 2012, and the site in the east has not had a spotted owl detection since a day resident single was found in 2007. The old-growth and suitable nesting habitat surrounding Delta Campground has not been surveyed, however the overall habitat acres in that area are well below the analysis threshold levels, and it is unlikely that an undetected pair will be nesting in that location. The U.S. Fish and Wildlife Service (USFWS) have determined spotted owl habitat viability thresholds of 50 percent suitable habitat in the core area and 40 percent suitable habitat in the home range, respectively. Suitable habitat levels below these thresholds are thought to compromise the reproductive success of owls. While there are some areas that have not been surveyed in the past or have very outdated survey data due to the time and expense of conducting surveys, no additional owl sites or nesting pairs are expected to be present. This is due to the low amount of suitable nesting habitat present that does not already overlap a known or historic site.

Effects of Suitable Habitat Removed to Known NSO Sites:
Removal of suitable habitat may affect, and is likely to adversely affect (direct and indirect), spotted owls because such harvest will remove suitable habitat and therefore decrease the amount of nesting, roosting, and foraging habitat for an owl pair.

No suitable spotted owl habitat will be removed with the Lang Dam project within the home range of any known spotted owl activity center. No suitable habitat will be removed within the home range radius of any known sites due to dropping stands that are RA 32, as well as field reviews that determined that other proposed units in the sites have less than 60% canopy cover and are therefore not suitable habitat.

Unit 180 has approximately 17 acres, and was determined to qualify as suitable spotted owl habitat and does not fall within the 1.2 mile home range radius of any known owl sites. While this unit itself has not been surveyed, it is located about 0.4 miles between areas to the west and east that are annually surveyed, and is in a highly fragmented area in which no additional owl sites are expected to currently exist.

Effects of Dispersal Habitat Removed to Known NSO Sites:
Removal of dispersal habitat may affect, but is not likely to adversely affect (direct and indirect), spotted owls (unless it is within the nest patch of a known or predicted owl site) because, even though dispersal habitat will be eliminated on these acres, sufficient habitat will remain in the area to facilitate owl dispersal which is the case for all proposed Lang Dam project units (USFWS 2014).

There are four units within the Lang Dam project that will remove approximately 187 acres of dispersal habitat to a post-harvest canopy cover of 20-39 percent for the purpose of improving stand structural diversity and enhancing big game forage. These are fast growing stands and are expected to increase in canopy closure by about 2 percent per year, with most of them achieving dispersal habitat again in 5-6 years after harvest. These four units are: 50, 160, 210, and 220.

Dispersal habitat will be removed within the home range of one known owl home range in the Lang Dam project area. Table 19 shows units within 1.2 miles of Known Owl Sites in the Lang Dam Project Area. Acres outside affected known or predicted owl sites are not shown (Willamette Planning Province Terrestrial Level I TEAM 2015) No dispersal habitat will be harvested within the 0.5 mile nest core.
Table 19 Alternative 2 Proposed Treatments in Spotted Owl Habitat.

<table>
<thead>
<tr>
<th>Owl Site</th>
<th>Harvest Treatment</th>
<th>Proposed Dispersal Habitat Units</th>
<th>Matrix</th>
<th>AMA</th>
<th>Admin withdrawn</th>
<th>Total (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2443</td>
<td>Dispersal Habitat Maintained</td>
<td>20, 60, 100, 110</td>
<td>0</td>
<td>128</td>
<td>0</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>Dispersal Habitat Removed</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1817</td>
<td>Dispersal Habitat Maintained</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Dispersal Habitat Removed</td>
<td>210, 220</td>
<td>0</td>
<td>53</td>
<td>0</td>
<td>53</td>
</tr>
</tbody>
</table>

Effects of Dispersal Habitat Maintained to Known NSO Sites:
Harvest Habitat Maintained may affect but is not likely to adversely affect the spotted owl both directly and indirectly because current spotted owl habitat will be maintained. In the Biological Assessment for the Lang Dam project, only dispersal habitat will be treated under this activity (USFWS 2014).

Dispersal harvest habitat maintained treatment is proposed on 128 acres that will result in a post-harvest canopy closure of at least 40 percent. Table 19 displays one known site with a home range that overlaps these treatment units. However, no dispersal habitat will be reduced with the harvest habitat maintained treatments. These treatments in dispersal habitat stands are may affect but are not likely to adversely affect spotted owls (USFWS 2014).

Spotted Owl Habitat Effects Summary Lang Dam Project:
A summary of the adverse actions anticipated by the Lang Dam project due to habitat modification is shown in Table 20 and Table 21. No northern spotted owl sites will be adversely affected by habitat modification and associated activities, and there will be no take or harm to spotted owls with this project.

Table 20 Summary of Adverse Effects due to Spotted Owl Habitat Modification

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Proposed Activity</th>
<th>Current Habitat Type</th>
<th>Post-treatment Habitat</th>
<th>LAA (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lang Dam</td>
<td>HH Remove</td>
<td>Suitable</td>
<td>non-habitat</td>
<td>17</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td></td>
<td>486</td>
</tr>
</tbody>
</table>

Table 21 Lang Dam Project Effects to the Northern Spotted Owl

<table>
<thead>
<tr>
<th>Lang Dam Project</th>
<th>Effects to the Northern Spotted Owl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotted Owl Habitat Modification</td>
<td>May Affect, Likely to Adversely Affect</td>
</tr>
<tr>
<td>Noise Disturbance?</td>
<td>May Affect, Not Likely to Adversely Affect</td>
</tr>
<tr>
<td>Effects to Critical Habitat</td>
<td>No Effect, not located within Critical Habitat</td>
</tr>
<tr>
<td>Habitat Modification within 300 meter nest patch?</td>
<td>No</td>
</tr>
</tbody>
</table>
Lang Dam Project  |  Effects to the Northern Spotted Owl
--- | ---
Habitat Modification within 0.5 mile nest core?  |  No
Habitat Modification within 1.2 mile home range?  |  No removal of suitable owl habitat within 1.2 mile home range
Take?  |  No

**Cumulative Effects**

*Alternative 1*
Since there would be no effects with Alternative 1, there are no cumulative effects to consider.

*Alternative 2*
The evaluation above incorporates past Forest Service activities in the Lang Dam project area in the analysis of the current condition (e.g. estimate of suitable and dispersal spotted owl habitat available accounts for past timber harvest). The other currently ongoing or planned activities in the Lang Dam project area will not remove any suitable spotted owl habitat within the home ranges of the two known activity centers.
Proposed Threatened and Forest Service Sensitive Wildlife

Sensitive species are species that are not federally listed under the Endangered Species Act, but that are designated by the Forest Service and given special consideration in project analysis due to viability concerns. The goal of the Forest Service is to manage for these species so that they will not become federally threatened or endangered. Effects of the alternatives on Forest Service sensitive species were considered in a project Wildlife Biological Evaluation (BE). This environmental assessment tiers to the analysis in the BE and provides a summary of the effects. Five sensitive species have habitat or potential suitable habitat in the project area and were analyzed in detail in the project BE. One of these species, the Crater Lake tightcoil, is on both the “Sensitive” species list and the “Survey and Manage” species list; therefore discussions of effects to this species will be limited to the table below and the Survey and Manage species discussion section.

Summary of Effects

No impacts to the habitat of Pacific Pond Turtles will occur. Alternative 2 may adversely impact individual Townsend's Big-eared and Fringed Myotis bats, but will not likely result in a loss of viability in the Planning Area, nor cause a trend towards federal listing. Snag habitat enhancement may benefit these bat species.

Pacific Pond Turtle

This species inhabit ponds, marshes, rivers, and streams, preferring those with rocky or muddy bottoms and aquatic vegetation (watercress, cattails, etc.). These turtles feed on aquatic plants, carrion, and insects. They have been found from sea level to about 3,800 feet elevation, although they are more common below 2,000 feet.

Pond Creek which borders Lang Dam unit 80 contains slow moving water habitat and beaver ponds, which may be used by the Pacific Pond Turtle. However, the relatively dense canopy may make this pond of lower habitat quality than if it were to be more open to sunlight, which turtles need. This area was surveyed in 2015 during the planning of the Lang Dam Project, and no turtles were detected. During planning of the Delta Thin Timber Sale in 1995, pond turtle surveys were also conducted in Pond Creek, with no turtles found (April 25 and June 30, 1995 and later additional visits that year). During all of the above surveys, no relatively open, suitable nesting habitat which consists of the preferred clay soil type with a high sun exposure was found.
Fisher
It is unlikely that fishers occur in the project area. While there have been three reported Fisher sightings on the McKenzie River Ranger District (Forest Service NRIS database), none of these have been verified with a photo or DNA. The last verified records of fishers on the Willamette National Forest were in the 1940s with the exception of a 2014 detection at the very south end of the Forest. This individual fisher may only be from a dispersing male from the recent fisher reintroduction at Crater Lake.

Townsend’s Big-Eared and Fringed Myotis Bats
These two bat species are known to roost in tree and snag cavities and under loose bark (Lacki et al. 2007). On the west side of the Cascades, snags are thought to be the main roosting habitat for fringed myotis and a minor roosting component for Townsend’s big-eared bats (Ormsbee personal communication). No tree/snag roost sites have been documented by the Forest Service in the project area or on the Forest, but such sites are very difficult to detect.

Direct and Indirect Effects
Pacific Pond Turtle

Alternative 1
Alternative 1 would have no impact on the Pacific Pond Turtle because no habitat impacts would occur.

Alternative 2
With the recommended no-cut stream buffer of 180 feet to protect the riparian area and water quality in Pond Creek, no impacts to the habitat of Pacific Pond Turtles will occur (Chapter 2 Design Features). There is an opportunity to fall trees into the pond/creek area which may enhance this habitat for Pacific pond turtles.

Cumulative Effects

Alternative 1
Since Alternative 1 would have not cause any impacts to the habitat of Pacific Pond Turtles, there are no cumulative effects to be considered.

Alternative 2
Since Alternative 2 will have not cause any impacts to Pacific Pond turtles, there are no cumulative effects to be considered. The Lower South Fork Floodplain Enhancement Project is currently being planned in the Lang Dam project, and will benefit turtle habitat by restoring slow-moving side channel habitat and creating five small ponds. There are no other ongoing or future planned projects in the Lang Dam project area that will impact turtles.

Direct and Indirect Effects
Fisher

Alternative 1
Alternative 1 would have no impact on the fisher. Stands under 40 years old would develop diverse structure more gradually compared to thinning them now. As these stands continue to thin themselves out, the small openings would begin to show more understory forbs, shrubs, and a second layer of conifers, moving these stands towards late-successional habitat which would benefit fishers. The older stands in the Lang Dam area would continue to develop towards old-growth habitat conditions, which should improve habitat conditions for fishers. Alternative 1 would not affect these stands, which, barring high-intensity fire or other large scale disturbance, would continue to develop forest structure like tree cavities for resting and natal dens that would benefit fisher if they occurred in the watershed.
**Alternative 2**

Due to the fact that Fisher has not credibly been documented to occur on the McKenzie River Ranger District, Alternative 2 is very unlikely to affect the Fisher, yet some potential Fisher habitat may be affected. Alternative 2 of the Lang Dam Project includes thinning approximately 53 acres (footprint acres which includes about 7 acres of no-cut skips) of stands over 80 years old. These older stands contain higher quality potential habitat for this species. Thinning proposed in Alternative 2 will degrade potential fisher habitat by reducing future snag and downed wood sources and by reducing forest canopy that could aid in thermoregulation (Raley et al. 2012). However, some forest structure of value to fishers will remain with the overstory tree retention that will be left and with the snags and downed wood that will be created and enhanced within about 120 acres of riparian reserves Table 5. Additional snags and downed wood may be created and enhanced throughout many units. Unit harvests will leave most of the largest overstory trees, however, depending on tree spacing, they may not always be retained. Alternative 2 will impact less than 1 percent of 1 hypothetical female fisher home range based on where units over 80 years of age are clustered. Less than 1 percent of 1 hypothetical male fisher home range may be impacted. Alternative 2 will retain sufficient habitat to provide for fishers should they reestablish in the area in the future.

The management recommendation to leave and/or create large down wood (EA Design Criteria in Chapter 2) may ensure habitat requirements of this species are met, and will provide long-term potential future habitat benefits to Fishers, if they occur in the area.

Fisher is not likely to currently inhabit the Lang Dam project area and thus, any effects to potential habitat are unlikely to occur. Due to the lack of any documented presence of the Fisher on the McKenzie River Ranger District, it is my determination that Alternative 2 will not impact this species. In the longer term (>10 years), with the potential for large down wood creation where it is currently scarce, Alternative 2 may benefit potential Fisher habitat.

**Cumulative Effects**

**Alternative 1**

Since Alternative 1 would have not caused any impacts to the habitat of fisher, there are no cumulative effects to be considered.

**Alternative 2**

Considering this project as well as past, present, and reasonably certain future projects, over 50 percent of the Lang Dam project area will remain in forest habitat greater than 80 years of age (EA Chapter 3, Forest and Stand Structure). No stands over 180 years of age will be modified and thus, about 20% of the project area will provide older forest habitat structures as potential high quality fisher habitat. The Lower South Fork Floodplain Enhancement Project is currently in the planning stage, and will remove or modify approximately 33 acres of older forest habitat in the project area. Alternative 2 will retain sufficient habitat to provide for fishers should they reestablish in the area in the future.

**Direct and Indirect Effects**

*Townsend’s Big-eared and Fringed Myotis Bats*

**Alternative 1**

Alternative 1 would have no impact on Townsend’s Big-eared and Fringed Myotis bats. Stands under 40 years old would develop diverse structure more gradually compared to thinning them now. Snag and down wood development would occur naturally over time, primarily within the next 20-40 years as the stands thin themselves, benefitting habitat for the Fringed Myotis and Townsend’s Big-eared bat. Stands between 40-80 years old would continue to grow larger tree diameters. As these stands continue to thin themselves out, the small openings would begin to show more understory forbs, shrubs, and a second layer of conifers, moving these stands towards late-successional habitat which would benefit bats. The
older stands in the Lang Dam area would continue to slowly develop towards late-successional habitat conditions, which should improve future habitat for fringed myotis Townsend’s big-eared bats.

**Alternative 2**

Alternative 2 may adversely impact individuals, but would not likely result in a loss of viability in the Planning Area, nor cause a trend towards federal listing. Snag habitat enhancement may benefit these bat species.

**Changes to foraging habitat:**

Bats readily forage over large areas, and use a variety of habitats including open and forested areas. Alternative 2 would create approximately 39 acres of open forested habitat with some larger trees and snags in small gaps. An additional approximately 347 acres will be thinned with Alternative 2 (harvest acres excluding skips). The site-specific effect of this change to bat foraging habitat is uncertain, and could range from negative to beneficial. The magnitude of the effects on foraging habitat at the landscape and forest level scales are insignificant, however, because Alternative 2 harvest acres affects approximately 9 percent of the Lang Dam project area, and about 0.04 percent of the Willamette National Forest.

**Amount of roosting habitat affected/Changes to roosting structures:**

Proposed harvest units under 80 years of age currently contain little to no snag habitat, and few potential bat roosting trees/snags that may be used by bats will be lost with Alternative 2. The approximately 53 (footprint) acres of stands over 80 years of age proposed for harvest in Alternative 2 do contain higher levels of snag habitat than the younger plantations. These snags may be lost if they are a safety hazard during the logging operation. Some of these stands will also have prescribed burning treatments after logging which is likely to result in some additional loss of snag habitat. Loss of hazard trees larger than 12” diameter which may have some bat roosting crevices along the haul route may also impact individual roost trees or snags used by this species.

Lang Dam units 210 and 220 contain some large snags and decadent features that might provide potential tree roost sites for bats, but at a much lower abundance than will be found in old-growth forests. Proposed timber harvest in the stands over 80 years of age will retain some of the larger trees and a few large snags, but the harvest and subsequent underburns will largely degrade bat roosting tree habitat on about 53 acres. These are the unit footprint acres and some additional snags in adjacent skips or outside unit boundaries may be lost if they are safety hazards in the logging or underburn operation. However, prescribed underburning may create additional snags that might be used by bats after 10 or more years. In addition, snag creation is recommended on 521 acres (15 out of 21 units) at the rate of 1-4/acre (Chapter 2 Design Features).

Stands mapped as suitable spotted owl habitat were used as a proxy for potential bat tree roost habitat because they contain larger trees and snags. It is estimated that there are about 2,628 and 804,700 acres of potential bat tree roosting habitat in the Lang Dam project area and on the Willamette National Forest, respectively. On the Willamette National Forest, this makes up about 48 percent of the total forest acres. In the Lang Dam project area, it comprises about 37 percent of the total acres. Alternative 2 will degrade about 0.6 percent (approximately 89 acres) of the estimated bat tree roosting habitat in the Lang Dam project area, and 0.002 percent of the total Willamette National Forest bat tree roosting habitat.

Because the final stand canopy closure in the older stand thinning units (210 and 220) will remain above 15%, and additional snags and downed wood will be created, it is estimated that in about 80 years, the proposed harvest units will regenerate to a two-layered stand that will begin to resemble old-growth as described by USFS (1986). At that time, these stands will still be lower quality bat roosting habitat than
the untreated stands in Alternative 1 because they would have fewer large snags and large decadent tree components.

**Potential for direct mortality to bats:**
Fringed myotis have strong fidelity to natal roost sites and pups are weaned by the end of July to the end of August depending on factors such as lateness of spring (Ormsbee pers. comm.). If snags or trees used as natal sites are fallen prior to that time, it is likely that some or all the pups and adults will be killed. Mitigation measures will protect some snags, but some will be fallen for safety and operational reasons. Some logging may occur before pups are weaned in late summer, especially in years when parturition is delayed. Thus there is a possibility that direct mortality to bat pups could occur as a result of timber harvest in Alternative 2. The possibility of a natal colony being directly harmed by logging is very low, however, because the bats are thought to be relatively uncommon and natal colonies are thought to occur at low densities on the landscape. Stands 80-100 years old that are proposed for treatment with Alternative 2 have lower potential for bat roosting than old growth forests or forests with substantial numbers of 250-year old trees. Any scattered remnant trees within these stands will not be cut unless they are a safety hazard, i.e. had a broken top. The approximately 53 acres of older forests (counting those over 80 years of age) harvested in Alternative 2 represents about 0.03 percent of the estimated total potential bat tree roosting habitat for these species in the Lang Dam project area. Additional mitigation measures are proposed that will reduce the possibility of direct mortality further (see Design Criteria section below). As the numbers of natal sites increases, so does the possibility that impacting approximately 53 acres of forest will impact a site. However, as the number of sites increases on the forest, the chance that loss of a single site will result in the species no longer maintaining a viable population on the Forest inversely diminishes because many unaffected natal sites will still exist.

Up to 588 acres of post-harvest prescribed underburning may kill a small number of green trees or burn large snags which may be additional loss of large tree/snag bat roosting habitat. However, generally the underburning will take place in spring conditions when fuels are somewhat moist, and it should not cause loss of much habitat. Tree mortality will in the longer term lead to the creation of suitable bat roosting habitat once the tree bark begins to peel off from the tree, leaving suitable bat roosting crevices.

There is a small risk that any snag or hazard tree cutting due to operating and safety concerns will cause mortality to these bat species. There is a chance that bats will escape if trees or snags they are roosting in are cut.

**Cumulative Effects**

**Alternative 1**
Since Alternative 1 would have not cause any impacts to the habitat of bats, there are no cumulative effects to be considered.

**Alternative 2**
The evaluation above incorporates past Forest Service activities in the Lang Dam project area in the analysis of the current condition (e.g. estimate of potential bat roosting habitat available accounts for past timber harvest) and assumed all of the younger stands are unsuitable for bat tree roosting. Other currently ongoing activities in the Lang Dam project area that could result in impacts to bat habitat are the Buck Thin and 7 Thin Timber Sale which will log about 134 acres in younger stands under 80 years of age. The 410 Road Hazardous Fuels Reduction Project was recently completed which removed understory vegetation <7” dbh in approximately 94 acres of stands of mixed ages ranging from 40-100 years of age. The Lower 19 Road Hazardous Fuels Reduction Project is currently being analyzed and proposes treatment of 520 acres in the Lang Dam project area. The Lower South Fork Floodplain Enhancement Project is another project that is currently in the planning stage that will remove approximately 33 acres of suitable owl habitat in the project area. Together with the proposed Lang Dam
Project Alternative 2, these projects will result in impacts to 563 acres of older forests or approximately 15 percent of the Lang Dam project area. The effects of the hazardous fuels treatments considered in this analysis will be negligible because only few older trees or snags will be lost. Viability will still be maintained throughout the project area, and the Lang Dam Project will not cause a trend toward federal listing.

**Survey and Manage Species**

The Northwest Forest Plan was amended with standards and guidelines for conducting project surveys and managing known sites for certain rare or endemic species that were associated with late successional forest habitat (Forest Service and BLM 2001). Species covered by this direction are referred to here as “Survey and Manage” species. There are four wildlife Survey and Manage species on the Willamette National Forest: Crater Lake tightcoil snail, Oregon Megomphix snail, red tree vole, and great gray owl.

**Summary of Effects**

Survey and Manage Species: While this project may impact individual Oregon Megomphix snails, it is not expected to result in any issues for population viability of this species. Alternative 2 will remove or thin approximately 53 acres (footprint acres with skips included) of red tree vole habitat in stands over 80 years of age, but will not affect any documented red tree vole nest areas. Alternative 2 will create about 65 acres of open habitat (39 acres of gaps and 26 acres of dominant tree release) which may enhance opportunities for great gray owl foraging. For all proposed units in Alternative 2, there will be no treatment within 10 meters of perennially wet areas, and there should be no impact to the Crater Lake Tightcoil.

**Oregon Megomphix**

This snail occurs at low to moderate elevations, below the zone of seasonally persistent snow pack. Megomphix snails are most often found within the mat of decaying vegetation under sword ferns and big-leaf maple trees and near rotten logs. Most occupied sites are on well-shaded slopes and terraces, and many are near streams (Management Recommendations for Terrestrial Mollusk Species: *Megomphix hemphilli*, the Oregon Megomphix, Version 2.0, Applegarth 2000). Oregon Megomphix is in S&M Category “A” in Linn County and this project is in Lane County, so surveys are not required. However, the guidelines do require management of known sites as of 9/30/99. In western Oregon most Megomphix locations are between 500-1500 feet, with 2540 feet being the highest elevation at which this species has been found (Forest Service and BLM 1999), however there has been a location found at about 3000’ elevation on the McKenzie River Ranger District and thus, this elevation is being used as the Megomphix habitat upper elevation level for the habitat analysis.

**Red Tree Vole**

Standards and guidelines to conduct red tree vole surveys and protect nest sites were developed, along with other habitat protection measures from the Northwest Forest Plan, to provide a reasonable assurance of persistence of certain species, such as red tree vole, which were believed to be rare and uncommon across the range of the Northwest Forest Plan at the time it was developed. For vertebrate species, like voles, this persistence objective is consistent with the goals of providing for viable and well-distributed populations under the National Forest Management Act Regulations (Forest Service and BLM 2001:3-4; Forest Service and BLM 1994:43-47).

Five red tree vole nests are currently known from the project area that were found during past timber sale surveys for Ridgecat and Cat Thin. Two of these nests were active in 1999 and 2000, and are located in units 60 and 130, both of which are young stands that are about 44 and 53 years old, respectively. The area surrounding the historic nest sites was intensively surveyed during fieldwork activities in 2015, however no nests were seen on September 25, 2015 and September 29, 2015. Three additional nests
outside the proposed unit boundaries were also found during the 1999 surveys with one being active and the other two inactive.

Surveys for the red tree vole were conducted in 2015 in all proposed Alternative 2 stands over 80 years of age if they met the survey requirements in the Red Tree Vole Survey Protocol Version 3.0 (Forest Service and BLM 2012) (units 180, 210, and 220). Stand exam data later determined that units 210 and 220 do not have a canopy covers over 60% and thus, they do not need to be surveyed. Unit 151 was surveyed although the stand age is under 80 years because it does contain some large remnant overstory trees. No red tree vole nests were found. Project surveys were not required in stands to be thinned under 80 years of age for Survey and Manage wildlife species due to exemptions “A”, under what is commonly known as the “Pechman exemption(s).”

Great Gray Owl
Individual great gray owls can be found in a wide variety of habitat types. However, forests appear to be necessary for reproduction in North America (Habeck 1994, Duncan and Hayward 1994). Examples of forest types known to be suitable for great gray owls include: ponderosa pine (Pinus ponderosa), lodgepole pine (Pinus contorta), tamarack (Larix occidentalis), Douglas-fir (Pseudotsuga menziesii), grand fir (Abies grandis), mixed conifer-hardwood, aspen (Populus tremuloidus), and other deciduous tree types. Platt and Goggins (1991) found great gray owl nests on the Willamette National Forest in mature and remnant old-growth Douglas-fir and mixed-conifer habitat. Most nests are located near natural meadows or manmade openings. Bryan and Forsman (1987) found nests in south central Oregon to be less than 980 feet (300m) from the nearest meadow opening. Platt and Goggins (1991) found nests within 660 feet (200m) of a timber-harvest-created opening.

NRIS, the Forest Service web-based wildlife sighting database, shows one Great Gray Owl record in the Lang Dam project area just below the road in unit 220 (Steve Ackers, 4/17/2013). This is a previously harvested stand that currently has about 46% canopy cover. Great Gray Owl surveys have not been conducted in the project area.

In some locations like on the Willamette National Forest, shelterwood harvesting has been found to be beneficial because it opens up closed forest canopy cover for foraging (Forest Service and Bureau of Land Management 2001). Pre-disturbance survey(s) for Great Gray Owls are not required because the proposed harvest units in Alternative 2 do not have proximity to natural openings > 10 acres, and pre-disturbance surveys are not required in suitable nesting habitat adjacent to man-made openings at this time (pg. 14, Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004). The required habitat characteristics of suitable Great Gray Owl habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004).

Crater Lake Tightcoil Snail
This species is associated with areas within 10 meters of perennial wetlands and riparian areas (Duncan et al. 2003).

Surveys were not required for the Lang Dam project because all suitable habitat for Crater Lake Tightcoil will be protected with a minimum of a 10m (30 feet) no-harvest buffer. There will be no active fire ignitions within this buffer area. Many of the perennial streams and wetlands will have a no-harvest buffer which well exceeds this of up to 180 feet (Chapter 2 Design Features).
Direct and Indirect Effects

Oregon Megomphix

Alternative 1
Alternative 1 would have no effect on the Oregon Megomphix snail because there would be no changes to current habitat near bigleaf maple trees.

Alternative 2
All Alternative 2 units are below 3000’ elevation and thus, may impact suitable Oregon Megomphix habitat on about 645 acres, which is an estimated 10 percent of the suitable habitat in the project area (about 6,680 acres below 3000’). While this project may impact individual Oregon Megomphix snails, it is not expected to result in any issues for population viability of this species. The NRIS database accessed on June 7, 2016 shows there are four 1999 records of the Oregon Megomphix in the project area. These known locations are not within or near any proposed units. In addition, there are 90 more Oregon Megomphix records just to the west of the Lang Dam project area, which indicates they are quite abundant in the vicinity. The NRIS database accessed on August 6, 2014 showed over 163 records of the Oregon Megomphix on the Willamette National Forest. These locations were detected with limited survey work over several years, and this number is likely only a very small percentage of all the Megomphix locations on the Forest. While impacts to individuals may occur, the overall population viability will not be impacted.

Cumulative Effects

Alternative 1
Since Alternative 1 would have no effect on the Oregon Megomphix snail, there are no cumulative effects to be considered for this species.

Alternative 2
Past actions which may still be impacting Megomphix habitat in the Lang Dam project area includes the recently completed 410 Road Hazardous Fuels Reduction Project which removed the understory under 7” dbh on 94 acres and may have reduced the habitat quality by reducing understory hiding cover and shade that this snail requires. Two other ongoing projects include the 7-Thin Stewardship Reoffer which includes 80 acres of thinning and three acres of gaps; and the Buck Thin Timber Sale which includes 51 acres of stand thinning. The Lower 19 Road Hazardous Fuels Reduction Project is currently being planned, and will treat a 520-acre area by thinning the understory vegetation. The Lower South Fork Floodplain Enhancement Project is another project that is currently in the planning stage that will remove or modify approximately 121 acres of Megomphix habitat in the project area. (Appendix D). Combined with the Lang Dam Project acres, these projects will impact Megomphix habitat on approximately 1,420 acres or approximately 19% of the suitable Megomphix habitat in the Lang Dam project area. Considering the effects of all past, present and reasonably foreseeable future actions on Oregon Megomplix in the project area, there are no concerns for future persistence or population viability.

Direct and Indirect Effects

Red Tree Vole

Alternative 1
Alternative 1 would have no direct effect on the red tree vole. Thinning of 628 acres of younger stands would not occur, and those stands would take longer to achieve higher quality red tree vole habitat characteristics, including larger tree canopies and diverse structure.
Alternative 2

Alternative 2 will remove or thin approximately 53 acres (footprint acres with skips included) of red tree vole habitat in stands over 80 years of age, but will not affect any documented red tree vole nest areas.

Suitable spotted owl habitat can be used to estimate the amount of the highest quality red tree vole habitat in the project area. There are currently about 2,628 acres of higher quality red tree vole habitat in the project area, and Alternative 2 will remove or thin about 0.6 percent. Because of the number of overstory trees that are being left, the stand will return to conditions matching the description of suitable red tree vole habitat (Forest Service and BLM 2012) in about 50-60 years. About 628 (footprint) acres of lower quality red tree vole habitat in stands under 80 years of age will also be impacted. While nests in younger or more open-canopied stands are less likely to be present, they may still occur.

Cumulative Effects

Alternative 1

Since Alternative 1 would have no effect on the red tree vole, there are no cumulative effects to be considered for this species.

Alternative 2

Other recently completed projects in the Lang Dam project area which have impacted red tree vole habitat quality include the 410 Road Hazardous Fuels Reduction Project which removed the understory under 7” dbh on 94 acres, about half of which was higher quality red tree vole habitat. This project may have reduced red tree vole habitat quality. Two other ongoing projects include the 7-Thin Stewardship Reoffer which includes 80 acres of thinning and three acres of gaps; and the Buck Thin Timber Sale which includes 51 acres of stand thinning, all of which are occurring in lower quality red tree vole habitat. The Lower 19 Road Hazardous Fuels Reduction Project is currently being planned, and will treat a 520-acre area by non-commercially thinning the understory vegetation in older, high quality red tree vole habitat stands. The Lower South Fork Floodplain Enhancement Project is currently in the planning stage that will remove or modify approximately 33 acres of higher quality red tree vole habitat, or about 88 acres of lower quality habitat in the project area. Considering all of these projects combined with Alternative 2 for the Lang Dam Project, about 617 acres of higher quality stands over 80 years of age, and about 897 acres of lower quality red tree vole habitat in stands under 80 years of age will be impacted. This represents about 17% of the higher quality stands in the Lang Dam project area being impacted, with about 2% of this amount resulting from the Lang Dam Project. Considering the effects of all past, present and reasonably foreseeable future actions on red tree voles in the project area, there are no concerns for future red tree vole persistence or population viability. All Survey and Manage guidelines are being followed in the Lang Dam Project.

Direct and Indirect Effects

Great Gray Owl

Alternative 1

Since Alternative 1 would have no effect on the great gray owl, there are no cumulative effects to be considered for this species.

Alternative 2

Decades of successful fire suppression, coupled with past timber harvest and dense planting, has resulted in a limited quantity of openings to support great gray owls.

Alternative 2 will create about 65 acres of open habitat (39 acres of gaps and 26 acres of dominant tree release) which may enhance opportunities for great gray owl foraging. On the west slope of the Cascades, the cutting of openings into forest stands initiates an early successional stage that can support small mammal populations likely to be used by great gray owls up to about ten years post-harvest (Quintana-Coyer et al. 2004). Unit 220 has the heaviest thin planned with a final post-harvest canopy.
cover of about 20%. The 2013 great gray owl sighting in unit 220 indicates some degree of foraging use, and with the proposed thinning to a final post-harvest canopy of approximately 20% the foraging habitat quality for great gray owls will improve. Other units to be thinned will have a final post-harvest canopy cover of 30-40% and thus, stands will only be moderately open for less than about ten years until the canopies close in again. This will only slightly improve foraging opportunities for great gray owls. For those units with older trees (units 180, 210, and 220), most of the largest overstory trees will be retained, which are the trees which may be used by Great Gray Owls for nesting.

Cumulative Effects

Alternative 1
Great gray owls would be impacted by Alternative 1 because no additional openings would be created that would improve their limited foraging opportunities. Decades of successful fire suppression, coupled with past timber harvest and dense planting, has resulted in a limited quantity of openings to support great gray owls.

Alternative 2
Past actions which may have improved great gray owl foraging opportunities in the Lang Dam project area include the recently completed 410 Road Hazardous Fuels Reduction Project which removed the understory under 7” dbh on 94 acres, making the stand more open for great gray owl foraging. Since larger down wood and root wad structures are still present in the understory, this should still provide for adequate small mammal hiding and denning opportunities. Increased sunlight has also stimulated grass and forb seed development which benefits small mammals and thus, the predatory great gray owls. Two other ongoing projects include the 7-Thin Stewardship Reoffer which includes 80 acres of thinning and three acres of gaps; and the Buck Thin Timber Sale which includes 51 acres of stand thinning. Portions of the planned Lower 19 Road Hazardous Fuels Project on approximately 520 acres may also lead to some slight foraging habitat improvements for great gray owls because the understory will be cleared out. The Lower South Fork Floodplain Enhancement Project is another project currently in the planning stage that will remove or modify approximately 121 acres of forest stands in the project area which may benefit small mammal prey of great gray owls. Considering the above-mentioned projects combined with Alternative 2 for the Lang Dam Project, about 1,441 acres of stands will be opened up, which may improve foraging habitat quality for great gray owls which have been recently seen in the Lang Dam project area. There is also a permanent linear opening in the Lang Dam project area due to a transmission line, which provides approximately 9 acres of permanent foraging habitat. Because nesting great gray owls are generally associated with larger, more permanent openings, it is unknown if all of the above-mentioned projects will provide adequate foraging habitat for nest establishment in the area. Since all of the above projects will retain most of the largest overstory trees, nest trees for great gray owls will continue to be present across the Lang Dam Project Landscape.

Direct and Indirect Effects

Crater Lake Tightcoil Snail

Alternative 1
Alternative 1 would have no effect on the Crater Lake Tightcoil snail.

Alternative 2
For all proposed units in Alternative 2, there will be no treatment within 10 meters of perennially wet areas, and there should be no impact to this mollusk. Protection buffers are being placed around perennial wetlands where they occur near or in the proposed harvest units, and prescribed fire treatments will not allow fire to be lit in the 10m riparian buffer area following the management recommendations for this species and thus, no impacts to this species is expected (Forest Service and BLM, 1999).
With the above measures in place, overall population viability in the project area and on the Willamette National Forest will be maintained, and the persistence of this species should not be compromised.

Cumulative Effects

Alternative 1
Since Alternative 1 would have no effect on the Crater Lake Tightcoil snail, there are no cumulative effects to be considered for these species.

Alternative 2
Since Alternative 2 will have no effect on the Crater Lake Tightcoil snail, there are no cumulative effects to be considered for this species.

Management Indicator Species

Summary of Effects
Viable populations of these species will be maintained at the Forest Level. While the loss of snags may impact habitat for these species, snag mitigation and enhancement will benefit these species. Alternative 2 will have beneficial impacts on elk and deer, minor impacts to pileated woodpeckers, and no impacts to marten, bald eagles, and peregrine falcons.

Direct and Indirect Effects
The use of Management Indicator Species (MIS) in project planning was established by the 1982 National Forest Management Act planning regulations. Management Indicator Species are species whose response to land management activities can be used to predict the likely response of a wide range of species with similar habitat requirements. The Final Environmental Impact Statement for the 1990 Willamette National Forest Land and Resource Management Plan identified MIS and the rationale for their selection (Forest Service 1990: III-69, Table 22). Viable populations of MIS will be maintained at the Forest Level. The effects of the alternatives on northern spotted owl are addressed above in the specific section for that species. The project Biological Evaluation concluded that the alternatives will have no impact on peregrine falcons because there is no high quality nesting habitat in the Lang Dam project area. The Biological Evaluation also determined that the alternatives will have no impact on bald eagles because the alternatives do not affect lakes and fish streams. The effects of the alternatives on the remaining MIS are addressed below.

Table 22 Wildlife Management Indicator Species for the Willamette National Forest and Lang Dam Project

<table>
<thead>
<tr>
<th>Indicator Species</th>
<th>Indicator Habitat</th>
<th>Reason Selected in 1990</th>
<th>Lang Dam Alternative 2 Impacts</th>
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</thead>
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<td>cavity excavators¹</td>
<td>dead and decaying trees</td>
<td>ecological indicator, limited habitat</td>
<td>Loss of snags may impact, snag mitigation and enhancement will benefit</td>
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<td>marten</td>
<td>old growth and mature conifers</td>
<td>ecological indicator, limited habitat</td>
<td>No impact</td>
</tr>
</tbody>
</table>
**Indicator Species** | **Indicator Habitat** | **Reason Selected in 1990** | **Lang Dam Alternative 2 Impacts**
---|---|---|---
northern spotted owl<sup>2</sup> | old growth and mature conifers | ecological indicator, limited habitat, proposed threatened species<sup>2</sup> | Likely to Adversely Affect
bald eagle<sup>3</sup> | old growth conifers near large bodies of water | federally threatened species<sup>3</sup> | No impact
peregrine falcon<sup>3</sup> | cliff nesting habitat near abundant prey | federally endangered species<sup>3</sup> | No impact

<sup>1</sup>Forest Service (1990) identified the following species in this group: red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, Lewis woodpecker, black-backed woodpecker, and northern three-toed woodpecker.

<sup>2</sup>Became a federally threatened species in June 26, 1990, as the Willamette NF Plan was being finalized.

<sup>3</sup>Bald eagles and peregrine falcons were subsequently delisted and are now Forest Service Sensitive Species

### Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Cavity excavator MIS are used as an ecological indicator for the abundance of dead and decaying trees. Pileated woodpeckers are MIS that use snags, but also prefer old and mature forests. Cavity excavator MIS species that occur or have potential habitat in the proposed Lang Dam Units are red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, and pileated woodpecker. None of these species are federally listed Endangered or Threatened Species, Forest Service Sensitive species, U. S. Fish and Wildlife Service Birds of Conservation Concern (USFWS 2008), or species that are regionally identified as having current viability concerns. Population trends for these species from breeding bird surveys from 1996–2013 indicate stable populations in Oregon for hairy woodpecker and downy woodpecker, and increasing population trends for pileated woodpecker and red-breasted sapsucker (Sauer et al. 2014). A decline in northern flicker and red-breasted nuthatch has been detected from 1996-2013. Northern flicker is a common resident species that is ubiquitous to most forest habitats in Oregon. They are most abundant in open forest habitat and along forest edges with available large (31 inches dbh or greater) snags (Marshall et al. 2003). The red-breasted nuthatch appears to be fairly common in Oregon and is somewhat flexible to use different forest types. This species is showing a slight population decline due to intensive forest management that reduces the amount of large diameter trees, snags, and structural diversity (Marshall et al. 2003). Despite a recent decline in numbers, both northern flickers and red-breasted nuthatches are well above population levels that will suggest a viability concern.

### DecAID Project Analysis: Snags

A collection of information, referred to as DecAID, has been developed by Region 6 to help projects identify the levels of snags and downed logs required to meet wildlife population needs (Forest Service 2012). At the landscape level, DecAID recommends providing dead wood at levels within the range of historic variability. The 5th field South Fork McKenzie River watershed (137,567 acres) was used to evaluate deadwood at the landscape level for this 645-acre project. Only about nine acres of units 20 and 60 fall within the adjacent McKenzie River-Quartz Creek 5th field watershed.

DecAID evaluates deadwood levels by wildlife habitat type. The South Fork McKenzie River watershed contains five different wildlife habitat types (Table 23). Treatment units within the Lang Dam project are made up entirely of Westside Lowland Conifer-Hardwood Forest (WLCH_C). The other four habitat types, WODF, EMC_ECB, MMC, and PARK, do not have any activities proposed in them, and are thus not further discussed.
Table 23 Wildlife Habitat Types in the South Fork McKenzie River Watershed.

<table>
<thead>
<tr>
<th>Wildlife Habitat Type</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastside (Interior) Mixed Conifer Forest (EMC_ECB)</td>
<td>1</td>
</tr>
<tr>
<td>Montane Mixed Conifer Forest (MMC)</td>
<td>69,400</td>
</tr>
<tr>
<td>Open Parkland (PARK)</td>
<td>5</td>
</tr>
<tr>
<td>Westside Lowland Conifer-Hardwood Forest (WLCH_C)</td>
<td>54,410</td>
</tr>
<tr>
<td>Westside Douglas-fir Forest (WODF)</td>
<td>2,262</td>
</tr>
</tbody>
</table>

Table 24 displays the results for the WLCH_C wildlife habitat type for the South Fork McKenzie River 5th field watershed and shows that this watershed is currently outside the estimated range of natural variability for large snags. Currently, only 8 percent of the acres are in the tolerance level 80 plus category compared to the estimated historic condition with a range of 10-30 percent. Various tolerance levels/_intervals (tl) are displayed that show the proportion of the landscape in the wildlife habitat type that will contain the shown range of snag levels in Table 24.

Table 24 Current Percentages of Landscape in Large Snags (>20 inches dbh) in the South Fork McKenzie River 5th Field Watershed for the WLCH_C Wildlife Habitat Type.

<table>
<thead>
<tr>
<th>HUC_10</th>
<th>HU_10_NAME</th>
<th>Wildlife Habitat Type</th>
<th>tl0to30</th>
<th>tl30to50</th>
<th>tl50to80</th>
<th>tl80plus</th>
<th>Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1709000402</td>
<td>South Fork McKenzie River</td>
<td>WLCH_C</td>
<td>45%</td>
<td>19%</td>
<td>28%</td>
<td>8%</td>
<td>137,567</td>
</tr>
<tr>
<td></td>
<td>Median Historic Condition for Willamette National Forest (historic variability in parentheses)</td>
<td></td>
<td>30 (15-45)</td>
<td>20 (10-30)</td>
<td>30 (15-45)</td>
<td>20 (10-30)</td>
<td>1,675,407</td>
</tr>
</tbody>
</table>

The median historic condition for the South Fork McKenzie River watershed was estimated using levels of snags and downed logs found in strategic plots in unlogged stands of various ages and an estimate of the normal distribution of seral stages derived from the assumed fire return interval. Median values are the mid-point where half of the time deadwood levels will be at or higher than that value and about half the time they will be at or lower than the value. Studies have indicated that fire frequency and severity varied considerably in the past due to substantial variability in weather conditions, and fire severity varied from century to century (Wimberley et al. 2000). Therefore, levels of dead wood have fluctuated considerably over time and plus or minus 50 percent of the estimated median value was used to approximate the historic range of variability.

DecAID provides information on snag and down wood in three tolerance levels, 30 percent, 50 percent, and 80 percent. The 30 percent tolerance level is typically used when considering landscapes that have exhibited extensive harvest activity. The 50 percent tolerance level is typically used when considering matrix land allocations and 80 percent is typically used when considering late-successional reserves. These considerations are general guidelines and it is the responsibility of the biologist to interpret and use information from DecAID to best fit the needs of the area being analyzed.

Table 25 Large Snags/Acre at Various Tolerance Levels for the WLCH_OCA Habitat Type

<table>
<thead>
<tr>
<th>Tolerance Limit (%)</th>
<th>LG Snags/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>large tree stands 4.25</td>
</tr>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>80</td>
</tr>
<tr>
<td>WCH</td>
<td>LG Snags/acre</td>
</tr>
<tr>
<td>large tree stands</td>
<td>4.25</td>
</tr>
<tr>
<td>small to medium tree stands</td>
<td>2.1</td>
</tr>
</tbody>
</table>
Cavity Excavator Snag Population Potential Analysis:
The Willamette National Forest Plan has a Standard and Guideline (FW-121) that states: “Habitat capability for primary cavity excavators shall be maintained to provide for at least 40% or greater potential populations. Habitat shall be provided and monitored at the subdrainage level.” The method that the Forest Plan used to calculate habitat population potential is no longer considered “best science” for determining that viable populations will be maintained.

In order to determine the current distribution of large snags and the capability of the landscape to support primary cavity excavators, an analysis was conducted at the forest level for all 5th field watersheds (February 2016). This analysis estimated the current percentages of the landscape that contain various levels of large snag (>20 inches dbh) habitat.

The 20” dbh and above size class available in the DecAID snag analysis data was used in these calculations, while the snag population potential method is based on 18” dbh and above. Consequently, the results slightly underestimate population potential because snags 18-19.9” dbh are not counted. Snag habitat potential in each watershed did not include acres on private land.

The calculations indicate that on the Willamette National Forest, there is a current snag population potential of about 54% in the Westside Lowland Conifer Hardwood habitat type (Table 26). At the 5th field level, all watersheds are above 40%, although some are not much above that value.

In the South Fork McKenzie River watershed, there is a current population potential of about 61%, compared to a historic reference condition of about 75% (Table 26).

<table>
<thead>
<tr>
<th>Analysis Area</th>
<th>Current</th>
<th>Historic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willamette National Forest-all watersheds</td>
<td>54%</td>
<td>73-77%</td>
</tr>
<tr>
<td>South Fork McKenzie River</td>
<td>61%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Snags in Westside Lowland Conifer-Hardwood Forest Habitat Type—DecAID Project Analysis

The snag analysis suggests that, for WLCH_OCA habitat, snags are currently below historic levels in the South Fork McKenzie River watershed in the 8 percent of the watershed that historically contained high numbers of large snags/acre (Table 24). The median reference condition for total snags 20 inches dbh (diameter breast high) or larger is about 12/acre on approximately 20 percent of the watershed. The median reference condition for smaller and medium snags under 20 inches dbh or larger is approximately 11/acre on that same six percent of the landscape.

Currently, within the South Fork McKenzie River watershed, approximately 58 percent of the WLCH_OCA habitat is estimated to have low levels of large snags (4/acre) compared to an estimate of 30 percent for the median historic condition.

Within the Lang Dam project stands being harvested, 48% of the units proposed show low levels of snags <3/acre (Table 27). Snags counted were 14 inch dbh and higher and thus, the difference to historic snag levels is greater than the comparison between Table 27 and Table 29. The current low density of snags and greater percentage of areas lacking higher levels of snags compared to historic conditions is mainly due to past clearcut harvesting that removed existing snags as well as the trees that could provide future snags.
Hundreds of wildlife trees have been created in various harvest units in the South Fork McKenzie River watershed since the late 1980s to mitigate for the loss of snags from timber harvest and ongoing fire suppression activities. Treatments used were blasting, girdling, girdle and inoculate, inoculate, sawtop, and combination treatments of sawtop and inoculate.

Table 27 2015 Snag Field Surveys of the Proposed Lang Dam Units. (Visual estimates of snag habitat over 14” diameter)

<table>
<thead>
<tr>
<th></th>
<th>High (&gt;6 trees/acre)</th>
<th>Moderate (3-6 trees/acre)</th>
<th>Low (&lt;3 trees/acre)</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 Lang Dam units</td>
<td>9%</td>
<td>0%</td>
<td>48%</td>
<td>43%</td>
</tr>
</tbody>
</table>

Due to the lack of areas with high levels of snags as described above, mitigation and/or enhancement is being recommended in selected units (Table 6, Design Criteria 34, 35, 36; Table 7).

Northwest Forest Plan Standards and Guidelines for Coarse Woody Debris in Matrix Management (C-40)

The Northwest Forest Plan specifies that for regeneration harvests, 240 linear feet of logs per acre greater than or equal to 20 inches in diameter will be left. Logs less than 20 feet in length cannot be counted towards this total, and only decay classes 1 and 2 will be counted. Down logs should reflect the species mix of the original stand. In areas of partial harvest, the same basic guidelines should be applied, but they should be modified to reflect the timing of stand development cycles where partial harvesting is practiced.

Logs in Westside Lowland Conifer-Hardwood Forest

Current levels of large down logs within proposed Lang Dam stands are within historic levels. Field surveys of the Lang Dam proposed units during 2015 showed approximately 27 percent of all proposed units with >6 down logs over 14 inches diameter/acre, 23 percent had moderate levels of approximately 3-6/ large logs acre, and 45 percent had under 3 large logs/acre (Table 29) While many of the plantations showed relatively high levels of very large diameter down wood that was left from the original harvest which provides excellent habitat benefits, about 45% of the area contains low levels of large down wood.

DecAID Project Analysis

Large down wood, as well as snag densities, have varied considerably from one century to the next due to wide fluctuations in fire severity. Table 28 displays an analysis of the current levels of the South Fork McKenzie River watershed and project area landscape that contain various per acre levels of large logs. For example, about 19 percent of the landscape will be expected to contain about 2-4 large logs per acre for the predominant WLCH_OCA wildlife habitat type.

Table 28 Current Levels of the Landscape Containing Various Levels of per Acre Large Log (>20 inches dbh) in the South Fork McKenzie River 5th Field Watershed for the WLCH_OCA Wildlife Habitat Type.

<table>
<thead>
<tr>
<th>HUC_10</th>
<th>HU_10_NAME</th>
<th>Wildlife Habitat Type</th>
<th>0</th>
<th>0-2</th>
<th>2-4</th>
<th>4-6</th>
<th>6-8</th>
<th>Over 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1709000403</td>
<td>South Fork McKenzie River</td>
<td>WLCH_OCA</td>
<td>32%</td>
<td>22%</td>
<td>19%</td>
<td>13%</td>
<td>6%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Current levels of large down logs within proposed Lang Dam stands are within historic levels, and population viability for species that depend on this habitat type will be maintained in the Lang Dam project area under Alternative 2.

Field surveys of the Lang Dam proposed units during 2015 showed approximately 27 percent of all proposed units with >6 down logs over 14 inches diameter/acre, 23 percent had moderate levels of approximately 3-6/ large logs acre, and 45 percent had under 3 large logs/acre (Table 29). Many of the plantations proposed for treatment with the Lang Dam project show relatively high levels of very large diameter down wood that was left from the original harvest, with quite large diameters over 40” which
provides excellent habitat that will last for many more decades. However, about 45% of the area contains low levels of large down wood.

Due to the high amount of areas that currently contain low levels of large down wood in the Lang Dam project area as described above, mitigation and/or enhancement is being recommended in selected units (Table 3, Table 4, Design Criteria 30, 31 Table 6).

**Table 29 2015 Down Wood Field Surveys. Proposed Lang Dam units showed the following visual estimates of down wood over 14” diameter.**

<table>
<thead>
<tr>
<th></th>
<th>High (&gt;6 trees/acre)</th>
<th>Moderate (3-6 trees/acre)</th>
<th>Low (&lt;3 trees/acre)</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 Lang Dam units</td>
<td>27%</td>
<td>23%</td>
<td>45%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Many of the plantations showed relatively high levels of large down wood that was left from the original harvest, with quite large diameters over 40”, such that it will last many more decades.

**Elk and Deer**

Elk and deer are Forest MIS, not because of viability concerns, but because they are important big game hunting species in Oregon. The project area is in the state-designated McKenzie Wildlife Management Unit (WMU). Since the beginning of the Willamette Forest Plan in 1990, deer numbers and hunter success have fallen by more than 50 percent and elk numbers have declined substantially below Oregon Wildlife Population Management Objectives (Forest Service 2011) in that WMU. Reduced forage quality and quantity due to the reduction in clearcut logging on the Willamette National Forest are important factors in this decline.

Past harvest activities have shaped the landscape in terms of the types of elk habitat. Harvest treatments were primarily clear cuts and patchy regeneration harvest. These harvested units once provided a wealth of quality forage for elk but have since grown into hiding and thermal cover. The Oregon Department of Fish and Wildlife developed statewide management plans for elk and black-tailed deer (ODFW 2003, ODFW 2008) that note the need for higher quality forage areas on National Forest lands. With the cessation of large-scale clearcutting in Northwest National Forests, forage quality and populations have declined on the Willamette National Forest for both deer and elk as estimated from 1990-2010. Elk harvests and hunter success peaked in the late 1990s and have declined since then (ODFW 2003). The estimation of elk numbers is not an exact science. The professional consensus of ODFW area managers (based on minimum known elk numbers, estimates of animals missed during surveys, and the amount of areas lacking counts) is that the Wildlife Management Unit that overlaps the project area is substantially below State Population Management Objectives (Brian Wolfer, pers. com. 2014).

Management objectives for deer and elk habitat apply to specific mapped “Emphasis Areas” within the Willamette National Forest. Each emphasis area has been assigned a rating of high, moderate, or low. Standards and Guidelines for management of these areas were developed in cooperation with the Oregon Department of Fish and Wildlife. The Lang Dam planning area includes portions of three designated emphasis areas: Cougar, East Fork and Minor Tributaries (Figure 10), however, all of the proposed activities except about nine acres are located in the Cougar emphasis area. The Cougar emphasis area has a low quality rating as does the Minor Tributaries area, while the East Fork is rated as high. These areas are managed for elk habitat under guidance from the Willamette National Forest Plan Standards and Guidelines (FW-137), with the assumption that providing high quality elk habitat will adequately address the needs for black-tailed deer.
Elk Model for Lang Dam Project Area

A Model to Evaluate Elk Habitat in Western Oregon (Wisdom 1986) was used to estimate habitat effectiveness (HE), (Willamette National Forest Plan 1990), which is defined as the proportion of achievement relative to an optimum condition. The management intent is to maintain effectiveness within a range of values with the optimum value being 1.0. HE incorporates and qualifies four key habitat attributes: size and spacing of forage (HEs), quality of forage (HEf), cover areas (HEc), and open road density through elk habitat (HER). Each habitat variable is calculated individually and allows for a comparison by variable or as a whole (HEI). The elk model considers past and ongoing activities and results in an evaluation of the cumulative impacts on habitat from the past, present, and foreseeable future actions in the emphasis areas.

Maintaining a balance between cover and forage areas is a key component of elk habitat management in the Wisdom model. However, Cook et al. (1998) found that thermal cover did not enhance elk survival and production. They also found that thermal cover was not required by elk where food was not limiting, and could not compensate for inadequate forage conditions. Further research has shown that high summer and fall forage quality is critical to elk reproduction, survival, and population growth and stability (Cook et al. 2004). The increased importance of available forage abundance and quality, compared to thermal cover has also been supported by nutritional and physiological studies of black-tailed deer (Parker et al. 1999).

Westside Elk Model for the Lang Dam Project Area

Recent research has found that the quality and quantity of summer and fall forage is of great importance to elk populations. An increase in summer and fall elk forage quality can directly increase calf weights prior to winter, overwinter calf survival, pregnancy rates, adult fall fat accumulation, and herd productivity (Cook et al. 2004). The benefits of increased summer forage quality that have been demonstrated for elk are also expected for deer. The Westside Elk Model was developed to estimate
how silviculture treatments affect summer forage quality in western Oregon (Rowland et al. 2013). This updated model contains the following two components.

Elk Nutrition Model: The nutrition model predicts dietary digestible energy (DDE) that elk can acquire from each plant community during summer. Digestible energy levels in elk diets in summer are affected by nutritional adequacy of the various vegetation communities used by elk while foraging and are related to reproduction and survival in summer and subsequent seasons. The nutrition model predicts DDE for landscapes. There are four inputs to calculate dietary digestible energy: potential natural vegetation (PNV) zone, modeling region (1 of 3), canopy cover (%) of live trees, and proportion of total live trees (>2.5 cm diameter breast height) that are hardwoods.

Elk Habitat Use Model: The key components that have been identified as important for predicting elk habitat use are: 1) dietary digestible energy (higher DDE, higher predicted elk use), 2) distance to roads open to public access (farther from roads, higher use), 3) percent slope, and 4) distance to cover/orage edge (closer to edge, higher use).

### Table 30 2016 Willamette National Forest analysis of DDE Categories by Elk Emphasis Area.

<table>
<thead>
<tr>
<th>DDE Class/Elk Emphasis Area</th>
<th>Cougar</th>
<th>Minor Tributaries</th>
<th>East Fork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>43%</td>
<td>57%</td>
<td>23%</td>
</tr>
<tr>
<td>Marginal</td>
<td>49%</td>
<td>41%</td>
<td>70%</td>
</tr>
<tr>
<td>Good</td>
<td>1%</td>
<td>0.2%</td>
<td>2%</td>
</tr>
<tr>
<td>Excellent</td>
<td>1%</td>
<td>0.2%</td>
<td>3%</td>
</tr>
<tr>
<td>Non-forested</td>
<td>6%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

**Marten**

Marten are members of the weasel family that prefer mature and old conifer-dominated forest habitat and use cavities in snags and logs for denning, resting, and natal sites. Recent information suggests that marten primarily only occur in montane conifer forests above about 4000’ elevation on the Forest. A 2012-2015 carnivore detection study in the Mt Jefferson, Mt. Washington, and Three Sisters Wilderness Areas on the Willamette and Deschutes National Forests found 90% of sites sampled (n=31) above 4000’ elevation to be occupied by marten (Hiller and McFadden-Hiller 2013; Doerr, personal communication). Marten are unlikely to inhabit the Lang Dam project area due to the low to moderate elevations below 4,000.’ While there have been several reported marten sightings below 4,000’ elevation on the Willamette National Forest, none of these sightings has been verified with a photo or DNA evidence.

**Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance**

*Direct and Indirect Effects*

**Alternative 1 – No Action**

Alternative 1 would have no impact on any cavity excavator MIS or pileated woodpeckers and would not affect current levels of snags and dead wood. The forest would continue to develop towards old-growth and this should result in a future increase in large snags and large downed logs in those stands and improve future habitat for woodpeckers that prefer old forest habitat, such as the pileated woodpecker. There would be no increase in habitat for species, such as northern flicker, that prefer forest edges and open forest habitat with large snags. There would be no additional wildlife tree and large down wood creation.

**Alternative 2**

The proposed Lang Dam harvest alternatives will affect snags and downed logs on about 9 percent of the project area with Alternative 2.
Snag abundance was generally low or non-existent in the plantations and across the Lang Dam project area, and thus few large snags will be lost. Units 210 and 220 had the highest snag levels and trees with dead tops as well as platform structures, some of which will be lost if they are safety hazards to the logging operations. This may lead to an initial decline of snags on about 53 acres in Alternative 2. It should be noted that these acres exceed the total harvested acres shown in Table 5 in Chapter 2 because the latter exclude skips, gaps and untreated Riparian Reserves, all of which may be impacted if they contain older snags that pose a safety hazard to the logging operations. Prescribed underburning that creates some degree of overstory tree mortality will help improve snag habitat conditions and is desirable at a variably low level, up to ten percent (Table 6 in Chapter 2, Design Features). Wildlife tree enhancement is recommended on approximately 491 acres in Alternative 2 if funding is available.

Lang Dam design features include a mitigation measure to protect existing snags where possible, a mitigation measure to create snags and large down wood in 120 acres of riparian reserves (Table 5), as well as a recommendation to enhance snag and down wood habitat in other units (Table 7 and Table 8 in Chapter 2).

With the Lang Dam project design features (Table 6 in Chapter 2) that recommend post-harvest monitoring and falling 0-3 trees per acre if these levels are not present, downed wood levels will initially increase on 492 acres of forest in Alternative 2. The level of dead wood creation will exceed the minimum levels needed under Forest Plan standards and guidelines, which are intended for regeneration harvest. Created snags will also contribute to future dead wood in the units, but, long-term over 100 years or more, there will be less large downed wood in the harvested acres compared to Alternative 1 because timber harvest will remove much of the future deadwood source.

The thinning prescription for the Lang Dam Project will retain canopy cover from 20-59% in the harvest units and thus, adequate numbers of leave trees will be retained for the recommended post-harvest snag and down wood enhancement. If these recommendations are implemented, Alternative 2 will retain snag and large down wood habitat above minimum Forest Plan Standards and Guidelines, and the proposed Lang Dam project will temporarily degrade, but not remove, habitat for most cavity excavators. There may be benefits to treating the older stands above 80 years of age in Alternative 2 to Northern flickers since they prefer large snags, forest edges, and open forest habitat, all of which will be maintained or created by the proposed silviculture treatments. Red-breasted nuthatches will also benefit with Alternative 2 because about 489 acres of stands under 80 years old will be thinned (Table 3), promoting increased structural diversity that benefits this species.

Pileated woodpeckers are also expected to continue to use the older stands after treatment since they are known to use shelterwood harvest areas (Forest Service 1990: III-73) and the heavy thin treatment proposed for the approximately 38 acres of unit 220 has comparable effects. Assuming that suitable owl habitat will be preferred pileated woodpecker habitat, Alternative 2 will remove 17 acres, or less than one percent of this habitat in the project area.

Cumulative Effects

**Alternative 1 – No Action**

Because there would be no impacts to cavity excavator MIS, pileated woodpeckers or dead wood with Alternative 1, there are no cumulative effects to consider.

**Alternative 2 and 3**

Using the combined acres of suitable and dispersal owl habitat, which represent forests with trees capable of producing 11 inches and larger snags, as a proxy for general cavity excavator habitat, Alternative 2 will degrade 10 percent of the habitat in the project area. Hazard tree removal along the haul route is also expected to result in a very slight additional decrease in snag habitat within the planning area.
Other currently ongoing activities in the Lang Dam project area that could result in impacts to snag and down wood habitat are the Buck Thin and 7 Thin Timber Sale which will log about 134 acres in younger stands under 80 years of age which will only result in low levels of snag habitat loss. The 410 Road Hazardous Fuels Reduction Project was recently completed which removed understory vegetation <7” dbh in approximately 94 acres of stands of mixed ages ranging from 40-100 years of age. The Lower 19 Road Hazardous Fuels Reduction Project is currently being analyzed and proposes understory removal treatment of 520 acres in the Lang Dam project area. The Lower South Fork Floodplain Enhancement Project is another project that is currently in the planning stage that will remove or modify approximately 121 acres of forested stands in the project area. That project may need to fell large snags if they are project safety hazards or fall within the reconfigured channel areas. However, that project may also provide benefits to down-wood-dependent. Together with the proposed Lang Dam Project Alternative 2, these projects will result in impacts to 1514 acres of forests older than 40 years of age, or approximately 19 percent of the Lang Dam project area. While the amount of snag habitat loss initially will not be high, in the longer term over many decades, the abundance of future snag and the subsequent large down wood habitat will be reduced from all of the above activities.

The private lands that make up 10 percent of the project area are expected to remain relatively poor habitat for cavity excavator MIS and pileated woodpeckers. Because Alternative 2 will impact only a small amount of the available habitat, snag and downed wood mitigation measures will be implemented, the individual MIS species are not on any viability “watch-list”, and, considering cumulative effects, future down wood and snag levels are expected to increase as past clearcuts on Forest Service lands mature, followed by the first and second thinning treatments. Alternative 2 is expected to maintain population viability of cavity excavator species and pileated woodpeckers in the project area and South Fork McKenzie River watershed, and will not contribute to any loss of viability of these species at the larger Forest scale.

**Elk and Deer**

*Direct and Indirect Effects*

**Alternative 1 – No Action**

Alternative 1 would maintain the currently poor and marginal quality big game forage levels in the Cougar Elk Emphasis and Lang Dam project area. Current trends of elk habitat development would occur naturally over time with Alternative 1. Existing elk foraging habitat in open plantations would continue growing denser into hiding cover and then into thermal cover over the next few decades. While the overall amount of low quality forage may continue to decrease herd health, elk damage issues in local home gardens and adjacent private forest lands in the Lang Dam project area may increase.

In ten years, forage availability is expected to decrease even more in this area as current harvest openings grow into hiding cover. In the absence of additional harvest or wildfire, no new foraging areas would be created. Current amounts and quality of optimal and thermal cover would not significantly change in the next few decades. Within 75 years, all of the existing thermal cover would shift into optimal cover. Road density and big game security would not change. Overall habitat quality would decrease from the loss of forage.

**Alternative 2**

Commercial thinning on 592 acres will change the function of elk habitat from thermal cover to mostly lower quality thermal cover that contains small inclusions of forage areas. 53 acres have been previously thinned are already in an open forage condition, and thinning them further will improve the forage habitat quality further which will last for 15-20 years. Units with a final post-harvest canopy cover prescription below 40 percent will not provide thermal cover for 7-15 years and be modified hiding cover. However, these more open units will show improved forage habitat conditions compared to those with higher final canopies above 40 percent. Improved forage habitat in the thinned areas will be
Relatively short lived. The understory will show temporarily improved shrub and forb development due to increased sunlight within stands. Forage created by timber harvest generally lasts about 15-20 years until the stands growth into dense plantations that provide less forage.

Early seral foraging habitat will also be created by cutting 1-to-3 acre gaps within thinning units to provide small forage openings totaling 39 acres with Alternative 2. Gap forage values will remain higher longer, than in the thinned areas surrounding the gaps, depending on tree regeneration within the created gaps. While 17 created gap acres will be planted, 22 gap acres will be left to regenerate naturally which may allow the area to remain in a forage condition for a few additional years.

From a wildlife perspective, areas with very large gaps or heavy thinning are not recommended due to the high abundance of invasive weeds in the Lang Dam project area. The permanent opening for the approximately 9 acre transmission line that crosses the Lang Dam project area has had ongoing weed treatments for many years, funded both by the Forest Service and external partners such as the Rocky Mountain Elk Foundation. Thus, any newly created openings will be expected to develop major weed infestations and thus, a more cautious approach that thins most Lang Dam units more moderately has been taken.

Additional benefits to forage quality will occur on the 588 acres proposed for light intensity, patchy, post-harvest under burning, which will stimulate understory vegetation growth. Post-harvest underburning will provide greater benefits to elk and other species dependent on early seral habitat.

After thinning thermal habitat quality will be low for several years. After this time, thermal habitat quality will be improved slightly because trees will have been released, growing taller and larger canopies. Additional understory development will also benefit thermal habitat quality.

There will only be a small reduction in open road densities with Alternative 2, which will decommission 0.3 miles and store 3 miles. Alternative 2 will result in an increase in disturbance throughout the implementation timeframe of this project (2-10 years) due to an additional 2.2 miles of temporary roads and increased traffic to access thinning stands. All temporary roads will be removed once activities are completed.

Past management activities initially resulted in an abundance of forage habitat with the many acres of regeneration harvesting that occurred in the Lang Dam project area. More recently, a lack of regeneration harvest has allowed these forests to grow into hiding and thermal cover to create the current condition represented by Alternative 1, the No-Action alternative. The overall impact of the proposed action is that thermal cover in treated stands will be changed to lower quality thermal cover, hiding cover, or forage. Additional thermal cover does not enhance elk survival or production (Cook et al. 1998).

Cumulative Effects

Alternative 1 – No Action

With Alternative 1, most of the elk and deer foraging habitat would be created on private land. Combined with other ongoing projects such as the ongoing Buck Thin, 7 Thin Stewardship, recently completed 410 Road Hazardous Fuels Reduction Project and the planned Lower 19 Hazardous Fuels Reduction Project, about 748 acres or about 10 percent of the Lang Dam project area would be treated, resulting in newly improved foraging habitat conditions of low to moderate quality.

Alternative 2

Thinning the proposed 645 acres in Alternative 2, combined with other ongoing projects such as the Buck Thin, 7 Thin Stewardship, the recently completed 410 Road Hazardous Fuels Reduction Project and the planned Lower 19 Hazardous Fuels Reduction Project and South Fork Floodplain Enhancement Project, will result in improvements to about 1,514 acres or about 19 percent of the Lang Dam Project area for elk and deer foraging habitat. The combined effect will result in newly improved foraging habitat
conditions of moderate quality. The Cougar Elk Emphasis Area will show increased levels of elk foraging on important winter range. The effects of this are likely to positively influence elk abundance in adjacent Emphasis Areas.

Given what is known about local deer and elk populations, the future viability of these species is assured and they will continue to benefit from habitat restoration opportunities that continue to be implemented – especially when conducted at an appropriate scale.

Marten

Direct and Indirect Effects

Alternative 1 – No Action
Alternative 1 would maintain the current forest habitat and the stands would continue to develop large diameter trees, large snags, and large downed logs as the stands progress into old growth forests. Structural features that marten prefer would continue to increase over time.

Alternative 2
Alternative 2 will not proposed any harvest activities above 4000’ elevation and thus, there will be no impact to marten habitat.

Cumulative Effects

Alternative 2
Because there are no impacts to marten, the Lang Dam project has no cumulative effects on this species.

Migratory Birds

Summary of Effects
Alternative 2 will remove about 53 acres over 80 and up to 117 years of age, and thin about 592 acres between 40 and 80 years of age. The older stands over 80 years of age provide habitat for bird species like the northern goshawk, which prefer older conifer forests. Alternative 2 will impact less than 1 percent of the suitable goshawk habitat in the project area. Alternative 2 will also create about 39 acres of 1-3 acre gaps, and about 26 acres of dominant tree releases. About 22 of those acres will not be planted following harvest, which will benefit migratory birds that use this complex early seral habitat.

Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U. S.C. 703-704). The U.S. Fish and Wildlife Service is the lead federal agency for managing and conserving migratory birds in the United States. However, under Executive Order (EO) 13186, all federal agencies are charged with the conservation and protection of migratory birds. A Memorandum of Understanding (MOU 2008) between the Forest Service (FS) and U.S. Fish and Wildlife Service requires, during NEPA planning, that the FS, to the extent practical, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the FS to consider approaches, to the extent practical, for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled information to assist biologists in disclosing effects to avian species during NEPA planning (Forest Service and Bureau of Land Management 2013). Effects to FS sensitive birds, federally ESA listed birds, and birds that are Management Indicator Species have been addressed above. Four additional migratory bird species that have been identified by USFWS as Species of Conservation Concern in the Northern Pacific Forest (USFWS 2008) and that have habitat in the proposed treatment units are addressed in this section. These four species are northern goshawk, Rufous hummingbird, olive-sided flycatcher, and purple finch.

An emerging concern for migratory birds in the Pacific Northwest is declining early-successional forest habitat (Swanson et al. 2010). Early seral conifer habitat is important habitat for many migratory bird
species, including three of the above Species of Conservation Concern (Altman and Hagar 2007). In particular, there is a lack of complex early seral habitat, which is early successional forests with abundant and diverse shrub understory composition, high abundance of large diameter snags and downed logs, and substantial green tree retention. While private logging lands may create early seral habitat, large diameter snags, downed logs and live leave trees are rarely retained in any quantity, and shrub and forb understory species may be suppressed by herbicide treatments.

**Direct and Indirect Effects**

**Alternative 1**

Alternative 1 would have no direct effect on migratory bird habitat and would not increase habitat for early-seral species. The Lang Dam units would continue to develop towards old growth forest conditions over many decades, resulting in improved nesting and foraging habitat for northern goshawks and other species that prefer this habitat.

**Alternative 2**

Alternative 2 will remove about 53 acres over 80 and up to 117 years of age, and thin about 592 acres between 40 and 80 years of age. The older stands over 80 years of age provide habitat for bird species like the northern goshawk, which prefer older conifer forests. These stands currently provide foraging and potential nesting areas for goshawks. No goshawks have been reported from any of the proposed Lang Dam units, however there were two wildlife sightings in the Lang Dam project area just to the east of the proposed units in the 1990s (Tim Fox 1997, Steve Shope and Joe Serna 1991) (NRIS database accessed June 8, 2016). Protocol goshawk nest surveys have not been completed. Mitigation measures will protect any raptor nests that are incidentally found in the harvest units during layout or implementation. Retention of some overstory trees will slightly reduce the amount of time required to regenerate the stands back to foraging and nesting habitat. In about 80 years after timber harvest, the treatment units will return to suitable goshawk foraging and nesting habitat. Using suitable spotted owl habitat as a proxy for suitable goshawk habitat, Alternative 2 will impact less than 1 percent of the suitable goshawk habitat in the project area.

Alternative 2 will also create about 39 acres of 1-3 acre gaps, and about 26 acres of dominant tree releases. About 22 of those acres will not be planted following harvest. Planting will be required in gaps that have greater than or equal to 25 percent of the unit in gaps. It is recommended that any gaps located more than 0.2 miles from a road not be planted due to the higher cost of planting and the potential to serve as higher quality early seral habitat.

Not planting the gaps will benefit migratory birds that use this complex early seral habitat. Gap placement will avoid steep, rocky areas and favor deep soils and areas where the understory will readily develop. The resulting open habitat is expected to last for about 15 years at the lower and moderate elevations up to about 3500’ and in the one-acre gaps until they fill in naturally with conifer seedlings. The larger 2-3 acre gaps may remain as open habitats for about 20 years if they are not planted. The lower elevation gaps present in the Lang Dam project area are expected to close in faster than higher elevation gaps. The species mix in the lower elevation gaps will include vine maple, deerbrush, red alder, Oregon grape, red huckleberry and native grasses and forbs, the seeds of which benefit some species of migratory birds, as well as pollinators.

**Cumulative Effects**

**Alternative 1**

Other ongoing and recently completed projects in the Lang Dam project area that would provide early seral habitat that migratory birds need include Buck Thin, 7 Thin Stewardship, the recently completed 410 Road Hazardous Fuels Reduction Project and the planned Lower 19 Hazardous Fuels Reduction Project. While Buck Thin and 7 Thin Stewardship would provide early seral gap habitat, the hazardous fuels projects would thin the stands which would only slightly opens the stand understory. Combined,
these projects total about 748 acres or about 10 percent of the Lang Dam project area that would provide early seral habitat conditions for migratory birds.

**Alternative 2**

Other ongoing and recently completed projects in the Lang Dam project area that will provide the early seral habitat that migratory birds need include Buck Thin, 7 Thin Stewardship, the recently completed 410 Road Hazardous Fuels Reduction Project and the planned Lower 19 Hazardous Fuels Reduction Project. Combined with Alternative 2, this will provide about 1,393 acres of slightly open forest stands on about 19% of the Lang Dam project area. The highest quality early seral habitat conditions for migratory birds will be within the gap treatment areas.

Only very few acres of early seral habitat has been created by wild fires in the project area in the past 50 years. A small fire burned in 2010 near Delta Campground, however it was mostly an understory burn that produced new snag habitat, but did not produce much early seral habitat.

An increase in early seral dependent migratory birds will be expected in the regeneration and gap treatment units, and forest edges adjacent to the units, but the increase in birds will be minimal at the landscape level. The 10 percent of the project area that is private timber lands will likely continue to provide some lower-quality early seral bird habitat where stands have been recently clearcut.

No other projects that remove older forest habitat are reasonably foreseeable in this watershed or project area. With Alternative 2, viable populations of goshawks and other migratory birds that use older conifer forests are expected to be maintained at the landscape level because about 20 percent of the project area would remain older forested habitat over 180 years old.

### 3.4 Heritage Resources

#### Summary of Effects

No effects are expected for activities associated with Alternative 1 or 2. Areas previously identified as culturally sensitive, and areas identified during surveys as culturally sensitive have been avoided by either dropping the proposed unit or redesigning the unit boundary. Additionally areas which could become identified during implementation are covered by protection measures that are already in place for this project (see Design Features listed in Chapter 2 Table 6).

#### Scale of Analysis

The geographic scale or area of potential effect used to assess the direct, indirect and cumulative effects for heritage resources includes all units proposed for treatment, road construction, landings, and fuel activities within the Lang Dam Project. An archaeological survey of the Lang Dam Project was conducted in order to comply with Section 106 of the National Historic Preservation Act (NHPA) and other relevant laws and regulations. A systematic surface pedestrian search of the project is the principal manner for implementing the mandated goals.

#### Assessment Methodology

The survey for Lang Dam project took place during May 2013 and May through August 2014 by three crew members. One to three person transects spaced at 15 to 20 meter intervals followed a specific orientation based on factors that included the shapes of units and landforms and the possible presence of historic, Indian or Euro-American travel routes. In high probability areas, one-by-one meter shovel scrapes made with entrenching tools exposed mineral soil in areas where the thick duff layer limited ground visibility. Bearing orientations were followed to the best of abilities, but adjustments in orientation and interval spacing were made in order to avoid dangerous or unreasonable conditions (e.g., exceptionally steep slopes or impenetrable vegetation). A total of 532 acres were surveyed
consisting of 471 high probability acres and 61 low probability acres. One new site was discovered during the survey (06180100747). The newly recorded cultural site is considered potentially eligible to the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine eligibility to the NRHP. No other known cultural sites will be affected by the proposed project actions.

Affected Environment
The prehistory and history of the McKenzie River drainage have previously been summarized in the Cultural Resource Overview for the Willamette National Forest, Western Oregon (Minor and Pecor, 1977) the ten-year update of the above overview (Minor, 1987), Prehistory and History of B. L. M. Lands in West-Central Oregon: A Cultural Resource Overview (Beckham, Minor, and Toepel, 1981) Archaeology of Oregon (2nd Edition) (Aikens, 1986) and numerous other publications. These documents provide adequate detail of ethnographic and historic background for this report.

Ethnographic research indicates that highly mobile pre-contact and early historic Indian groups, notably the Molala, Kalapuya, and their predecessors inhabited the western Cascade Mountains for at least eight thousand years and engaged in subsistence rounds guided by seasonal cycles associated with peak times for hunting, fishing, and plant gathering. Based on linguistic evidence, the primary inhabitants of the Upper McKenzie watershed at the time of contact were likely members of the Santiam band of the Molala (Toepel 1987). Most of what is known of the Molala comes from ethnographic research on the Northern Molala band located in the vicinity of Mount Hood’s drainage systems and the Southern Molala band located west of the Klamath Lake area. Little information exists regarding the Santiam band of the Molala, who are thought to have inhabited present-day Linn and Lane counties in the region between the northern and southern groups (Toepel 1987).

Pre-contact Indian use in the area is reflected in the cultural material left behind including chipped obsidian lithic scatters and obsidian lithic isolates. The lithic scatters and isolated finds are indicative of tool manufacture, modification and use related to hunting, gathering and processing various subsistence resources.

The first recorded contact between the Indians and European trappers and settlers came in 1812 when members of the Pacific Fur Company under the leadership of Donald McKenzie (for whom the river and valley are named) entered the area (Williams, 1988). Subsequent interaction with trappers, missionaries, military expeditions and settlers also brought them into contact with European diseases such as smallpox and influenza, which decimated their populations. In many cases, the diseases traveled the Indian trade routes and preceded the arrival of the Europeans themselves.

By the mid-1800s many of the remaining Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molalla Treaties of 1855. Other Molala shifted to the Siletz Reservation along the Oregon coast, the Klamath Reservation to the south and to the Warm Springs Reservation in eastern Oregon where they were absorbed into the Confederated Tribes of Warm Springs. Today, their descendants continue to live in all of these places and use the Cascade Mountain to collect traditional use materials.

Historic Use
Evidence of historic use in the vicinity of the project appears mainly in the form of trails which functioned as a part of the administrative and communication network in the early days of the Forest Service. Most of these historic trails still exist and continue to be maintained today.

The first Castle Rock Forest Service fire lookout was built in 1917 as a simple 8x8' pole structure. In 1925 a second lookout was constructed of standard design with a cupola attached to the roof. The third lookout was built in 1938 by the CCC using lookout design plan FC-1. This lookout was destroyed by vandals in a 1974 Halloween fire and never reconstructed.
Many of the Lang Dam Thinning units were originally clear cut harvested in the late 1940s and 1950 and others harvested in the 1970s. The original timber harvest of these units occurred prior to the President signing Executive Order 11593 and implementation of Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992). During this period prior to the mid to late 1970s, the Forest Service was not required to hire professional archaeologist to conduct cultural resource surveys. Thus few sites were known on the forest.

**Environmental Consequences**

**Direct and Indirect Effects**

**Alternative 1**

Implementation of the no action alternative would have no direct or indirect effect on cultural resources since there would be no change to the integrity of cultural resource sites because no ground disturbance would occur.

**Alternative 2**

Timber harvest, new and temporary road construction, ground base and skyline yarding and post-harvest fuel treatment contribute to ground disturbance. Ground disturbance can affect the surface and subsurface integrity of an archaeological site and thus its significance to the National Register of Historic Places. Since appropriate and approved surveys have been conducted and cultural site protection measures are already in place (see Design Measures Table 6 in Chapter 2), the potential direct effects to all other potentially eligible sites will be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project will require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract clause BT6.24 (or its equivalent) must be included in all project prospectus and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during timber sale operations.

**Cumulative Effects**

**Alternative 1**

Based on a review of the past, present and foreseeable projects listed in Appendix D, none overlap in time and space that would cause cumulative effects to the known cultural sites from any of the proposed actions under the Lang Dam Project. Appropriate and approved surveys and cultural site protection measures are already in place for this project (see Design Criteria Chapter 2, avoidance clause).

**Alternative 2**

Based on a review of the past, present and foreseeable projects listed in Appendix D, none overlap in time and space that will cause cumulative effects to the known cultural sites from any of the proposed actions under the Lang Dam Project. Appropriate and approved surveys and cultural site protection measures are already in place for this project (see Design Criteria Chapter 2, avoidance clause).
3.5 Transportation

Summary of Effects Analysis
Alternative 2 will have approximately 2.2 miles of temporary road built within the project area to support timber haul. Implementation of alternative 2 will result in a temporary increase of potential sediment delivery due to additional miles of temporary road use, road maintenance activities and increased traffic accessing the treatment stands. Temporary roads will be decommissioned once activities are completed and will not change road miles or access in the long term.

Alternative 2 will implement approximately 3.3 miles of system road closures or decommissioning within the project area. The proposed road closures will decrease vehicular access (public, administrative and commercial), decrease the current effective open road density, reduce existing road erosion problems, reduce road maintenance costs and may reduce illegal garbage dumping, the spread of noxious weeds and human caused fires. There will be fewer roads for public and administrative vehicle access for recreation, reforestation, fire and noxious weed control. Removing berms to access roads for fire suppression will take additional time and heavy equipment. However, closures will reduce illegal garbage dumping, reduce the spread of noxious weeds, reduce human-caused fires and will be left in a hydrologically stabilized condition with less effects to aquatic resources.

Scale of Analysis
The geographic scale used to assess direct, indirect and cumulative effects for Roads and Access includes the project activity units and the overall Lang Dam project area.

Affected Environment
The project area includes approximately 38.0 miles of existing roads. There are approximately 35.2 miles of Forest Service system roads, 2.3 miles of State Highway, 0.4 miles of State managed roadway and 0.1 miles of County road in the project area. The Forest Road system consists of approximately 3.4 miles of arterial road, 3.0 miles of collector roads and 28.8 miles of local roads.

In and near the Lang Dam project area past management activities have provided the current network of Forest Roads mainly from timber sales. The current system of roads provides access to the area for administration, fire protection, public recreation, and forest product utilization. Approximately 12.1 miles of road are asphalt surfaced, 21 miles are surfaced with crushed aggregate, and 5.1 miles are native surfaced. Approximately 19.7 miles of road within the project area are currently open to mixed motorized use. (MVUM).

Oregon State Highway 126 is the primary transportation corridor serving the project area. Forest Road 19 is the primary transportation corridor serving the project area from Oregon State Highway 126 and is the only road classified as an arterial within the project area. Road 19, known as Aufderheide Drive, is a double-lane asphalt surfaced road and serves as a segment of the West Cascades National Scenic Byway. Roads 1900408 (Langasher), 1900410 (Powerhouse Rd), and 1900411 (Cougar Creek) are local roads that will provide the primary access to Road 19. There are no roads classified as collectors being proposed for use.

There are currently 2.0 miles of forest system roads in the project area that are closed. These roads are closed by means of gates, berms, or other physical barriers implemented through road management, or naturally by vegetative growth or blown down timber, or by administrative order. There are approximately 0.7 miles of roads in the project area that have been previously decommissioned.

The current road system allows the Forest Service administrative access to conduct a wide variety of forest management and fire protection activities in the area. Specifically, the forest roads provide access to developed Forest Service campgrounds, various boat ramps, numerous trailheads, lakes, and various
dispersed camping sites. These roads also provide access to U.S. Army Corps of Engineers dam facilities and BPA transmission lines. Access for firewood and special forest products gathering is also accomplished through use of the road system.

The road system receives maintenance in accordance with established road management objectives. Over the last decade, a limitation on road maintenance funds on the Forest has resulted in a backlog of maintenance work including road side brushing, drainage and ditch cleanout, and road surface repair on many of the primary and secondary roads in the project area. Under Alternative 2, there are drainage improvements which would be implemented prior to commercial haul, to protect water quality. Some of the existing culverts located within the road segments needed for haul are in poor condition and are in need of replacement. Additional deferred maintenance is expected in the future unless maintenance budget funding is improved.

**Environmental Consequences**

**Direct and Indirect Effects**

**Alternative 1**

Alternative 1 would not change the use pattern of roads or correct existing road maintenance problems. Without treatment-related road maintenance, the existing budgetary trend makes it unlikely that funding would be available to support adequate road maintenance. Brush and tree re-growth and associated reduced visibility, debris on road, and surface irregularities from OHV and other traffic could eventually result in unsafe traveling conditions for public and administrative traffic, as well as increasing resource damage associated with localized erosion. There is currently a backlog of road maintenance and some local roads are impassible due to fallen trees or brush encroachment. Culverts that are not maintained because of impassible roads may plug and cause washouts with sediment reaching into major drainages.

**Alternative 2**

Road maintenance will occur on 11.5 miles of road with Alternative 2 (See Figure 11). Road maintenance will protect the existing road infrastructure, improve safety of the road, and decrease sedimentation on roads used for project implementation. Road maintenance may include roadside brushing, road surface blading, ditch and culvert drainage maintenance, culvert replacement, surface rock ing, asphalt patching and/or the installation of drainage dips and water bars which will result in the proper drainage and safe use of the roads (see Design Features Table 6 in Chapter 2). Roadside brushing will increase sight distance and increase visibility for safer driving. There are miscellaneous segments of low standard road identified as potential haul routes throughout the project area that will require minor road width adjustments and road surface rehabilitation to support commercial haul.
Figure 11 Proposed Road Activities in the Lang Dam Project Area
Maintenance proposed with Alternative 2 may cause a temporary increase in sedimentation while the road maintenance work is being done (prior to treatments and associated road use), but will decrease the volume and velocity of water that carries sediments off roads afterwards. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts may increase sediment production until road surfaces and slopes stabilize, typically within approximately one to two seasons. Attention will be paid during road maintenance activities to minimize potential delivery to adjacent streams and Best Management Practices will be applied to prevent sedimentation to the greatest extent. Designated water sources for filling water tankers for surface blading, compaction and dust abatement operations will not significantly affect stream flows.

Alternative 2 will provide necessary road maintenance on haul routes and roads used for other treatment activities. This will reverse the trend of declining road conditions across an estimated 11.5 miles of road or approximately 33 percent of the Forest Service road system within the project area. The miles of road open to public access in this alternative will be reduced. Maintenance activities will cause some short-term delays or detours for road users while roadwork is being performed. All OHV use on roads currently open to mixed use will be restricted while treatment activities are taking place.

Alternative 2 will have approximately 2.2 miles of temporary roads built within the project area. Implementation of Alternative 2 will result in a temporary increase of disturbance due to additional miles of temporary roads and increased traffic to access the treatment stands. Temporary roads will be blocked, decommissioned and hydrologically stabilized once activities are completed and will not change road miles or access in the long term.

Portions of the original road system were constructed to accommodate large yarding towers that were used to log large tracts of land. Current thinning activity usually utilizes small, mobile, road-based yarders. Temporary spur road construction needed to reach harvest units by these smaller yarders has been kept to a minimum utilizing the existing transportation system, skid trails and previously disturbed areas wherever possible. New temporary roads will typically be located to use gentle slopes and minimize soil disturbance wherever possible.

All currently closed system roads that will be re-opened and utilized for timber haul (approximately 0.3 miles) will have maintenance performed prior to any haul. Upon the completion of project activities, these roads will then be physically blocked to traffic. All roads treated will be left in a hydrologically stable condition to drain properly and protect water quality. Future road maintenance costs will be reduced because roads will be re-closed to traffic and left with self-maintaining water drainage features.

Alternative 2 will implement approximately 3.3 miles of system road closures or decommissioning within the project area (See Table 31). These roads will be closed through placement of various types of barriers. Roads identified for storage treatments may include any of the following treatments as needed; closure by physical barrier, non-drivable water bars, removal of culverts from stream channels with fills of shallow to moderate depth, and reduction of fill depth for culverts in deep fill locations. Stored roads will include minimal disturbance to the roadbed because they may need to be reopened in the future for various management activities, including timber harvest and fire suppression activities. Roads identified for decommissioning may include any of the following treatments described with road storage but may also include removal of culverts from stream channels in deep fills, slope re-contouring, and sub-soiling. System roads are decommissioned when it is has been determined they are no longer needed to provide access for management activities, these roads are removed from the road system. Roads currently closed by gates will continue to maintain administrative access. The recommendations included in the Willamette National Forest Road Investment Strategy (September 2015) were reviewed, verified and used by the interdisciplinary team as a tool to help identify the future status of roads included in the planning area.
Table 31 Road Closures and Decommissioning in the Lang Dam Project Area

<table>
<thead>
<tr>
<th>Road Number</th>
<th>Length</th>
<th>Haul Route</th>
<th>Current Status</th>
<th>Proposed Treatment Alternative 2</th>
<th>Comment</th>
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<tr>
<td>1900399</td>
<td>0.30</td>
<td>Yes</td>
<td>Closed</td>
<td>Decommission</td>
<td></td>
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<tr>
<td>1900399</td>
<td>0.25</td>
<td>Yes</td>
<td>Open</td>
<td>Storage</td>
<td>Close at FS/Army Corp. boundary</td>
</tr>
<tr>
<td>1900558</td>
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<td>No</td>
<td>Open</td>
<td>Storage</td>
<td>Close beyond powerline right-a-way</td>
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<tr>
<td>1900409</td>
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<td>Storage</td>
<td></td>
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<tr>
<td>1900447</td>
<td>0.29</td>
<td>No</td>
<td>Closed</td>
<td>Storage</td>
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<td>1900482</td>
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<td>Storage</td>
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<td>Storage</td>
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</tbody>
</table>

The proposed road closures will decrease vehicular access (public, administrative and commercial), decrease the current effective open road density, reduce existing road erosion problems, and reduce road maintenance costs. Roads closed by the project will be left in a hydrologically stable condition to protect water quality. There will be fewer roads for public and administrative vehicle access for recreation, reforestation, fire and noxious weed control. Removing berms to access roads for fires suppression will take additional time and equipment. Table 32 shows the proposed road activities associated with harvest and the miles for each alternative.

Table 32 Proposed Road Activities Associated with Harvest

<table>
<thead>
<tr>
<th>Activities</th>
<th>Unit of Measure</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Road Construction</td>
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<tr>
<td>Road Storage</td>
<td>Miles</td>
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<td>3.0</td>
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</table>
Cumulative Effects

Alternative 1
Alternative 1 would not change the use pattern of roads or correct existing road maintenance problems. Without treatment-related road maintenance, the existing budgetary trend makes it unlikely that funding would be available to support adequate road maintenance.

Alternative 2
Past management actions have created 35.2 miles of Forest Service road system within the project area that require continuing road maintenance to provide adequate safe use and resource protection. Past budgets have resulted in maintenance rates that have led to a decline in road conditions across the project area. Alternative 2 will provide necessary road maintenance on the haul routes and roads used for other treatment activities. Road maintenance and road closure treatments proposed under this alternative, combined with the maintenance that occurred with the 7 Thin Stewardship Reoffer will continue to improve the road system by reducing sedimentation increasing safety and reducing future maintenance costs. Road storage and decommissioning will provide fewer roads for public and administrative vehicle access for recreation, reforestation and fire access.
3.6 Recreation

Summary of Effects
Access to portions of Castle-Rock trail (Trail #3506) will be temporarily disrupted during harvest activity as a result of implementation of the Lang Dam Project. During trail closure periods it will not be possible to ride the section of Castle-Rock Trail between FSRD 411 and FSRD 480 as part of the newly improved O’Leary, Castle-Rock, King-Castle mountain biking loop. Disruptions will be mitigated by design criteria that does not allow harvest activity during weekends or holiday’s during the summer (May-July) and the trail will remain open at all times during the months of August and September. Visual qualities of the surrounding stands adjacent to approximately 1600ft. of the trail will be maintained through limited and site specific harvest and design criteria which include low cutting stumps within 100ft of the trail, removal of timber sale boundary markers after harvest and design criteria requiring that leave trees are marked on the side of trees facing away from trails. The trail itself will be protected by design criteria that ensures that any damage to the trail will be repaired after harvest activity and will meet the standards for a class 3 mountain biking trail. There will be no significant effects to developed or dispersed recreation sites or to scenic driving.

Scale of Analysis
The area that was analyzed for effects to recreation were developed and dispersed recreation sites and trails within the Elk, Cougar Creek, Cougar Reservoir, and East Fork subwatersheds (6th field) of the McKenzie River and South Fork McKenzie River Watershed (5th field).

Figure 12 Forest Plan Management Allocations with Recreation Attributes
**Affected Environment**

The project area is used primarily for hiking and mountain biking on system trails, fishing along the lower South Fork of the McKenzie River and dispersed camping in support of hunting during elk and deer hunting season. The project proposes to treat timber adjacent to approximately 1600 feet of Castle-Rock Trail (Trail #3506) which is accessible by a trailhead on Forest Road 411 and is part of a larger trail network. Dispersed camping in the project area is typically associated with seasonal hunting activities although some camping use does occur in conjunction with trail system users or people simply getting away for a few days of camping in the forest. Developed recreation facilities in the project area include Delta Campground, the Delta Old Growth Trail, Echo Boat Launch and East Fork Trail Trailhead.

**Recreation Opportunity Spectrum (ROS)**

The Forest Service uses a land classification system to inventory and describe a range of recreation opportunities called the Recreational Opportunity Spectrum (ROS) from the Willamette Forest Plan FEIS, page III-93. This system seeks to identify recreation settings of varying characteristics that range from remote, undeveloped areas to easily accessed, highly developed sites. Settings are described in the following five ROS Classes: Primitive, Semiprimitive Non-motorized, Semiprimitive Motorized, Roaded Natural, and Roaded Modified. Primitive falls on the most unmodified natural environment end of the spectrum and Roaded Modified falls on the most substantially modified end of the spectrum. Table 33 displays the ROS classes within the project area and the acres proposed for treatments. Figure 13 shows management areas within the project area and associated ROS classes.

![Figure 13 Recreation Opportunity Spectrum Map](image)
Recreational Driving/Road Access

Driving for pleasure (sightseeing) is a popular activity on the district, primarily during the summer months when roads are open and free of snow. Use fluctuates from very light on most dead end roads to moderate use on secondary and connector roads. Most roads in the project area are lightly used and are not part of any popular designated scenic driving routes, however a portion of the Aufderheide Forest Road (FSRD19) is part of the West Cascades National Scenic Byway and is in the project area. During hunting season road use will increase, particularly on secondary roads, in the project area.

Developed Sites

There are three developed recreation sites in the project area; Delta Campground, Echo Boat Launch and East Fork Trail Trailhead. Delta Campground is open from late April through September and provides 38 campsites, pumped water, restrooms, amphitheater and access to the Delta Old Growth Interpretive Trail. Echo Boat Launch provides a day use picnic area, restrooms, fee station and paved boat ramp that allows access to Cougar Reservoir. East Fork Trail Trailhead provides access to the East Fork Trail, a restroom, picnic table, parking and wilderness entry station. The trail parallels the East Fork of the McKenzie River and provides connector access to trails that lead deeper into the Three Sisters Wilderness.

Dispersed Camping

There are several known low use dispersed campsites within the project area. These sites are usually associated with favorite hunting areas and are not typically used outside the hunting season. A recently updated (2013) Forest Order 18-2013-01-03 is within the project area and prohibits camping a half mile on either side of Forest Road 19. It also includes areas between Forest Road 410 and Forest Road 19 and areas surrounding Delta Campground and the Delta Campground access road.

Trails

Castle-Rock Trail is a class 3 mountain biking trail that runs through a proposed harvest unit (unit 220) and is a part of a popular and growing mountain biking trail system. It serves as a key segment of a newly developed mountain biking route that includes portions of Olallie Trail (Trail #3529), O’Leary Trail (Trail #3321), Castle-Rock Trail (Trail #3506) and King-Castle Trail (Trail #4326) as well as select road segments which can either be ridden on a bike or used to support shuttle vehicles. Approximately 1.5 miles of Castle-Rock Trail is currently maintained to standard while .5 mile of the trail is showing signs of erosion due to tread sloughing. Additionally, there are two stream crossings that are eroding the trail tread and
increasing sedimentation into the streams. Trail heads that support use of the newly improved mountain biking trail system are in need of improved wayfinding information and demarcation signs (USFS family of signs). They could also benefit from expansion and better delineation of parking areas to curtail resource damage caused by expected increases in use. In particular O’Leary Trailhead on Forest Road 411 is in need of these improvements. Another trail in the project area is Echo Trail (Trail #3309). This trail is infrequently used and is in need of maintenance to maintain trail tread in a variety of areas. The upper portion of Castle-Rock trail is also in the project area and provides a short hike from a trailhead at the end of Forest Road 480 to a former fire lookout site where there is an expansive view of the McKenzie River Valley and the Three Sisters mountains. Delta Old Growth Nature Trail is accessed by Delta Campground and is a one mile loop and has interpretive stations that can be referenced using an interpretive guide that is available at the trailhead. No project related treatments are proposed in the vicinity of these trails.

South Fork McKenzie River Wild and Scenic Study River

The Omnibus Oregon Wild and Scenic Rivers Act of 1988 added segments of 40 rivers to the National Wild and Scenic River system. It also called for the study of seven Oregon Rivers to determine whether they are eligible and/or suitable for inclusion into the national system. A 25.7 mile stretch of the South Fork McKenzie River (South Fork) is one of these study rivers. To be eligible for Wild and Scenic River designation, a river must meet two criteria: 1) It must be free flowing and 2) It must have at least one Outstandingly Remarkable Value (ORV). The study segments of the South Fork have no impoundments so it meets the criterion for free flowing. The South Fork has four values that meet the criteria for ORV's: Scenery, Recreation, Fish and Prehistoric, therefore the South Fork McKenzie River was found eligible for classification as a Wild and Scenic Study River (WSSR).

The portion of the South Fork McKenzie River between Cougar Reservoir Dam to its confluence with the main stem of the McKenzie River is within the Lang Dam project area. This segment of the South Fork is identified as segment 3 by the Eligibility Determination for South Fork McKenzie River (USDA Forest Service, Pacific Northwest Region, 1992). Segment 3 has a management classification of Recreation. Recreation management classification means that a river is readily accessible by public roads and that roads, human habitations and other development will be in close proximity to the river. In addition, human activities may have substantially modified the scenery and there is a high potential for development of recreation occupancy sites as well as boat launching and mooring sites. The South Fork Report (Eligibility Determination) further recognizes that evidence of timber harvest is predominant throughout this segment. In addition, evidence of large scale human activity is predominant in the landscape in the upper portion of this segment and includes features such as extensive slope terracing, Cougar dam, power line corridor, a bridge and a USGS gauging station.

This segment of the river is primarily used by recreational anglers fishing from the bank of the river or from watercraft on the river. It is also sometimes floated by white water enthusiasts in watercraft such as hard shell kayaks and also by smaller inflatable watercraft including rafts when water levels are high enough. The river is characterized by generally swift flow and a narrow channel that is constrained by dense vegetation on both sides in many places. Water flows are governed by the release of water from the dam. There are no developed put in or take out locations on this section of the river and most boaters put in near the base of the dam at a roadside parking area and carry boats over and down a section of rip rap (bank stabilizing boulders). The take out is typically somewhere downstream of the confluence with the main stem of the McKenzie River at developed boat launch facilities such as Forest Glen boat launch near the community of Blue River which is managed by Lane County.

Segment 3 of the river can be divided into two distinct portions. The upper portion is paralleled by Forest Service Road 410 and is accessible by several spur roads. The landscape in this segment shows evidence of human modification primarily associated with Cougar Dam. Spur roads off of Forest Service Road 410 are open to vehicle traffic and provide access to areas that are typically used for fishing, or for just
enjoying the river environment. Several older spur roads have been closed to vehicles and now offer foot access to a variety of user created trails that access a range of riverside locations where fishing is the primary activity. Much of this upper portion of the river falls within a forest order area where camping is prohibited (Forest Order 18-2013-01-03).

The lower portion of segment 3 of the river curves sharply west and leaves the forest order closure area. The landscape in this portion is dominated by dense forest and limited expansive views into the broader landscape from the river. Evidence of human activity is largely unnoticeable throughout this segment except for timber harvest activity which may be noticeable by the lay person in the near term after harvest activity has concluded and in the longer term by people who have some kind of experience or background in forestry. This section of the river, until it’s confluence with the main stem of the McKenzie River, is roughly paralleled by Forest Service Road 408 (Lingasher Road) however the road is far enough from the river to be unnoticeable. Several spur roads off of Forest Service Road 408 provide access to the river although in this stretch there is only one known established dispersed campsites along the river bank. This particular campsite is located off of Forest Service Spur Road 388 and has historically been problematic due to incidences of property abandonment, garbage, long term residing and other associated resource damage. Additionally the campsite has no barriers to stop vehicles from driving up to the bank of the river which has resulted in damage to riparian vegetation.

Environmental Consequences

Direct and Indirect Effects

Alternative 1
Recreation use of the National Forest in the project area would remain unchanged with the no action alternative and therefore would have no effects to recreation. The recreating public would continue to use the project area for recreational purposes, and would continue current use of dispersed campsites, trails, and roads.

Alternative 2
Short term effects of proposed timber harvesting, log truck hauling, and fuel treatments will include the following: localized road closures, and possible disruption to hunting, hiking, biking, camping and driving in some areas. The logging activity, hauling, and fuel treatments may cause increased noise disturbance and may temporarily increase the amount of dust in the air while these operations are under way. These effects will be mitigated by restrictions to log hauling on weekends.

Trails
Harvest activities in units that are in close proximity to Castle-Rock Trail (Trail #3506) will produce short-term direct effects for Castle-Rock Trail users and particularly for bikers who are riding the O’Leary-Castle Rock-King Castle trail system because this section of the trail will be closed during harvest activity. To reduce the impact of the closure, harvest activity in units that will affect Castle-Rock trail will not occur during weekends or holiday’s during the summer (May-July) and the trail will remain open at all times during the months of August and September (See Design Criteria, Table 6 in Chapter 2). The segment of Castle-Rock Trail that provides access to the Castle-Rock lookout vista point will not be affected. Visual qualities of the surrounding stands adjacent to approximately 1600ft. of the trail will be maintained through limited and site specific harvest and design criteria which include low cutting stumps within 100ft of the trail, removal of timber sale boundary markers after harvest and design criteria requiring that leave trees are marked on the side of trees facing away from trails. Trails will be protected to the extent possible by specific design criteria (see Table 6) such as retaining important anchor trees to ensure upslope stability adjacent to the trail and by limiting the impact of log yarding across the trail by using a suspension system that elevates one end of logs being transported. A recreation specialist will be incorporated into the layout phase of the project for units adjacent to trails to identify anchor trees to be retained. Placement of gaps (small clearings less than 3 acres) upslope of the trail will be at least 200 feet
away which will ensure canopy cover is maintained over the trail. This will preserve current conditions where light penetration is limited and where seasonal vegetation growth is held in check. This is important because seasonal growth of understory vegetation requires maintenance to keep the trail open. After harvest activities have concluded any affected trails will be repaired to meet the established existing trail classification and trails that are designated for bike use will be repaired to meet class 3 biking trail standards. Safety of trail users will be addressed by closing the trail to public use during harvest activity. The public will be notified about the project through signage, outreach to local businesses, on the Willamette National Forest webpage and through other media sources such as the local newspaper. No other system trails in the project area will be affected by the Lang Dam project.

**Developed and Dispersed Recreation Sites**

There will be no effects to developed recreation facilities in the project area because no harvest treatments are proposed adjacent to these sites and access to them will not be disrupted. Access to one dispersed campsite off of Forest Service Road 408 (Lingasher Road) will be restricted during harvest activity.

**Roads**

Road quality will be enhanced due to maintenance and will improve ride quality and safety on 11.5 miles of forest roads in the project area. Some minor disruptions to recreational driving may occur in specific locations within the project area during harvest activities. Log hauling on the road system will not occur during weekends which will reduce impacts to forest road users during peak recreation use periods. Forest Roads that access trailheads that support mountain biking and hiking on trails that are part of the O’Leary, Castle Rock, and King Castle trail system will have limited to no log hauling occurring in August and September because harvest in units adjacent to this trail system will be restricted during these months.

**South Fork McKenzie Wild and Scenic Study River**

Proposed harvest units (20, 30, 40, 50, 80, 140, 151, and 160) are within segment 3 of the South Fork Wild and Scenic Study River. Recreational use of this segment of the river will not be affected by harvest activity. There will be no diminishment to the ORV (Outstandingly Remarkable Value) of Recreation for river dependent uses such as fishing and boating because proposed harvest and harvest related activities will not significantly affect access to the river or impede boating on the river. During harvest activity access to an established dispersed campsite off of Forest Service Spur Road 388 will be temporarily disrupted. After harvest activity has concluded this access road will be blocked to vehicles to protect riparian resources. This action will benefit the river by protecting it from accruing resource degradation associated with vehicle access. The site will remain open for public use for those who choose to park and walk in or float in from the river. A benefit to river dependent activities as related to the ORV of Recreation will be the reclamation of natural resources at this dispersed site, improved security and an overall improved opportunity for camping, day use and angling.

The ORV of Scenery will not be diminished because the proposed treatments in this segment of the river will be consistent with all applicable standards and guidelines for Visual Quality Objectives (VQO’s). Timber harvest activity will be consistent with a landscape where evidence of timber harvest is a predominant feature.

**Cumulative Effects**

**Alternative 1**

Recreation use of the National Forest in the project area would remain unchanged with the no action alternative and therefore Alternative 1 would have no direct or indirect effects on recreation within the project area. The recreating public would continue to use the project area for recreational purposes, and would continue current use of dispersed campsites, trails, and roads.
Alternative 2

Trails
The likelihood of trail closures being in effect for project related work associated with the past Horse Creek and proposed Green Mountain project at the same time as those proposed by the Lang Dam project is low.

Direct effects to trails will be mitigated by design criteria that protects trails. Short term effects such as the presence of slash and freshly cut stumps and tree marking will add cumulatively to effects if these effects overlap in time and space with the past Horse Creek and proposed Green Mountain project. Some cumulative effect overlap within the 3-6 year vegetation recovery period or during pre-harvest related activities may occur.

Developed and Dispersed Recreation Sites
There will be no cumulative effects to developed and dispersed recreation sites as a result of implementation of the Lang Dam project because there are no effects to developed sites and only one dispersed site will be affected and this site will benefit in the long term from the project.

Roads
The Lang Dam Project will maintain 11.5 miles of road which will add cumulatively to road improvements associated with the Horse Creek and Green Mountain Projects by improving the recreational driving experience by enhancing ride quality and safety on these roads. Storage of 3 miles and decommissioning of .3 miles of road as a result of the Lang Dam Project will not affect access to dispersed recreation sites, developed recreation facilities or trailheads so there will be no cumulative effects to recreation as a result of road storage or decommissioning.

South Fork McKenzie Wild and Scenic Study River
The Forest Road 410 Hazardous Fuels Reduction Project encompassed approximately 94 acres along segment 3 of the South Fork Wild and Scenic Study River. The purpose of this project was to thin overstocked forest stands to reduce the intensity of wildfire and to increase the depth and field of view into the surrounding environment to enhance law enforcement ability to detect illegal campers and associated campfires in the no camping zone established by forest order. A Wild and Scenic River Assessment under Section 10(a) was completed for the 410 Hazardous Fuels Reduction Project and the finding was that the proposed action, as designed, will not degrade the values of the South Fork McKenzie River but will enhance water quality conditions (Wild and Scenic River Assessment under Section 10(a) for Forest Road 410 Hazardous Fuels Reduction Project, 2014). The proposed actions of the Lang Dam project will not add cumulatively to the effects of the hazardous fuels reduction project because no timber harvest is proposed within the hazardous fuels reduction project area.

3.7 Scenic Quality

Summary of Effects
There will be no significant effects to scenery as a result of implementation of the Lang Dam Project. All visual quality objectives (VQO’s) will be maintained consistent with forest plan direction. There will be some limited short term impacts to scenery along portions of trails affected by timber harvest activities however in the long term (6 years and beyond) the forest stands in these areas will recover with the end result being greater depth and field of view into the surrounding environment with larger individual trees and a more interesting mix of vegetation, color, texture and composition.
Scale of Analysis
The view shed area that was analyzed for effects to scenery were principle travel routes and recreation areas within the Elk, Cougar Creek, Cougar Reservoir, and East Fork subwatersheds (6th field) of the McKenzie River and South Fork McKenzie River Watershed (5th field).

Affected Environment
The project area is primarily used by hikers, hunters, anglers and bikers where enjoying scenery is often an integral part of the experience for these visitors. Trails in the project area are predominantly used by mountain bikers and hikers during the summer months and are used by hunters during hunting season. Mountain biking is a burgeoning use type and has been recently further supported by improvements to the O’Leary, Castle-Rock, King-Castle biking loop. Anglers and boaters enjoy sections of the lower South Fork McKenzie River which is designated as a Wild and Scenic Study River and where recreational boating and fishing are popular. Recreational driving and sightseeing occurs along sections of the West Cascade National Scenic Byway that passes through the project area and views of portions of the project area are possible from a developed overlook atop Cougar Reservoir Dam.

Scenic Driving
A portion of Forest Service Road 19 (Auferheide Memorial Drive) is in the project area and is part of the West Cascades National Scenic Byway. National Scenic Byways are defined as areas with one or more archeological, cultural, historic, natural, recreational and scenic qualities and are a collaborative effort established to help recognize, preserve and enhance selected roads throughout the United States. Auferheide Drive was named after Robert Auferheide, the Willamette National Forest Supervisor from 1954 until his death in 1959. The highway consists of paved roads which carve a path through scenic forests, the historic logging community of Westfir, the Constitution Grove, Box Canyon Guard Station, the Auferheide Memorial, Cougar Reservoir and the McKenzie Highway. The route follows the Middle and North Forks of the Willamette River, up Box Canyon and down the South Fork and main fork of the McKenzie River. A number of interpretive sites are located along the Auferheide Memorial Drive as well as numerous campgrounds, dispersed camping areas, trail heads, boat launches and day use areas. Box Canyon Guard Station and Indian Ridge Lookout are renovated and re-purposed historic buildings that are available for visitor reservations during the summer months. The portion of the Auferheide Memorial Drive that is in the project area is that portion between the confluence with Highway 126 and the top of Cougar Reservoir Dam.

Developed Recreation Sites
Developed recreation sites in the project area include Delta Campground, Echo Boat Launch and Day Use Area and East Fork Trailhead. Delta Campground has 38 campsites, an amphitheater and also provides access to the Delta Nature Interpretive Trail. Echo Boat Launch is a paved boat launch that supports boating on Cougar Reservoir and also provides a primitive picnic area and restroom. East Fork Trailhead provides access to the East Fork Trail, paved parking, a restroom and picnic table.

Dispersed Recreation Sites
There are few established popular dispersed recreation sites in the project area. Most dispersed site use is associated with seasonal hunting for deer and elk. An exception is one site located off of Forest Road 388 which is a spur road off of Forest Road 408 (Lingasher Road). This site is used throughout the summer periodically and is often occupied by long term forest dwellers and as a result the site is associated with resource damage.
Trails
Castle-Rock Trail is a class 3 mountain biking trail that runs through a proposed harvest unit (unit 220) and is a part of a popular and growing mountain biking trail system. It serves as a key segment of a newly developed mountain biking route that includes portions of Olallie Trail (Trail #3529), O’Leary Trail (Trail #3321), Castle-Rock Trail (Trail #3506) and King-Castle Trail (Trail #4326) as well as select road segments which can either be ridden on a bike or used to support shuttle vehicles. Another infrequently used trail in the project area is Echo Trail (Trail #3309). The upper portion of Castle-Rock trail is also in the project area and provides a short hike from a trailhead at the end of Forest Road 480 to a former fire lookout site where there is an expansive view of the McKenzie River Valley and the Three Sisters mountains.

Delta Old Growth Nature Trail is accessed by Delta Campground and is a one mile loop and has interpretive stations that can be referenced using an interpretive guide that is available at the trailhead.

South Fork McKenzie Wild and Scenic Study River (WSSR)
The portion of the South Fork McKenzie River between Cougar Reservoir Dam to its confluence with the main stem of the McKenzie River is within the Lang Dam project area. This segment of the South Fork is identified as segment 3 by the Eligibility Determination for South Fork McKenzie River (USDA Forest Service, Pacific Northwest Region, 1992). Segment 3 has a management classification of Recreation. A Recreation management classification means that a river is readily accessible by public roads and that roads, human habitations and other development will be in close proximity to the river. In addition, human activities may have substantially modified the scenery and there is a high potential for development of recreation occupancy sites as well as boat launching and mooring sites. The South Fork Report (Eligibility Determination) further recognizes that evidence of timber harvest is predominant throughout this segment. In addition, evidence of large scale human activity is predominant in the landscape in the upper portion of this segment and includes features such as extensive slope terracing, Cougar dam, power line corridor, a bridge and a USGS gauging station.

Roads and Viewpoints
Forest Service Road 19 is within the project area and is part of the West Cascades National Scenic Byway. The Cougar Dam overlook viewpoint is located on this road and is within the project area. This viewpoint is located at the western terminus of the top of the dam and has a developed parking lot with interpretive signage. A crosswalk provides access to a viewing platform that looks into the Lang Dam project area below the dam and into the lower South Fork McKenzie River drainage.

Environmental Consequences

Methodology
The analysis methods used to evaluate the effects of the alternatives on scenery were based on a review of the Forest Plan for consistency with applicable standards and guidelines and the Scenery Management System (SMS) handbook. Field reviews of proposed harvest units from key travel routes (trails and roads) in conjunction with GIS geo-spatial mapping and a digital perspective analysis tool using Google Earth was used to evaluate project effects on scenic quality.

Visual Management System (VMS) and Scenery Management System (SMS)
The Visual Management System (VMS) was used to inventory and analyze aesthetic values on National Forest Lands until it was replaced by the Scenery Management System (SMS). The SMS evolved from the VMS and differs in that it has been expanded to reflect updated research findings. The current Land and Resource Management Plan for the Willamette National Forest remains tiered to the VMS system. For the purposes of this analysis both VMS and SMS terminologies have been referenced and used together to retain consistency with the forest plan while recognizing changes in systems used for analyzing scenery.
Landscape visibility is a function of many essential, interconnected considerations including the following: 1) context of viewers, 2) duration of view, 3) degree of discernable detail, 4) seasonal variations and 5) number of viewers. Existing travel ways such as trails and system roads were analyzed for effects to scenery and were analyzed according to viewing distance classifications described in the SMS handbook. These distances are:

- Immediate Foreground (0-300 feet)
- Foreground (300 feet-.5 mile)
- Middleground (.5 mile-4 miles)
- Background (4 miles-horizon)

The Forest Plan establishes VQO categories (VMS) to describe the degrees of acceptable alteration of the natural landscape when considering timber stand management (Forest Plan FEIS, 1990). The five VQO and corresponding SMS categories are provided in Table 34 as well as definitions. Figure 13 in the previous Recreation section shows the proposed project area acres and proposed treatment acres within Management Areas and associated Recreation Opportunity Spectrum (ROS) class and Visual Quality Objective (VQO). Figure 12 shows management areas in the project area and management areas with specific VQO classifications for those management areas with proposed harvest treatments.
Table 34 Visual Quality Objectives and SMS Categories

<table>
<thead>
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<th>Visual Quality Objectives (VQO’s) and Corresponding SMS Categories</th>
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<td><strong>VQO-Preservation/SMS-Very High:</strong> Provides for ecological change only (VMS). Landscape character is intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level (SMS).</td>
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<tr>
<td><strong>VQO-Retention/SMS-High:</strong> In general, human activities are not evident to the casual forest visitor (VMS). Landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so completely that and at such a scale that they are not evident (SMS).</td>
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<tr>
<td><strong>VQO-Partial Retention/SMS-Moderate:</strong> In general, human activities may be evident but must remain subordinate to the characteristic landscape (VMS). Landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed (SMS).</td>
</tr>
<tr>
<td><strong>VQO-Modification/SMS-Low:</strong> Human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture, and appear as natural occurrence when viewed in foreground or middle-ground distances. Landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.</td>
</tr>
<tr>
<td><strong>VQO-Maximum Modification/SMS-Very Low:</strong> Human activity may dominate the characteristic landscape but should not appear as a natural occurrence when viewed as background. Landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character</td>
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Direct and Indirect Effects

**Alternative 1**

No timber harvest treatment would occur with the implementation of Alternative 1. All visually sensitive Management Areas would remain consistent with Forest Plan standards and guidelines, and VQO’s would be maintained. Alternative 1 would have no direct or indirect on scenic quality in the project area.

**Alternative 2**

**Scenic Driving**

Treatments proposed by the Lang Dam project are consistent with all standards and guidelines for applicable VQO classes therefore no effects to scenic driving are anticipated.

**Developed Recreation Sites**

Scenery from developed recreation facilities (Delta Campground, Echo Boat Launch and East Fork Trailhead) would not be affected by proposed activities associated with the Lang Dam Project because no timber treatments will be visible from these locations. There is a possibility that minor increases in dust may be noticeable from these locations during hauling activities but this is expected to be negligible.

**Dispersed Recreation Sites**

No effects to scenery are expected for the few low use dispersed sites in the project area as a result of timber treatments with the exception of a known dispersed campsite located off Forest Service Spur Road 388 which is accessed via Forest Service Road 408 (Lingasher Road). Harvest treatments in the vicinity of this campsite will create a more open forest structure and improve depth and field of view in what is presently an overstocked stand.

**Trails**

Castle-Rock Trail (Trail #3506) is a class 3 mountain biking trail and about 1600ft. of the trail passes through unit 220. A class 3 designation requires that a VQO of Partial Retention be maintained within the trail corridor (100ft. on either side of trail). A VQO of partial retention requires that in general, human activities may be evident but must remain subordinate to the characteristic landscape (VMS). Landscape character may appear slightly altered and noticeable deviations must remain visually subordinate to the landscape character being viewed (SMS). The forest plan further specifies that for trails passing through
management areas with a more restrictive VQO the more restrictive standard shall apply. In this case the trail passes through management area 11a which has a VQO of Modification. The trail has a more restrictive VQO so management activities within the trail corridor must adhere to the more restrictive VQO of Partial Retention.

Design criteria has been established that will ensure the applicable VQO of Partial Retention is retained. Pre-harvest tree markings will be required to be placed on the side of trees facing away from trails. These markers will be removed after harvest activities have concluded. Trail users on trails that pass through harvest unit 220 may notice slash, fresh cut stumps and skid trails in the short term after harvest treatments have concluded. As vegetative recovery takes place (3-6 years), and post treatment mitigation measures are implemented (removal of slash piles, boundary markers), evidence of harvest activity will become largely unnoticeable and will be subordinate to the characteristic landscape. In the long term (6-10 years) the end result will be a largely natural setting with greater depth of views into the surrounding landscape due to decreased stand density and healthier and larger individual trees with less understory vegetation. The end result will be consistent with all applicable VQO’s for the trail. Additionally, site specific gap placements downslope of the trail will be located with input from a recreation specialist and will provide improved views of the surrounding landscape for trail users.

Middle-Ground distance views (.5 mile-4 miles) of some units in the project area will be visible from Castle-Rock which is a former fire lookout location that is accessible by Castle-Rock Trail. This viewpoint offers sweeping views of the McKenzie River Valley and is a popular hiking destination. Proposed treatments will be consistent with the characteristic landscape where evidence of past timber harvest is a predominant feature of the landscape (Figure 14).

![View from Castle Rock to the west](image)

**Figure 14 View from Castle Rock to the west**
South Fork McKenzie River Wild and Scenic Study River (WSSR)
Some proposed timber treatment units (20, 30, 40, 50, 80, 140, 151 and 160) are within segment 3 of the South Fork McKenzie Wild and Scenic Study River (WSSR). Proposed timber treatments in these units will not diminish the ORV of scenery because the treatments will be consistent with the landscape character of this segment of the river where evidence of human activity such as timber harvest, dams and associated infrastructure such as roads, powerline corridor and extensive man-made terracing of adjacent slopes are noticeable and are recognized as part of and consistent with the existing visual landscape (Eligibility Determination for South Fork McKenzie River, USDA Forest Service, 1992).

Roads and View Points
The majority of proposed units will not be visible from major viewing locations such as developed recreation areas, major roads or road junctions or from trails at landscape level views (middle-ground and background distances). Exceptions to this are viewing areas at the top of Cougar Reservoir Dam and Castle-Rock Lookout. These are both locations where the visiting public does engage in viewing the landscape as part of their visit to the area. Castle Rock lookout is a low use trail and Figure 15 illustrates the view from the former Lookout location. The viewing platform at the top of Cougar Dam is an important viewpoint for travelers enjoying vistas while traveling on Forest Road 19. Figure 15 shows a Google Earth overlay with proposed units from Cougar Dam Reservoir Looking North and Figure 16 shows a photograph from Cougar Dam looking north into the project area. Units 151, 160 and 180 will be clearly visible from atop Cougar Reservoir at middle ground distances however the proposed thinning treatments for these units will meet all standards and guidelines for VQO’s in the management area and will be consistent with the landscape which shows considerable human modification to the natural environment particularly in the form of timber harvest. A number of units will be clearly visible from Castle Rock at middle-ground distances and these units will meet applicable VQO’s for management areas and will be consistent with a landscape where evidence of timber harvest is predominant.
Figure 15 View of proposed units from Cougar Dam Looking North

Figure 16 Cougar Dam looking north showing a human modified landscape
Cumulative Effects

**Alternative 1**
No timber harvest treatment would occur with the implementation of Alternative 1. All visually sensitive Management Areas would remain consistent with Forest Plan standards and guidelines, and VQO’s would be maintained. Alternative 1 would have no cumulative effects on scenic quality in the project area.

**Alternative 2**

**Scenic Driving**
The Lang Dam project, past Horse Creek Project and proposed future Green Mountain Project will not close any portions of that segment of the West Cascades Scenic Byway that is in the general vicinity of these projects therefore there will be no cumulative effects to scenic driving as a result of implementation of the Lang Dam project.

**Developed Recreation Sites**
There will be no effects as a result of implementation of the Lang Dam Project to developed recreation sites therefore there will be no cumulative effects with other projects.

**Dispersed Recreation Sites**
There will be no significant effects as a result of implementation of the Lang Dam Project to dispersed recreation sites therefore there will be no cumulative effects with other projects.

**South Fork McKenzie River Wild and Scenic River**
Because the ORV’s (Outstandingly Remarkable Values) attributed to the South Fork McKenzie River will not be diminished as a result of the proposed action or action alternatives for either the Lang Dam project or proposed Green Mountain Project there will be no cumulative impact.

**Viewpoints and Scenic Corridor**
The proposed alternative will not affect scenic quality as viewed from the forest road system or from developed or dispersed recreation sites. Because of this there will be no cumulative effects as a result of implementation of the Lang Dam project.

**Trails**
Thinning treatments along system trails and near trailhead locations associated with the past Horse Creek Project and future proposed treatments associated with the Green Mountain Project may add incrementally to cumulative scenery effects as a result of implementation of the Lang Dam Project however the effect will be negligible due to design criteria which is in place for all three projects that limits impacts to scenery.

If the post-harvest vegetative recovery period (3-6 years) or pre-harvest related activities such as tree marking associated with the proposed Green Mountain Project or past Horse Creek project overlap in time with the Lang Dam project there will be some limited, incremental cumulative impact to scenery. The likelihood that all three projects implement project work in such a way that overlap occurs is low however. Design criteria are in place to protect scenery resources for all three projects so VQO’s will be maintained consistent with forest plan direction.
3.8 Inventoried Roadless Areas (IRA)

Summary of Effects
Alternative 2 will have no effects on the IRA because no timber harvest or associated activities will occur within the IRA. Two harvest units (190 and 220) in the Lang Dam Project are adjacent to the IRA. See Figure 17. These units will have boundary markers established during implementation to ensure all harvest related activities are restricted to areas outside the IRA boundary.

Scale of Analysis
The geographic scale used to assess direct, indirect and cumulative effects for Inventoried Roadless Areas (IRA) is the Lang Dam project area boundary located within the Elk, Cougar Creek, Cougar Reservoir, and East Fork subwatersheds (6th field) of the McKenzie River and South Fork McKenzie River Watershed (5th field).

Affected Environment
Inventoried Roadless Areas (IRAs) were identified in the 2001 Roadless Area Conservation Rule in a set of inventories roadless area maps (contained in Forest Service Area Conservation Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service), or any subsequent update or revision of those maps (36 CFR 294.11). These areas were set aside through administrative rulemaking and have provisions, within the context of multiple use management, for the protection of inventoried roadless areas. Most IRA boundaries are substantially identical to those identified as “Roadless Areas” referred to in the 1982 planning rule (36 CFR 219.17)
and identified by the Forest Plan, FEIS, however some localized, minor differences in boundaries may exist. 1134 acres of IRA is located within the Lang Dam Project boundary.

**Environmental Consequences**

**Direct and Indirect Effects**

*Alternative 1*

No treatments would occur with the implementation of Alternative 1, therefore no direct or indirect effects to the IRA would occur.

*Alternative 2*

Alternative 2 will have no effects on the IRA because no timber harvest or associated activities will occur within the IRA. Two harvest units (190 and 220) in the Lang Dam Project are adjacent to the IRA. See Figure 17. These units will have boundary markers established during implementation to ensure all harvest related activities are restricted to areas outside the IRA boundary.

**Cumulative Effects**

*Alternatives 1 and 2*

No effects to the IRA will occur within the Lang Dam project; therefore no cumulative effected to the IRA will occur.

### 3.9 Botanical Resources

**Summary of Effects Analysis**

There were no listed sensitive species found during surveys, so there is no effect. There were no Survey and Manage species found during surveys, so there is no effect. No disturbance buffers will protect special habitats, so there is no effect. Invasive plants are present in the project area. Project Design Criteria will minimize the spread of them.

**Scale of Analysis**

The scale of analysis for botanical resources is limited to the units proposed for treatment.

**Affected Environment - Sensitive Botanical Species**

Current management mandates conservation of several categories of special status plants on the Willamette National Forest. These include species from the Regional Forester Sensitive and Strategic Plant lists. Special status species are protected by USDA Forest Service regulations and manual direction (FSM 2672.4).

Numerous plants on the Regional Forester Special Status Species list for the Willamette National Forest have the potential to occur in the Lang Dam project area, which encompasses a wide range of western Cascade forest habitats. The complete species list is in the Biological Evaluation in the Project File.

Prefield review of the Lang Dam project area showed no known sensitive plant populations. *Romanzoffia thompsonii*, a small, flowering plant found in open, rocky, seasonally wet habitats ranging 750 to 6,000 feet elevation, occurs in the South Fork Watershed.

The project area was reviewed summer 2015, using intuitive controlled surveys. The surveyor traversed through the project area enough to see a representative cross section of all the major habitats and topographic features, looking for the target species. When the surveyor arrived at an area of potential
habitat, defined in the prefield review or encountered during the field visit, they completed a survey for the target species.

Although potential habitat occurs for special status fungi in the project area, no surveys for these species occurred because they are infeasible (except *Bridgeoporus nobilissimus*, which is a perennial conk found on Noble fir snags and stumps). The sensitive fungi on the Willamette National Forest species list are limited in distribution and their habitats are poorly understood (i.e. there are very general habitat characteristics listed in the literature).

Unit surveys resulted no sensitive species in the project area.

**Environmental Consequences – Sensitive Botanical Species**

**Direct and Indirect Effects**

**Alternative 1**
This alternative will have no effect on special status botanical species because habitat modification as a result of timber harvest will not occur in the project area.

**Alternative 2**
There will be no effect on special status plants in the Lang Dam project area from timber harvest because no plants were located at the time of surveys.

Without knowing for certain the presence or absence of these fungi in the Lang Dam project area, a reasonable assumption is there will be some localized effects to individuals from activities proposed in the Lang Dam EA. These potential localized effects are specific to fungi only.

Timber harvest could impact some unknown fungi in the project area as a result of soil compaction and microclimatic change by increasing the effects of solar radiation through canopy removal (Griffiths and Swanson 2001). The thinning and gap creation will have the same effect of regeneration harvest, but to a lesser degree based on spatial impact. Alteration of seral stage creates a change in underground fungal species diversity and regeneration harvest does diminish the richness of ectomycorrhizal species (Byrd et al. 2000). Logging intensity has also been shown to affect abundance and composition of ectomycorrhizal fungi (Durrall et al. 2006).

Both natural fuels and post-harvest under burning have potential to affect fungi species. Research indicates diversity in ectomycorrhizal species, live root biomass, and duff levels is reduced by prescribed fire, compared to non-burned treatments (Smith et al. 2005). The majority of fungal species diversity resides in mineral soil (Bruns et al. 2002). Considering, fire behavior can be unpredictable; effects could occur from a change in expected fire severity during under burning operations. As a consequence, high intensity fires could kill fungi in mineral soil (Dahlberg 2002). The burn season could affect fire severity, with fall and spring burns having differential influences on the community structure and abundance of ectomycorrhizal fungi (Dahlberg et al. 2001). Pile burning could have an effect on some fungi in terms of radiant heat impacts; since concentrated burning can result in localized higher fire intensities and changes in fungal species diversity (Baar et al. 1999).

There could be effects from a loss of host trees as a result of timber harvest and there could be effects due to fuels treatments. Research found fungal reproduction was not affected at the 40 percent retention level, but was almost eliminated at the 15 percent retention level. (Luoma et al. 2004). The Lang Dam project proposes 39 acres of gaps under the proposed action. However, Alternative 2 proposes treatments (i.e. gaps) which will reduce tree retention in some stands closer to the 15 percent threshold where there are effects to sensitive fungi.

Gaps could have additional effects on fungi species potentially occurring in the project area by removing host trees of from their inoculum source. Ectomycorrhizal root tip density drops greatly when the
distance from gap edge exceeds 10 meters (Berglund and Jonsson 2003). No harvest areas (skips) will be retained in units with gaps and may allow for some level of mycelia retention. However, gaps greater than 10 m (approximately 33 feet) from the next skip should be assumed to have some impact on fungi propagation.

Post-harvest under burning has potential to affect fungi species. Research indicates diversity in ectomycorrhizal species, live root biomass, and duff levels reduction by prescribed fire, compared to non-burned treatments (Smith et al. 2005).

Cumulative Effects
The cumulative effects analysis area for sensitive plants is the Lang Dam harvest units because there is potential habitat for these species and any expected cumulative effect from the proposed action will occur in the project area boundary. There are no known sensitive plants in the Lang Dam project area; therefore, there is no cumulative effect to these species

This section analyzes cumulative effects to potential sensitive fungi habitat. Alternative 2 proposes 630 acres of harvest. Harvest has occurred on approximately 5,143 acres of land (71% of the project area) in the past. Of the 630 acres treated, ground disturbance is expected to stay under the Willamette National Forest FW-081 Standard of 20% of an activity area impacted or 129 acres of the 7195 acre project area. Alternative 2 will increase potential cumulative effects to fungi by under 2 percent. Alternative 2 carries a higher risk of cumulative effects to sensitive fungi species as compared to the No Action Alternative.

Affected Environment – Survey and Manage Botanical Species
This project is consistent with the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. This project utilizes the December 2003 species list. This list incorporates species changes and removals made as a result of the 2001, 2002, and 2003 Annual Species Reviews. Lang Dam project area surveys occurred during the summer of 2015. The survey and manage tracking form is available in the Project File.

Pre-field review of the Lang Dam project area showed no known Survey and Manage plant populations. One Survey and Manage lichen, *Peltigera pacifica*, occurs in the South Fork watershed. It occurs in moist, low elevation forest on soil, moss, rocks, logs, and tree boles.

The project area was reviewed summer 2015, using intuive controlled surveys. The surveyor traversed through the project area enough to see a representative cross section of all the major habitats and topographic features, looking for the target species. When the surveyor arrived at an area of potential habitat, defined in the pre-field review or encountered during the field visit, a survey for the target species was completed.

Unit surveys resulted no Survey and Manage species in the project area.

Environmental Consequences – Survey and Manage Botanical Species
Direct and Indirect Effects

*Alternative 1*
This alternative would have no effect on survey and manage species because habitat modification as a result of timber harvest would not occur in the project area.

*Alternative 2*
There will be no effect on survey and manage species in the Lang Dam project area from timber harvest because no plants were located at the time of surveys.
Cumulative Effects
The cumulative effects analysis area for survey and manage species is the Lang Dam harvest units because there is potential habitat for these species and any cumulative effect from the proposed action is expected to occur within the harvest boundary. There are no known survey and manage plants in the Lang Dam; therefore, there is no cumulative effect to these species.

Affected Environment – Special Habitats
Special habitats are non-forested habitats which are limited in size and distribution across the landscape. Small, scattered habitats play important roles not only for perpetual occupants of the sites, but also for those organisms who use them seasonally, or for only a portion of their life cycles.

Numerous factors contribute to the creation or maintenance of special habitats. Among such factors, topography and hydrology often determine the microclimatic conditions at these sites. Some features, such as rock outcrops, are static and remain on the landscape. Wetland special habitats can be ephemeral or perennial depending on the water source. Meadows are unique because both natural disturbances and processes create them. Conversely, they can also be lost to natural processes such as encroachment. Table 35 identifies special habitats in potential Lang Dam harvest units.

Table 35 Special Habitats in the Lang Dam Project Area

<table>
<thead>
<tr>
<th>Proposed Units</th>
<th>Special Habitat</th>
<th>*No-Disturbance Buffer</th>
</tr>
</thead>
<tbody>
<tr>
<td>20, 30, 60, 70, 80, 90, 100, 110,120, 150, 160, 170, 180</td>
<td>wetland/seep</td>
<td>**30 ft.</td>
</tr>
</tbody>
</table>

*No-disturbance buffer distance is based on Special Habitat Management Guide. **Buffers will be expanded if Aquatic Resource analysis recommends increasing them in order to maintain hydrologic function.

Environmental Consequences – Special Habitats

Direct and Indirect Effects

Alternative 1
There will be no measurable effect to any seep/wetland with selecting this alternative.

Alternative 2
The action alternatives will have no impact on special habitats. Buffers will protect special habitats from harvest and ground disturbing activities. These habitats are not as common as forested habitats and they support plant communities which are different from those of coniferous forest. These buffers will maintain the microclimate, hydrology, and prevent damage to the areas during project implementation. Without the no-disturbance mitigation, reduced cover could potentially decrease humidity and increase temperature earlier in the growing season, thus altering habitat viability.

Cumulative Effects
The analysis area for special habitat cumulative effects is the Lang Dam units. This area was chosen because activities outside the analysis area will have no effect on special habitats located within the project analysis area.

There will be no effect to special habitats in the Lang Dam project area because of the no-disturbance buffer mitigation; therefore, there will be no cumulative effect from the proposed actions.

Based on the analysis of this project, there will be no incremental change to existing populations of special habitats in the project area as a result of selecting any of the alternatives. There are no
foreseeable future actions (e.g. burning, encroachment thinning) which will contribute additional cumulative effects to special habitats within the project area.

**Affected Environment - Invasive Plants**

Several populations of invasive plants are present in the Lang Dam project area. Plant species such as: St. John’s Wort (*Hypericum perforatum*), Scotch Broom (*Cytisus scoparius*), Tansy Ragwort (*Senecio vulgaris*), Bull thistle (*Cirsium vulgare*), Himalayan Blackberry (*Rubus armenicus*), cutleaf blackberry (*Rubus lacinatus*), and spotted knapweed (*Centaurea strobile*) are found along roads within and adjacent to the project area (Table 36). With the exception of spotted knapweed, these weeds are considered “established invaders” because they are commonly found on adjacent properties and throughout the Willamette National Forest. Spotted knapweed and false brome (*Brachypodium sylvaticum*) are considered “new invader” species because their distributions are limited in the Forest and they have greater potential for spread.

False brome and other known species in the Lang Dam project area are found on road shoulders, but occur in some proposed harvest units. Similar management actions in adjacent watersheds have contributed to the establishment of this plant in particular. Based on post-harvest observations of these other stands, it is assumed false brome will likely become established in all suitable habitats adjacent to established populations in the Lang Dam project area. Best Management Practices, such as Early-Detection, Rapid-Response, equipment cleaning, and competitive seeding are effective at minimizing post-harvest effects on invasive plants.

Grasses and forbs are the first plants to colonize early seral habitats, with shrubs and trees establishing later as the stand matures. Gaps and other created openings attract wildlife looking for forage. Though less palatable than native forage, false brome is browsed, and then passed through manure. The seed also embeds in their fur. Most foraging wildlife species cover large areas, as such, there is potential to increase the range invasive plants, even with established Best Management Practices.

**Table 36 Invasive Plants in the Lang Dam Project Area**

<table>
<thead>
<tr>
<th>Invasive Species</th>
<th>Proposed Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>False brome (<em>Brachypodium sylvaticum</em>)</td>
<td>170, 190, 220</td>
</tr>
<tr>
<td>Spotted knapweed (<em>Centaurea maculosa</em>)</td>
<td>20, 30, 60, 80, 150, 160, 180</td>
</tr>
<tr>
<td>Blackberry species (<em>Rubus armenicus/R. lacinatus</em>)</td>
<td>20, 30, 50</td>
</tr>
<tr>
<td>Scotch Broom (<em>Cytisus scoparius</em>)</td>
<td>20, 30, 40, 150, 170, 180</td>
</tr>
<tr>
<td>Tansy Ragwort (<em>Senecio vulgaris</em>)</td>
<td>20, 30, 40, 150</td>
</tr>
<tr>
<td>St. John’s Wort (<em>Hypericum perforatum</em>)</td>
<td>20, 30, 60, 80, 150, 180, 220</td>
</tr>
</tbody>
</table>
Environmental Consequences – Invasive Species

Direct and Indirect Effects

**Alternative 1**
There would be no effects to invasive plants with this alternative. Invasive plant populations would likely continue to spread at the current rate. Selecting this alternative would not create disturbed areas as a result of harvest, hauling, or fuel treatment activities.

Since the No-Action alternative does not propose thinning, temporary road construction, or fuel treatments it would not create additional suitable habitat in terms of soil disturbance, temporary roads, gaps, or landings. However, natural vectors (i.e. wildlife and wind) would continue to spread invasive plants. New and potential invader plant populations documented in the Lang Dam Project Area would remain highest priority in receiving treatment and monitoring, as determined by the District Botanist.

**Alternative 2**
Invasive plant effects in this alternative can be minimized through proper inventory and project design. Since the majority of the Forest’s invasive plant infestations occur along road shoulders, road maintenance and skid trails in harvest units represent a particular risk for inadvertently spreading weeds. Activities such as grading, brushing and mowing, culvert upgrades, and ditch cleaning can spread invasive plant species from one watershed to another.

Ground disturbance and habitat modification from project implementation will have an effect on invasive plants. It provides suitable conditions for invasive plants to establish or out-compete early pioneer native species. This effect will be observed for approximately 3-5 years on temporary roads and created openings (landings and gaps). This effect will diminish over time as native vegetation establishes and out-competes the non-native species. Often there are many other connected activities, such as road improvements and slash treatment which have a presence on the landscape and result in some degree of ground disturbance.

Based on the observed response of false brome to management in similar timber types, it is likely Alternative 2 could eventually spread false brome into an additional 320 acres early seral habitat (gaps) above and beyond the commercial thinning acres. This is also in addition to 324 acres regeneration harvest. Regeneration harvest will leave approximately 20 trees per acre depending on land allocation and will result in larger swaths of available ground for false brome establishment. False brome establishes along disturbed margins and spreads into adjacent habitats, invading successfully under a range of environmental conditions including shade and high nutrients (Holmes et al. 2008).

In order to mitigate the effect ground disturbance will have on invasive plants, temporary roads and landings will be re-vegetated using native grass seed. Off-road machinery washing will occur prior to accessing and departing sale areas to mitigate the potential of vectoring invasive plant propagules. Rock sources used in temporary road construction will be free of invasive plants and approved by the road engineers and the District Botanist.

By comparison, Alternative 2 proposes to harvest more acres and modify more habitat in the Lang Dam project area than Alternative 3. Therefore Alternative 2 carries a higher risk of creating new habitat for weed invasion.

**Cumulative Effects**
The cumulative effects analysis area for invasive plants is the Lang Dam project area because it addresses known distribution of invasive plants and likely travel routes for the proposed project. The invasive plants found in the project area are shade-intolerant and generally confined to roadsides and open areas, with the exception of false brome which in known to occur in some proposed harvest units.
The Lang Dam project proposes 630 acres of timber harvest. Past management action has contributed to the current invasive plant condition, with approximately 5,143 acres of timber harvested from 2014 through the present. This includes implementation of projects analyzed in Bridge EA, Horse Creek EA, Green Mountain EIS, and various fuels reduction projects. Temporary roads constructed with the timber projects were re-vegetated and decommissioned after the activities were completed. Decommissioning and re-vegetation post-harvest was done to mitigate the effect of temporary roads by prohibiting vehicular access and establishing competing vegetation. Based on plant observations in similar habitats, native vegetation generally returns to a previously disturbed area within 2-5 years. Competitive seeding reduces the amount of resources available to invasive plants and the amount of time it will take for native plants to colonize a site.

Timber harvest is the greatest contributor in this project to cumulative effect on invasive plant habitat just as it does to fungi habitat. Alternative 2 proposes 630 acres; while approximately 5,143 acres have been managed in the past. Alternative 2 will increase potential cumulative effects to invasive plant by approximately 12 percent. Therefore, Alternative 2 carries a higher risk of cumulative effects to invasive plants compared to Alternative 1.

Mitigation of approximately 50 percent of these cumulative effects could occur through proper implementation of the Project Design Criteria list in Chapter 2, which includes a number of best management practices such as equipment cleaning, using weed-free rock, minimizing soil disturbance, and competitive seeding of temporary spurs and landings.

3.10 Fire and Fuels

Summary of Effects Analysis

Alternative 2 Proposed Treatments will include underburning and hand/machine piling and burning. Treatments will meet Forest Standards and Guides to reduce fuel loading created from harvest. Reduced fuels will create greater safety for firefighters and public when future wildfires occur. The treatments will reduce the potential for higher wildfire behavior within the Wildland-Urban Interface of private land and community boundaries, improve wildfire management operations and support positive impacts to natural resources. The use of prescribed fire will add a secondary benefit of returning the natural disturbance process to the forest ecosystem.

Scale of Analysis

Project and stand specific data, as well as landscape level data, were used as it represents the nature of wildfire and how it moves across the landscape. Stand level information was used to identify and predict specific fuels characteristics and effects.

Affected Environment

Fire on the Landscape

Historically, fire played an active role and fire’s role will continue to be vital on the Willamette National Forest (Agee 1993). Researchers have concluded “forest fire[s] [have] been an important process in Pacific Northwest forests profoundly affecting forest age and species distributions, hence wildlife habitat, watersheds processes, aquatic ecosystems, carbon dynamics, and nutrient cycling” (Weisberg and Swanson 2003). It is a biophysical process (Ryan 2013), an ecosystem process (Teensma 1996) and species have adapted to the fire process (Pausas 2009). Fires are often caused by lightning, and prior to Anglo-settlement Indigenous people actively managed the land by using fire (Ryan 2013; Boyd 1999; Weisberg 1998; Teensma 1996). Removing natural wildfire and limiting prescribed fire have inhibited or halted natural processes for changes in the forest ecosystem. The influences of human actions
(development, fire suppression and logging) over the past century have changed fire disturbance processes across the project area.

Near the project area, researcher Alan Tepley's studies (2013) convey non-stand replacing fires (i.e., fire that kills 70% or less of the overstory trees) have been eliminated which affects the changes of various cohorts in structure over time. This is a characteristic of mixed severity fires or Fire Regime III (FRIII). These fires are not stand-replacing but rather create a patchy mosaic of different mortality (forest structure and diversity) across the landscape (Tepley 2013; Swanson 2008; Kertis et al. 2007; Weisberg 1998; NWCG Glossary). Fire regimes I, III and V are in and around the project area. Fire Regime I describes fires frequency and severity at 35 years or less with low severity (mortality). Fire Regime II is 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced) and Fire Regime V is 150+ year frequency and high (stand replacement) severity. Figure 18 displays the Fire Regime in and around the project area.

![Figure 18 Fire regimes in the Lang Dam Project Area](image)

Private land, power lines for Eugene and the local community, Cougar Dam and other structures intermingle with wildland fuels making the project a part of the Wildland-Urban Interface (WUI) in the McKenzie River Valley. These structures are considered within the Wildland-Urban Interface where wildland fuels within 1.5 miles can threaten to ignite structures (Silvis Lab, website). Additionally, recreators and long-term campers create a high probability for human caused fires which can impact the Wildland-Urban Interface and public safety. Within the past 45 years, 19 of 22 fires in the Project Area have been human caused. Continuous canopy closure and increased vegetation and fuel in the understory due to fire suppression and human management create more potential for faster spreading wildfire.
Fuel Profile

Dead needles, sticks and branches are the fuels that most often carry the fire and are measured by size as it relates to the amount of time for the fuel to dry: 1 hour fuels – 0-.25 inch diameter; 10 hour fuels - .25-1 inches; 100 hour fuels – 1-3 inches (NWCG Glossary). Larger fuels, greater than 3 inches, contribute to residence time and play a role in fire behavior but are not often used to model fire behavior. One, 10 and 100 hour fuels are estimated for post-harvest loading (amounts) and used in fire behavior modeling and predictions. One hour fuels fluctuate quickly during the course of a day. When weather conditions warm up through the fire season, 10 and 100 hour fuels dry and become more readily available to burn enabling fire to move quickly or burn more intensely.

Surface fuel loading (the amount of fuels on the ground) and depth correlate to the fire behavior (Brown and Snell 1980). Fuel loading (measured in tons/acre) is used to model fire behavior within the units. Horizontal or surface fuels refer to fuels on the ground, while vertical fuels refer to the ladder fuels (from the ground to the canopy of trees) such as brush, younger trees and limbs on the bole of larger trees within the stand.

Lichen carries fire and often creates tree torching or increases the chances for crown fire to initiate and move. Lichen exists in moderate amounts inside and outside of the project area and it is on the boles and branches of trees. Lichen dries faster than 1 hour fuels, burns quickly and carries fire and often creates tree torching or increases the chances for crown fire to initiate and move.

Fire Behavior

Fire is a dynamic process influenced by fuel loading and multiple environmental factors such as wind, topography, temperature, and humidity. Modeling fire behavior helps to identify fires movement and impacts within the vegetation. Fuel models (FM) are used to quantitatively describe surface fuel loading which is used as inputs to the fire behavior models, as well as for firefighter’s reference when engaged in a wild or prescribed fire (Anderson 1982; Maxwell et al. 1980). In the project area the following fuel models are identified:

- FM8 – young stands (20-80 years old) with light fuel loading of approximately 5 tons/acre of 0-3 inch fuels and varying amounts of brush in the understory; low intensity fires with low severity (low mortality of dominant overstory vegetation). This FM represents the proposed harvest units and stands within the project area.

- FM10 – intermediate to older stands (>80 years old) with moderate to heavy fuels on the ground, ladder fuels and lichen in the trees; high fire intensity and severity including crown fire with mortality. 0 to 3 inch fuels are often 7 tons per acre or greater. This FM represents stands outside of the proposed units and within the project area.

- FM11 or 12 - representative of light to moderate slash loads following timber harvest and the average modeled fuels loading is about 13 tons/acre or more. The continuity of slash can greatly increase fire behavior depending on fuel loads. This FM represents stands post-harvest and prior to fuels treatments.

Fire behavior was modeled using BehavePlus5 (NWCG Glossary) with fuels inputs that correspond to the Lang Dam Project Area. Fire weather data used in the model represents hot and dry summer conditions. During this weather a wildfires rate of spread can escape initial attack and potentially threaten firefighters, public or private property (Table 37).
Table 37 Modeled Wildfire Behavior for Proposed Lang Dam Units

<table>
<thead>
<tr>
<th></th>
<th>Rate of Spread (chains/hour)\textsuperscript{b}</th>
<th>Flame Length (feet)</th>
<th>Percent Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing conditions inside and outside of units\textsuperscript{a} (FM10)</td>
<td>9 ch/hr</td>
<td>8 feet</td>
<td>45 percent</td>
</tr>
<tr>
<td>Post-harvest, NO fuels treatment (FM11)</td>
<td>15 ch/hr</td>
<td>8 feet</td>
<td>50 percent \textsuperscript{b}</td>
</tr>
<tr>
<td>Post-fuels treatment (FM8)</td>
<td>3 ch/hr</td>
<td>1 feet</td>
<td>1 percent</td>
</tr>
</tbody>
</table>

\textsuperscript{a} – Prescription parameters were hot, dry conditions similar to those during fire season. (80°F, 10 mph 20 ft. wind, 1, 10, 100 hour fuels at 4, 6, 8% moisture, respectively).

\textsuperscript{b} – One chain equals 66 feet.

NOTE: See Fire/Fuels analysis for modeling data.

Firefighters ability to suppress a wildfire is not safely achievable when flame lengths (FL) are too intense (hot) for firefighters (FL measured >4 foot high) and the rates of spread (ROS measured in chains per hour which is 66 feet per hour) exceeds the ability of firefighters to build handline faster than the fire is moving. Fire suppression operations will require mechanized suppression resources to safely suppress the fire. Other characteristics that create fire suppression difficulties or increase fire fighter hazards are: tree torching or fire carrying through the crowns of trees and spotting ahead or outside of the main fire perimeter, fire spreading quickly through the canopy of trees from high amounts of lichen, and extreme temperatures and dry weather that create dry fuel ready to burn.

With suppression and forest management, wildfires have not played their natural disturbance role on the landscape. The departure from historic conditions affect the current wildfire behavior, fuels, stand structure, spatial arrangements, species composition and successional roles. Using prescribed fire for slash reduction can offer changes to aim towards diversity and adding the ecological benefits (Means et al. 1996).

Environmental Consequences

Direct and Indirect Effects

\textit{Alternative 1}

No fuels treatments would take place in the no action alternative. Fire suppression would continue, given proximity to private land and the community. Vegetation would persist through successional pathways with no natural disturbance. Additionally, prescribed fire as a disturbance process in the project area would most likely not occur without forest management. Without wildfire or changes to stand structure from thinning, wildfires have potential to burn more acres given greater fire behavior if suppression is unsuccessful.

\textit{Alternative 2}

Harvests will create slash on 532 acres increasing the fuel loading, especially in the 1, 10 and 100 hour fuels. The proposed fuels treatments for Alternative 2 will reduce slash and range from underburns, mechanical or hand piling and burning. Underburns are favorable, however treatments could change due to funding, size of the trees and location of the units. Acreage not underburned may have other post-harvest fuels treatments such as grapple piling, mastication or chipping. Following timber harvest the heavy fuel loading can persist at least five years or more with red needles during the first one to two years. Slash is lofty which allows air to funnel through creating a productive burning environment, especially with red needles. The increase in fuels raises the potential for greater or more intense wildfire behavior. During a wildfire the rate of spread (ROS measured in chains per hour which is 66 feet) in slash can be greater than pre-harvest existing conditions.
The proposed fuels treatments for Alternative 2 will reduce slash in all units. This will aim to meet the Forest Standards and Guides (FW-252) and consist of acres of underburning, machine or hand piling and burning. Harvest created slash will be treated 1-2 years post-harvest. The fuels treatments within each unit will help improve firefighter and public safety during future wildfires, help to increase diversity to the project area and offer a secondary benefit of returning the natural disturbance process of fire.

Post-harvest fuel loading was calculated for all units based on the stand exam data. The values are for 1, 10, and 100 hour fuels (0-3 inch diameter fuels) measured in tons/acre and categorized by stand age classes. The average post-harvest fuel loading (without fuel treatments) is 13 tons/acre. Post-fuels treatment fuel loading will meet Design Features (<11 tons/acre). Modeling data was specific to each unit and can be referenced in the Fire/Fuels analysis file.

From past experience on the District, underburns often consume an average of 80 percent of the fine fuels 0-1 inch diameter (1 and 10 hour fuels), 40-60 percent of the 1-3 inch fuels (100 hour fuels) and only about 20 percent of the 3-9 inch fuels (1000 hour fuels). The fuel moisture of large woody material (> 9 inches) is most often higher and will not be consumed, only the bark will be charred. Prescribed fire treatments will be one or two underburns or one or two units with piles burned in a day.

Fire behavior was modeled for existing fuel models and post-harvest with and without fuels treatments (Table 37). Weather parameters used for modeling were hot, dry conditions similar to those during the fire season.

In the event of a wildfire, fire behavior will be reduced with harvest (reducing canopy continuity) and fuels treatments (reducing fuel bed) by keeping fire on the ground and not in the canopy thus improving suppression efforts. A more open canopy can allow the sun to quickly heat the vegetation and fuels on the ground, and with fewer trees the potential for wind within the stand can increase. Even though these modifications could result in faster rates of spread during a wildfire they will be lower intensity (heat), duration and lower flame lengths compared to harvested stands with no fuels treatments. The harvest and fuels treatments also reduce ladder fuels (vertical and horizontal fuels) which will reduce the potential for tree torching or crown fire (Safford 2009; Lindh 2003; Agee 2002) reducing spotting in and out of the unit.

Wildfire and prescribed fire are dynamic processes influenced by multiple environmental factors such as wind, topography, temperature, and humidity. Due to these influential factors, which create and alter fire behavior, a chance exists to exceed underburn objective parameters and Design Criteria (mortality <10% and meeting Forest Standard and Guides FW-252, FW-081, FW-253). To reduce these factors, underburns will take place under prescribed weather and fuels conditions, most likely in the spring or fall. The prescribed burns will be administered using tempered speeds of ignition to reduce mortality of residual canopy. These conditions and operations slow or stop consumption after the fine fuels are consumed and keep the intensity moderated. In the event the fire behavior exceeds treatment objectives or burning operations, changes are evaluated immediately and adjustments are made to alter or reduce fire behavior. Containing fire in the units is important given firefighter and public safety, private property, project objectives and surrounding natural resources.

Prescribed underburns (through the entire unit or in gaps) will also help to create snags and return fire as a natural disturbance process to the ecosystem. Underburns will help to reduce competition and prepare the site for natural or planted regeneration and improve species diversity. Prescribed fire will return the disturbance that creates changes to the soil, nutrients, vegetation species and regeneration (Swanson 2008) as well as simulate non-stand replacing wildfires (mixed severity) (Teply 2013; Barrett et al. 2010).

Underburns may require firelines constructed around the perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Firelines are created by scraping fuel back to mineral soil (18” line) and scattering fuels that lie within 10 feet of the fireline. If needed, units
on steep slopes will have waterbars constructed within the fireline to reduce erosion. Firelines are rehabilitated to existing conditions if needed.

Firelines are usually not built along skips or riparian reserves (shaded areas). During the prescribed burn, these areas burn with less intensity due to lower temperatures and higher relative humidity from the thicker canopy cover. Fire often backs into the shade and behavior decreases to a smolder or extinguishes itself.

Hand, grapple, and landing piles are covered with regulatory plastic following construction (Oregon Department of Forestry 1995). This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall, winter or early spring when there is very low risk of fire spreading from the piles. Removing the plastic before burning is suggested in order to aid in reducing emissions from the plastic.

After treatments the fuel profile will aid in protecting private property surrounding the treatment units. Fuels treatments next to private property will aid in changing fire behavior moving from the project area to private and vice versa. Again, hazards to firefighters and public, property/structures, and resources will be decreased and suppression tactics and safety will improve. Additionally, many unattended campfires (19 in the past 45 years in the project boundary) will be better detected with greater visibility in the understory.

Monitoring for McKenzie River fire and fuels will take place prior to, during and following the fuels treatments. Fuels treatments and data offer information to use in future projects.

For information on smoke emissions see Air Quality Section 3.11

Cumulative Effects

Cumulative effects of the Lang Dam Project alternatives were analyzed in the East Fork, Elk Creek, Cougar Creek and Cougar Reservoir 6th field watershed. Past, present and reasonably foreseeable hazardous fuels projects and timber harvest aid in changing wildfire behavior and activity due to reductions in fuels. Since 2008, hazardous fuels projects have been occurring throughout the McKenzie River communities along major roads/highways and next to private property boundaries. These treatments add to the benefits of fuels treatments and thinning in the Lang Dam Project. Hazardous fuels projects are different than timber harvests as only the understory trees and shrubs <10” dbh are cut, piled and burned or chipped. This type of understory thinning aids in reducing fuel continuity from the ground to the crowns of trees. When fire moves in the canopy, spreading quickly and increasing spotting, private property and homes are put at a greater risk. All of these projects and Lang Dam proposals will aide in community wildfire safety and reduction. The following projects are planned within the next 5 years:

- 410 Road Hazardous Fuels Project Decision Memo CE – 94 acres of hand piles along FS Road 1900-410 and King Road will be burned this winter 2016/2017.
- Highway Corridor Fuels Reduction DM 2009 – 24 acres of hand piles along the north side of Highway 126 at the FS Road 19 junction will be scheduled to burn in 2017/2018.
- Lower Road 19 Hazardous Fuels Project CE (in planning) – approximately 300 acres of thinning and hand piling and burning will begin in 2017. The project will continue over the next two to five years and hand pile burning will begin in 2018.
- Green Mountain EIS fuels treatments will begin within the next five years following the timber harvests.
Alternative 1
Because of no action, there would be no additional impact on the environment from this project when added to the impacts of other past, present, or reasonably foreseeable future actions (40 CFR §1508.7). Fire suppression would continue thereby affecting the changes to the ecosystem with the continued removal of the natural disturbance.

Alternative 2
For Alternative 2 approximately 532 acres or 13 percent of the analysis area will have post-harvest fuels treatment. These treatments, in addition to the planned and previously implemented fuels and thinning projects within and surrounding Lang Dam Project, will assist in changing the continuity of fuels. These changes are on a finer scale than the way wildfire could or will have naturally occurred but having the change will offer beneficial assistance to fire fighter and public safety and reduce risks to private property.

Additionally, continued fire suppression and timber management have different effects (on wildlife, habitat, aquatics, soils and vegetation species) than having fire play its natural role. Many documents and researchers speak about the importance of fire in the forest ecosystem. As stated by Teensma (1996), “restoration and maintenance of fire as an ecosystem process is critical to retention of biological diversity and ecosystem sustainability.” Mixed fire severity regimes across the landscape is a component to maintain varying historic pathways (Tepley et al. 2013). The Lang Dam Project will help fire play a role in aiding the ecosystem processes through reducing post-harvest fuels.

Compliance with the Forest Plan and Other Regulatory Direction
The Willamette National Forest Land and Resource Management Plan (Forest Plan) FEIS and Record of Decision (ROD) establishes management standards and guidelines for treatment, maintenance, or reduction of hazardous fuels to achieve the desired future condition. Measurement criteria are consistent with the Forest Plan standards and guidelines.

- McKenzie River Ranger District follows The Northwest Oregon Fire Management Plan – an interagency plan established to provide additional guidelines for prescribed and wildfire activities.

- A detailed, nationally approved interagency prescribed fire burn plan is a requirement for any activity involving prescribed fire. An individual plan is developed and used on each activity unit. It identifies management objectives specific to the Forest Plan, details about the stand to be burned, prescription parameters, contingency, safety hazards and mitigations, and public notification. Prior to fuels treatments fuels will be identified on the ground using transects and/or photo series to gather specific fuel loading. The District Ranger or Forest Line Office is required to sign and approve the burn plans before implementation.

3.11 Air Quality

Summary of Effects Analysis
Smoke emissions (airborne particulate matter) from pile burning or underburning should not last more than one or two days after the burn. The fuel loading post-harvest and consumption amounts will be measured prior to burning and the timing of the burns (date of burn and length of ignition) will aim to avoid high amounts of smoke that trigger hazardous air quality readings on nephelometers. Smoke emissions were modeled in FOFEM (First Order Fire Effects Model) program using representative fuel loading post harvests. Direction of travel was modeled in BlueSky Playground program with average seasonal wind and with moderate amount of consumption smoke did not heavily impact the Smoke
Sensitive Receptor Areas (<50 ppm of PM$_{2.5}$ particulate matter micrometers). Oregon Smoke Management forecasters will be notified prior to the burn and they will authorize implementation based on the amount of emissions predicted and the current weather forecast wind directions. Fire management personnel will notify surrounding communities and those that may receive low to moderate amounts of smoke during the burn.

**Scale of Analysis**

Scale of analysis is in (upper McKenzie River Valley communities) and surrounding the project area. The travel or path of smoke is analyzed at a larger airshed (geography that shares the common flow of air) and will extend within and outside of the Willamette National Forest.

**Affected Environment**

Standards for ambient air quality are set by the Environmental Protection Agency (EPA) and are designed to protect human health and welfare. Air quality can be impacted by the presence of particulate matter (and other pollutants) produced by both prescribed fire and wildfire smoke. EPA considers wildfires to be natural events even though some accidental human actions initiate some wildfires and, to some degree, prior land management practices can influence the frequency and scale of wildfires. Smoke generated from prescribed burning and wildfire must meet federal and state air quality standards set forth in the 1970 Clean Air Act (CAA section 160).

The State of Oregon has been delegated authority for attainment standards set by the 1990 and 1977 Amendments of the Clean Air Act. To regulate these standards, Oregon developed the Oregon Clean Air Act State Implementation Plan (Oregon Department of Forestry 1995). These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest uses this plan for emission control in Oregon (USDA Forest Service 1990).

Under the Oregon regulations for prescribed fire smoke emissions, visibility and particulate matter (PM$_{2.5}$ and PM$_{10}$ micrometers) are measured through predicted fuels burned and through using nephelometers in smoke-sensitive receptor areas (SSRA). The nephelometer measures particulate matter and relates the measurements to air quality and pollution and impacts to humans. These are regulated in the airsheds surrounding the Lang Dam Project area, which includes SSRA and Class I Airsheds. Nephelometer values range from good to hazardous, 0 – 500. “An Air Quality Index value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level EPA has set to protect public health” (AirNow website). Prescribed fire on Lang Dam is prescribed to be below 100.

Priority areas near the Lang Dam Project:

- **Smoke Sensitive Receptor Areas (SSRA)**
  - Oakridge – 27 air miles southwest
  - Willamette Valley, eastern edge is Deerhorn – 20 air miles west
  - Bend – 43 air miles east
- **Class I Airsheds – protected from visibility impairment (Oregon Visibility Protection Plan)**
  - Three Sisters Wilderness – southeastern boundary of project area
  - Mt. Washington Wilderness – 13 air miles northeast
- **McKenzie River communities (non-designated state areas)**
  - McKenzie Bridge – three air miles northeast
  - Blue River – two air miles northwest
Environmental Consequences

Direct and Indirect Effects

Air quality is important and a concern for people and airsheds. During prescribed fire, smoke emissions are short term (1-2 days). Blue River and McKenzie Bridge communities may have smoke during the evening hours following the prescribed fires as diurnal wind patterns can carry smoke downhill or down the valley. Class 1 Airshed guidelines will be met and coordinated with the Smoke Management Forecaster. The movement of smoke through the airshed will also be reviewed from the Forecaster.

Alternative 1

If no management actions take place in the Lang Dam Project Area there would be no air quality impacts from fuels treatments. However, the risk of wildfire would still exist. Air quality impacts from wildfire are considerably higher than they are from prescribed fire. Wildfire smoke emissions are not short term and can often last for many weeks or months, as they did during Scott Mountain Fire in 2010 and Shadow Lake Fire in 2011. Smoke emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of PM$_{2.5}$ and PM$_{10}$ given the amount of time the fire burns.

Alternative 2

Smoke emissions will be mitigated based on the timing of the burns, seasonality, forecasted transport wind direction, and weather. The Oregon Smoke Management plan requires scheduling prescribed fire on days which are suitable in relation to other land owners burning, weather forecasts and location to Class I Airsheds and communities. The importance of visibility in Class I Airsheds, such as Three Sisters Wilderness on the east side of the project area, is recognized and burn prescriptions and timing will be designed to minimize potential for smoke intrusion in these areas. Prescribed fire will aim to burn in order to protect visibility standards for Class I Airsheds.

Communities near the Lang Dam Project Area may be temporarily impacted by drift smoke from the prescribed fire underburns or pile burning. Smoke settling into the valley can impact community members who are sensitive to smoke. The time span smoke is emitted is short and the impact on community members are important to monitor.

The local communities and public will be notified prior to burning. During the prescribed fire activity signs will be placed along the road or near the treatment area to inform public drivers of smoke along the road. Additional guidance will be calling local community members, posting signs in the community areas (i.e., grocery stores), submitting publication in the local newspaper and tracking burn program on the Willamette National Forest Webpage. Prescribed fires notification and implementation will also be designed to minimize the potential for impact to visitors in these areas:

- Delta Campground – within the northern portion of the Project Area
- Terwilliger Hotsprings – along Rd 19 and three miles south of Cougar Dam

From past experience on the District, underburns often consume an average of 80 percent of the fine fuels 0-1 inch diameter (1 and 10 hour fuels), 40-60 percent of the 1-3 inch fuels (100 hour fuels) and only about 20 percent of the 3-9 inch fuels (1000 hour fuels). The fuel moisture of large woody material (> 9 inches) is most often higher and will not be consumed, only the bark will char. Prescribed fire treatments will be one or two underburns or one or two units with piles burned in a day.

Particulate matter emissions was modeled and compared between wildfire and post-harvest prescribed fire. Results identified wildfire emitting 300-400 percent more PM during one burn period. The fuels burned during a wildfire are greater at consuming large woody material and full tree crowns versus prescribed fire burning when larger fuel (logs and tree crowns) is moist and not consumed. The comparison of wildfire and prescribed fire uses the same number of acres for each, burning one day and under weather conditions that characterize the time of burn for prescribed and wildfires. Wildfires are
modeled with no suppression burning for one burn day using hot, dry conditions. Data can be found in the Air Quality Analysis.

It is important to note the emissions levels for all the fuels treatments within the project do not occur as a single event or at the same time. Underburns and pile burns usually occur during different seasons which will also alleviate smoke emissions during one period in time. In comparison, wildfire emission will occur over several days if it escaped initial attack. Under hot, dry weather wildfires can continue to burn for several days or months.

The direction of travel for smoke can be modeled in BlueSky Playground application. The program calculates fuel consumption and visually displays the travel path of smoke. This allows the prediction of where the smoke may travel and what effect it will have on air quality. For example, calculating results from an underburn on Unit 170 in May demonstrates the common seasonal wind carrying smoke in SSW and SSE directions. Inputs of average fuel loading post-harvest (13 tons/acre) and seasonal wind (direction and speed) were used. Smoke emissions and direction will be dynamic as fire ignition timing varies upon the weather and time of day. Model results can be found in the Air Quality Analysis.

Cumulative Effects

Alternative 1
Because this is no action, there would be no impact on the environment from the incremental impact of an action when added to the impacts of other past, present, or reasonably foreseeable future actions (40 CFR §1508.7). Fire suppression would still continue with the potential for wildfires to grow and emit particulate matter.

Alternative 2
Impacts on air quality from smoke emissions will not exceed state mandated policy. Prescribed fire smoke emissions will be short duration (1-2 days). Prescribed fire design features and prescription parameters will reduce the quantity of emissions during prescribed burns (See section 3.2). Because smoke is of short duration and dissipates over the course of one or two days past management activities will not cumulatively add to air quality impacts from the proposed treatments.

Additional projects will contribute to the amount and duration of particulate matter if treatments occur within the same few days of Lang Dam fuel treatments. The timing and emissions will be regulated and smoke will last 1-2 days per treatment (the number of burns implemented per day). The following hazardous fuels projects and fuels treatments, within and bordering the Lang Dam Project Area, will occur within the next five years:

- 410 Road Hazardous Fuels Project Decision Memo CE – 94 acres of hand piles along FS Road 1900-410 and King Road will be burned this winter 2016/2017.
- Highway Corridor Fuels Reduction DM 2009 – 24 acres of hand piles along the north side of Highway 126 at the FS Road 19 junction will be scheduled to burn in 2017/2018.
- Lower Road 19 Hazardous Fuels Project CE (in planning) – approximately 300 acres of thinning and hand piling and burning will begin in 2017. The project will continue over the next two to five years and hand pile burning will begin in 2018.
- Green Mountain EIS fuels treatments will being within the next five years following the timber harvests.

If two or more units are burned in or outside of the project area in one day (including burns on private land) smoke management forecasters coordinate with other land agencies or owners so air quality can be monitored and treatments scheduled in order to maintain acceptable air quality. This coordination will ensure this project meets guidelines and regulations through Oregon DEQ. No other foreseeable
management activities will affect air quality or occur in the Lang Dam Project Area or surrounding areas that could affect communities or wilderness.

Compliance with the Forest Plan and Other Regulatory Direction

1. Willamette National Forest Land and Resource Management Plan (Forest Plan) FEIS and Record of Decision (ROD) establishes management standards and guidelines for air quality intrusion to Class 1 Airsheds. Timing is evaluated during prescribed fire treatments.

2. The Oregon Smoke Management Plan and the State Implementation Plan regulate the standards set by the 1990 Clean Air Act and 1977 Clean Air Act and its amendments. The Willamette National Forest closely follows this plan and Oregon Department of Environmental Quality regulations to maintain air quality standards in communities and Class 1 Airsheds during prescribed fire and wildfire. Air quality analysis was based on the guidelines the Willamette NF follows. Particulate matter (PM) production was evaluated with the predicted fuel loadings post-harvest. Calculations of the estimated amounts of PM created was modeled in the First Order Fire Effects Model (FOFEM). Direction of spread within the surrounding airsheds was modeled in BlueSky Playground. Prior to work on the ground, each burn will be registered in Fastrax Smoke Registration Program (https://fastrax.ordvac.com/) to assure implementation and compliance with air quality regulations.

3. Wilderness Act established policies in the Forest Plan for reducing particulate matter intrusions within the Class I Airsheds. These standards and guidelines are managed in prescribed fire planning to reduce intrusions into the wilderness and work with smoke management forecasters prior to burning.

3.12 Water Quality and Aquatic Resources

**Summary of Effects Analysis**

The riparian vegetation and large woody material that provide for aquatic and terrestrial habitat complexity and productivity have been altered by past logging practices, road construction, and the construction of Cougar Dam. There is a lack of vegetation species diversity and structural complexity at the landscape and project scales. In general, the habitat elements that contribute to quality of fish and wildlife habitat and productivity are in an impaired condition primarily due to the presence of Cougar Dam, the removal of large woody material from streams and floodplains, and the alteration of riparian vegetation due to past logging and an altered flood regime. These conditions need to improve in order to meet Aquatic Conservation Strategy (ACS) objectives and support healthy, native fish and wildlife populations in the watershed.

Alternative 1 would have no immediate effect on the current conditions. Desired riparian conditions – high species and structural diversity with large dead and down wood – slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). And given the presence of Cougar Dam, flood disturbances that would benefit riparian vegetation would continue to be impaired. Active restoration of Riparian Reserve stands that currently do not meet ACS objectives would not occur. In addition, the currently dense Riparian Reserve stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands. Alternative 1 would result in little or no change to impaired habitat conditions for fish and other aquatic species.

Alternative 2 will commercially thin 120 acres and skip (i.e. not thin) 89 acres of Riparian Reserve to reduce the density of overstocked stands, increase species diversity and structural complexity, and accelerate tree growth to more quickly attain ACS objectives. This alternative will largely protect future
in-stream wood sources due to no treatment buffers (i.e. 89 acres of skips) but may reduce short-term (1-2 decades) sources of small dead wood in the outer portions of some Riparian Reserves in order to achieve desired vegetation characteristics. However, wood values will remain within the range of natural variability and abundant overstory will be retained for future wood input sufficient to sustain physical complexity. Direct management actions will create dead and downed wood within some Riparian Reserves. Sedimentation potential will increase during harvest activities but decrease after harvest due to road upgrades, decommissioning, and storage. The risk of sediment delivery through culvert failure will be reduced due to culvert installation, replacement, and drainage improvement. Due to project design features, protection measures, and enhancement treatments, Alternative 2 will result in beneficial changes to habitat conditions for fish and other aquatic species.

Alternative 2 was evaluated for effects on ESA-listed fish species bull trout, Upper Willamette spring Chinook salmon and their designated critical habitat. Potential project effects on population, habitat, and non-habitat indicators were evaluated in the Biological Assessment (BA). Although some project activities may have minor adverse effects at the site scale, the effects to the ESA listed fish and their habitat are considered to be either insignificant or discountable. The effects determination is described as “May Affect, but not Likely to Adversely Affect (NLAA) Upper Willamette spring Chinook salmon, bull trout, and their designated critical habitat.

**Scale of Analysis**

Unless otherwise noted, the geographic scale used to assess direct, indirect, and cumulative effects to water quality and aquatic resources for this project includes the project area units, the project area, the Elk Creek-McKenzie River, Cougar Creek-South Fork McKenzie River, Cougar Reservoir-South Fork McKenzie River, and East Fork-South Fork McKenzie River 6th field sub-watersheds (Figure 2 in Chapter 1).

**Assessment Methodology**

Data on current and historic watershed condition was gathered from the South Fork McKenzie Watershed Analysis (1994 and revised in 2010) and through GIS analysis of a USFS vegetation database (FSVeg).

At the beginning of the project all potential units were surveyed by fisheries, hydrology, wildlife, and botany specialists. Each unit was gridded to capture streams, springs, wetlands, and information on riparian conditions.

Based on stream and riparian characteristics, the hydrology, wildlife, and botany specialists jointly developed recommendations for no-treatment buffers and other potential treatments (e.g. down wood creation) for each waterbody. Refer to Table 5 in Chapter 2 for unit by unit information on Riparian Treatments.

Methods used for the analysis of fish, aquatic insects and in-stream habitat included:

- Field reviews of units,
- a review of stream surveys within the project area,
- a review of the McKenzie River Watershed Analysis (USDA Forest Service 1994 and 2010) for pertinent information,
- a review of macroinvertebrate data collected on the ranger district,
- review of other specialist reports,
- project design features.
Salmonid fishes (salmon, trout, chars, and whitefish) and the caddisflies on the sensitive species list have the potential to be affected by changes in stream shade that increase stream temperatures, supply and delivery of large woody material to the stream channel, and changes to sediment regime. Therefore, we analyzed these habitat attributes to determine the effects of the proposed activities to salmonid fish (a management indicator species) and caddisflies.

**Affected Environment – Riparian Conditions**

Most of the Lang Dam Project Area is located in the older West Cascades geologic region and contains stable, productive soils. Active slope instability from either debris chutes or slump / earth flow complexes effecting riparian reserve areas do not usually occur in this general area.

Primary streams within the project area include the South Fork McKenzie River, Cougar Creek, and Pond Creek. Most of the tributaries to the South Fork McKenzie River are moderate to high gradient (> 2 percent) first to fifth order\(^1\) streams. Boulders and large wood are key components found in these steep step/pool channels. Figure 19 shows the location of the major streams within the project area and the Riparian Reserve treatment units.

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\(^1\) Stream order: each headwater perennial Stream is assigned an order of 1. The confluence of two 1st-order streams assigns the downstream reach an order of 2. In this method, the confluence of two 2nd-order streams results in a downstream reach of order 3, and so on. The confluence of a 1st-order stream with a 2nd-order stream does not change the order of the downstream reach; it continues to be a 2nd-order reach in this case.
the land has been impacted by management. Some Riparian Reserves were clear-cut and replanted with Douglas-fir. As a result, many of these stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominant stands, with tree densities above the natural range of variability expected in this area. Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al. 1997; Poage and Tappeiner 2002). Therefore, stands with a range of 40 to 60 conifers per acre will be considered to be within the range of natural variability. Stand densities in the project area range from 234 to 503 total trees per acre (including trees under 4 feet tall), with an average of 331 trees per acre. Even if just over story trees > 7 inches dbh are considered, the average stand density is still high at 147 trees per acre. Additionally, Pollock et al. (2005) found that natural “riparian stands often develop in a much more open structure, such that stem exclusion is much less common and understory vegetation usually is present throughout the development of a forest.” The existing lack of complexity and diversity of many of the stands in the project area may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian dependent wildlife.

Little is known of wood counts in the smaller unnamed streams within project units since few are fish-bearing and are not typically surveyed using the standard USFS protocol. Field surveys were conducted in all proposed units, but these surveys provided only an estimated size range of “pool forming” wood and an estimated range of abundance.

Historic logging practices have greatly altered vegetation patterns within the project area. In late-seral stands, shrubs and herbs are reinitiated as conifers die and create gaps in the canopy. A study of riparian plant communities in northwest Oregon (McCain 2005) provides data on “relatively unmanaged” conditions. In this study, a total of 441 sites in the western Cascades were surveyed, with many of the Willamette sites on the McKenzie River Ranger District. The study describes riparian and upland plant communities based on geomorphic features (e.g. in-channel, cobble bars, terraces, floodplain, etc.). On the “steep banks/terraces” and “high terraces/major floodplain” features (common to streams in the project area), deciduous trees had typical cover values of 15-64 percent. Additionally, valley cross-sections (300-foot riparian transects) on 3rd and 4th order “relatively unmanaged” streams in the west Cascades had a hardwood basal area of 7-16 square feet/acre and hardwoods were present throughout the 300-foot transect. This study suggests that in “relatively unmanaged” riparian plant communities, there is typically a hardwood, shrub, and herb component. In addition, late-seral and old growth stands have numerous natural gaps which are frequently colonized by deciduous species (Warren 2013). The natural range of variability for early seral vegetation patterns within riparian forests are between 5 and 20 percent (Swanson 2012) and a large component of this early seral vegetation is deciduous and herbaceous (Gregory et al. 1991). These deciduous and herbaceous species provide many benefits to riparian and aquatic ecosystems, including better food resources and higher productivity for aquatic invertebrates compared to conifer-dominant systems (Sedell and Dahm 1984; Webster and Benfield 1986; Romero et al. 2005; Allen 1995; Wipfli 1997; Wipfli and Gregovich 2002; Cummins 2002; Allan et al. 2003; Musselwhite and Wipfli 2004; Wilzbach et al. 2005; Kiffney and Roni 2007); increased nitrogen fixation, organic matter cycling, soil fertility (Compton et al. 2003), and wildlife benefits.

Currently there is between 10-14 percent deciduous or mixed type vegetation within the Riparian Reserves of the Project Area. Based on the fact that there is a lack of both early- and late-seral vegetation classes that have a large deciduous and herbaceous component, it follows that these species are underrepresented on the current landscape. Figure 20 illustrates the desired conditions for late-seral Riparian Reserves with a mix of species and complex stand characteristics. Figure 21 illustrates typical overstocked stands in the project area.
Figure 20 desired conditions for Late-seral Riparian Reserves

Some portions of Riparian Reserves within the project area have higher structural and species diversity and are providing adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input to waterbodies, and habitat for riparian-dependent wildlife. Figure 22 illustrates properly functioning conditions within Riparian Reserves in the project area.

Figure 21 an example of overstocked, conifer-dominant stand in Riparian Reserves
The overall lack of deciduous and herbaceous vegetation may be impacting stream ecosystems. Nutritional energy becomes available to the stream community from two main sources: photosynthesis by aquatic plants in the stream itself (autochthonous sources) and decomposition of organic matter imported from outside the stream (allochthonous sources). The mix of energy sources has a major influence on the structure and function of stream ecosystems. Streamside vegetation provides large quantities of organic matter in the form of leaves, needles, and woody material. Leaves and needles usually contribute most of the readily usable organic matter in woodland streams (Murphy and Meehan 1991). Leaves and needles need to be conditioned by microbes for about 30 days before invertebrates will consume them.

In summary, the riparian vegetation and large woody material that provide for aquatic and terrestrial habitat complexity have been altered throughout much of the watershed and project area due to: clearcutting and replanting to single species monocultures; removal of hardwoods from riparian areas; removal of in-stream wood; replanting to create overstocked conditions; and removal of fire disturbance mechanism. Based on data gathered through landscape and stream reach assessments, it was determined that current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics needed to attain ACS Objectives. See Appendix C (Aquatic Conservation Strategy Objectives) for more details. Though the trend is slow, the overall aquatic habitat is improving in the project area as the riparian vegetation recovers towards more natural conditions.
Environmental Consequences – Riparian Conditions
Direct and Indirect Effects

Alternative 1 – No Action
Current rates of large wood recruitment, provided mostly by stem mortality (from competition, disease, wind and snow downed trees) and bank erosion, would be maintained. Alternative 1 would provide a slightly higher rate of in-stream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90 percent of the wood recruitment zones, the No-Action alternative would protect 100 percent. In some streams, recruitment trees are of sufficient size to meet ACS Objectives; but in other streams with small diameter riparian stands, the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Small diameter trees are also more likely to be transported out of the system. In-stream wood abundance is low for most streams in the project area and is largely due to the lack of current wood inputs and the lack of stable wood in channels. This lack of large, stable woody material indicates that the trees that are being delivered to stream channels are too small to be functional.

The No-Action alternative would not accelerate desired vegetation conditions. Desired riparian conditions – high species and structural diversity with large dead and down wood – would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively lower levels.

Accelerated restoration of riparian stands that currently do not meet ACS Objectives would not be accomplished. Alternative 1 would perpetuate the impacts of homogenous, densely stocked stand conditions longer into the future potentially by several decades.

In addition, the currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands. Although these are natural disturbance processes that contribute to forest habitat and diversity, a large disturbance event, or one of high severity, has the potential to reduce vegetation, large woody material, and stream shade across large areas of Riparian Reserves. Research conducted in the Pacific Northwest has shown that while fire severity may be lower along perennial streams due to relatively cool and moist conditions, fire severity along intermittent streams can be similar to adjacent upland areas (Tollefson 2004). In fact, under some circumstances, riparian areas can become corridors of increased fire spread (Pettit 2007).

Alternative 2 – Proposed Action
The Northwest Forest Plan (NWFP) prohibits timber harvest in Riparian Reserves except as needed to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS Objectives (NWFP Standards and Guides, TM-1(c)). Based on data gathered through landscape and stream reach assessments, it was determined that current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics needed to attain ACS Objectives. Therefore, there is a need to treat parts of the Riparian Reserves to accelerate attainment of desired conditions. Other areas, however, are currently meeting desired vegetation characteristics and treatment is not necessary. In some cases, the maintenance or restoration of each one of the ACS Objectives can be a balancing act with trade-offs. For example, to meet the riparian vegetation objectives (“species composition and structural diversity of plant communities” and “habitat to support well distributed populations of native plant, invertebrate and vertebrate riparian dependent species”) in young, dense conifer stands, a common silvicultural tool is to remove overstory density to encourage understory growth and structural development. Removal of
overstory density, however, could potentially lead to increased thermal loading or reduction of wood volume available for recruitment. Because of these trade-offs, conflicting objectives were carefully balanced based on characteristics of each waterbody and adjacent riparian area.

Alternative 2 proposes both active and passive management of Riparian Reserves: thinning, down wood augmentation, and no treatment. Below are descriptions of the types of treatments proposed and the considerations for analysis with each.

**Thinning in Riparian Reserves**

The body of literature on the effects of thinning on stream and forest ecosystems is quite extensive. Several key factors in determining where this type of treatment will be beneficial for the attainment of ACS objectives were considered. In-stream wood recruitment, upland down woody material levels, stand structure, and species composition are described below. Alternative 2 will thin approximately 120 acres within Riparian Reserves. Appendix E details where treatments are proposed within Riparian Reserves and the vegetation objectives for each unit in Alternative 2.

**In-Stream Wood**

In-stream wood is important to the health of aquatic habitats, and many researchers have studied the areas along streams where wood recruitment typically occurs. Wood recruitment zones, as they are called, vary from as little as 8m (26 feet) up to about 45m (148 feet) depending on various factors (Benda and Bigelow 2014, Spies et al. 2013). According to Benda and Bigelow (2014) and shown in Figure 23, wood source areas are highly variable, but are strongly correlated to tree height and the dominant wood recruitment process for each stream reach. In their study, they found that in managed forests of the Cascades Range, where bank erosion and tree mortality are the dominant wood recruitment processes, 90 percent of in-stream wood originated from within about 8 meters (26 feet) of stream channels and the remaining 10 percent is supplied from a distance equivalent to one tree height. Figure 23 shows the source distance curves for wood in Benda and Bigelow (2014). In less managed and unmanaged forests, 90 percent of in-stream wood originated from about 13 meters (43 feet) of stream channels.

![Figure 23 Source Distance Curves for Study Area](image)

In Meleason et al. (2003), the simulation model OSU STREAMWOOD was used to evaluate the potential effects of different riparian thinning scenarios on wood recruitment to streams over time. In one scenario, they modeled the contribution of wood from forest plantations (up to 120 years old in a
Douglas-fir – western hemlock forest), beyond no-harvest buffers of varying widths. The results suggest that no-harvest buffers greater than 10 meters (33 feet) from the stream channel contributed minimal amounts of wood volume to streams. In McDade et al. (1990), the mean wood source distance for first, second, and third order Cascade and Coast Range streams in mature and old growth stands was approximately 10 meters. Conifer tree heights in these stands ranged from 40 to 80 meters (131 to 262 feet). Johnson et al. (2011) demonstrates that in streams adjacent to undisturbed mature or old-growth forests in central and southern British Columbia, 90 percent of the wood at 90 percent of the study sites originated within 18 m (59 feet) of the channel. Robison and Beschta (1990) determined that the probability of a tree falling into a stream channel is primarily a function of tree height and distance from the stream. The upper crown of a tree, however, particularly in managed stands, is not of sufficient size to be considered of functioning size in the channel (i.e. large enough to influence stream morphology). Therefore, the “effective tree height” – the height to the minimum diameter and length necessary for the wood to qualify as “of functioning size”– is a more appropriate standard to use for assessing source area distance.

In all of the proposed riparian thinning stands, an area near the stream was designated as a no-harvest buffer to protect these wood recruitment zones as well as other resource concerns such as temperature. The overall goal for developing wood recruitment zones was to protect at least 90 percent of trees that could potentially be recruited to the stream channel. This level of future wood input is thought to be at sufficient levels to sustain physical complexity and stability required by the ACS Objectives. This no-harvest buffer ranges in width depending on specific conditions in each unit (i.e. width and gradient of stream, vegetation characteristics, etc.) and by stream type (i.e. seasonally flowing streams, perennial non-fish bearing streams, and fish bearing streams). Based on the research findings, a primary wood recruitment zone of 30 feet from each side of narrow (typically the intermittent class 4 and small class 3) stream channels was defined for young, dense stands within the project area, where bank erosion and tree mortality are the dominant wood recruitment processes and average tree heights range from 57 to 95 feet. Along the wider perennial and fish bearing streams where average tree heights were greater than 95 feet, no-treatment buffers range from 60 feet to 360 feet depending on conditions.

Terrestrial Down Wood

In addition to in-stream wood, numerous studies have been conducted that address both the specific roles of down wood in ecosystem inclusive of its ecological function for wildlife and aquatic species. However, there is no reliable method of accurately quantifying levels of downed wood expected to occur in the upland portions of Riparian Reserves, assuming there were no human impact to the forest since these are subject to many variants. Two management rotations in Douglas-fir stands have been estimated to reduce the abundance of dead wood by 90% compared to levels in natural old-growth systems (Rose et al.). It should be noted that stands go through a “U” shaped pattern of down wood development naturally; and depending on stand age, a fluctuation of large woody material is expected.

An estimate of the range of natural variability was used to develop down wood objectives. These objectives were based on input from wildlife specialists, modeling exercises using Forest Vegetation Simulator (FVS), and scientific literature review. Across the project area, current levels of down wood are within estimated historical ranges (see Wildlife Section for more information). Field surveys of the Lang Dam proposed units during 2015 showed approximately 27% of all proposed units to have higher levels of large down logs (over 14” diameter) over 6/acre, 23% had moderate levels of about 3-6/acre, and about 45% had low levels of large down logs under 3/acre. Many of the plantations showed relatively high levels of large down wood that was left from the original harvest, with quite large diameters over 40", such that it will last many more decades.
Table 38 2015 Down Wood Field Surveys of the Proposed Lang Dam Project

<table>
<thead>
<tr>
<th>22 Lang Dam unitsa</th>
<th>High (&gt;6 trees/acre)</th>
<th>Moderate (3-6 trees/acre)</th>
<th>Low (&lt;3 trees/acre)</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27%</td>
<td>23%</td>
<td>45%</td>
<td>5%</td>
</tr>
</tbody>
</table>

*aunits showed visual estimates of down wood over 14” diameter*

Given the unnaturally over-stocked conditions of these managed stands, in the long term (decades to a century), there will still be adequate woody material to maintain volumes within the natural range of variability. Abundant overstory will be retained for future wood input sufficient to sustain the objectives listed in the Aquatic Conservation Strategy (Appendix C).

However, within specific treatment units where current estimates are below the desired ranges, dead and down wood objectives will be met through leaving more of the residual stand (for future die off from stand competition) or through supplemental down wood creation treatments (see Table 38). These treatments are proposed as a potential enhancement effort so that habitat needs could be met at a site specific as well as a landscape level.

**Stand Structure and Species Composition**

Based on a review of existing literature and stand development theory, Spies et al. (2013) found that the “greatest potential ecological benefits of thinning to accelerate the development of older forest structure (e.g. large trees, large dead trees, spatial structure and compositional heterogeneity, etc.) come in dense uniform plantations less than 80 years and especially less than 50 years old.” The benefits of thinning in stands over 80 years old are more variable. Stand conditions were reviewed for each waterbody and recommendations were based on multiple variables, not just age. These factors included tree height and diameter, stand density, species composition, and understory development.

In Alternative 2, all of the stands where thinning will occur within Riparian Reserves are under 80 years old. The stands over 80 years old were surveyed, but no streams were found and thus do not contain Riparian Reserves.

Where thinning is proposed within Riparian Reserves, increases in abundance of understory vegetation, species diversity, stand structural diversity, and tree growth at a faster rate than background levels are expected. It should be noted that some modeling has shown that young conifer stands, if left untreated, will follow a trajectory towards forest structure found in certain reference conditions (Pollock et al. 2012). Reference conditions were considered to have mature, late-successional conifer dominated stands with abundant large trees in the overstory, abundant large snags, and a well-developed understory of shade-tolerant trees. However, according to Harrington et al. (2005) thinning tends to increase shrub cover and greatly increase within-stand variability where shrub cover is absent before treatment. Riparian thinning can also promote the development of late successional forest attributes of value to many riparian and upland-associated species (Pabst et al. 2009, Harrington et al. 2005). Based on new research (Ruzicka et al. 2014), increased tree growth within no-treatment buffers adjacent to thinned stands is also anticipated. In their study, trees responded to an apparent edge effect up to 15 m (49 feet) downslope of thinned areas. So it is expected to have similar beneficial effects within a large portion of the no-treatment buffers.

A minimum of 50 percent canopy closure (approximately 40 percent canopy cover) will be maintained throughout the stand (which results in an average of 70-90 trees per acre remaining on site which is slightly higher than average old growth stand densities but will help support future down wood creation. Over all, the proposed prescriptions are a compromise between thinning and retention to, as much as possible, meet the greatest diversity and important resource protection needs such as microclimate and future large wood input.
No-Harvest Treatments in Riparian Reserves

Alternative 2 proposes a variety of management actions for Riparian Reserves. One action is to leave the current stand relatively intact. The no-harvest portions of the Riparian Reserves were selected where added protection of existing habitats were needed. These no-harvest areas are either partial buffers within the Reserves or full Riparian Reserves. For example, in Unit 90 the Riparian Reserve and stream morphology is very diverse so the no-harvest buffer varies between 30 feet to the full 180 feet. Along some of the streams, the Riparian reserves show existing stand and vegetation diversity, sensitive habitat, soil stability issues, temperature sensitivity, or existing quality aquatic habitat so no thinning was recommended within these Riparian Reserves. Information on proposed silvicultural treatments in Riparian Reserves, or non-treatment, can be found in Appendix E.

Other Treatments

Within some treatment units, the introduction of low severity fire into patches of Riparian Reserves is anticipated during fuels treatments. Fire will be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fire line around the Reserves which will potentially result in erosion. With local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, will be retained. In lightly burned areas, understory conifers will experience some mortality, but fire adapted species such as willow, vine maple, and other hardwood shrubs will re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. At low burn severities, large wood will not be removed from the Reserves. The net results, though localized, will be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than non-thinned plantations.

Table 39 summarizes the acres of Riparian Reserves affected by the various vegetation treatments. It also includes the number of acres that will not be treated based on recommendations from site specific field visits.

Table 39 Riparian Reserve Management on Federally Managed Lands in the Project Area

<table>
<thead>
<tr>
<th>Activity</th>
<th>Acres Proposed for Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alternative 1</td>
</tr>
<tr>
<td>Thinning</td>
<td>0</td>
</tr>
<tr>
<td>No Treatment Skip</td>
<td>0</td>
</tr>
</tbody>
</table>

Wherever possible, temporary roads will be located on gentle slopes or will utilize locations previously disturbed by historic logging that had not been decommissioned. Those segments located within the Riparian Reserves will be located well outside of the primary shade zone or cross perpendicular to the stream. Alternative 2 will have about 1.2 miles of the 2.2 miles of temporary roads proposed within the Riparian Reserves. This is equivalent to approximately 2.4 acres of disturbance. There are 3 proposed temporary stream crossings which are needed to access portions of units. These temporary roads and crossings will be extensions of the 1900399 road and will access units 70, 80, 90, 100, and 110. Impacts to large wood are expected to be similar to those of thinning treatments. Typical rates of re-vegetation start occurring within 2 decades from natural regeneration if the disturbed area is not replanting. All temporary road crossings will be removed, and all temporary roads in Riparian Reserves will be decommissioned after treatment activities are completed.

In summary, Alternative 2 will thin approximately 120 acres within Riparian Reserves (see Appendix E for Units). The adverse impacts of thinning on in-stream large wood and future recruitment will be very
minor at the watershed, project, and reach scales since approximately 4.3% of Riparian Reserves will be thinned in Alternative 2, and within those units at least 90 percent of the wood recruitment zones will be protected. The minor reduction in wood recruitment will occur at a very slow rate due to the naturally slow rate of the dominant wood recruitment processes (bank erosion and tree mortality) of streams in the project area. The beneficial impacts of thinning to accelerate tree growth will also be very minor at all scales due to the relatively small area treated and slow rates of tree growth. The beneficial impacts of thinning on riparian forest structure and diversity will be limited at the watershed scale due to the minor area of treatment (approximately 1.7 percent), but will have measurable beneficial impacts at the project and unit scales. Benefits of thinning will start occurring within 3-5 years, and will persist for decades. Analysis and field reconnaissance of Riparian Reserves by fisheries, hydrology and wildlife personnel on a unit by unit basis assured that Riparian Reserve prescriptions will provide for small wood inputs from no-harvest buffers and fall and leave in the short term (1-2 decades) while treating outer portions of riparian reserves for long-term (2-5 decades or more) shade, wood source and terrestrial habitat complexity. Table 39 summarizes the acres of Riparian Reserves affected by the various treatments. The proposed management of Riparian Reserves in Alternative 2 will not deter attainment of and will largely benefit ACS Objectives. The Aquatic Conservation Strategy compliance document (Appendix C) explains how each Objective is maintained or improved.

Cumulative Effects

Alternative 2
Actions in Appendix D were analyzed for effects to riparian condition and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the minor impacts expected from the Lang Dam project will not measurably contribute to impaired riparian conditions.

Private timber lands are present on approximately 701 acres in the project area. Although they are managed according to Oregon Forest Practice Rules, impacts to streams may occur. Because the primary shade and wood recruitment zones will be protected and impacts minimized on federal lands, cumulative effects to streams across the watershed are not anticipated.

The majority of the effects in the Lang Dam project area will be located in the Cougar Creek-South Fork McKenzie River subwatershed. A review of recent past, present, and reasonably foreseeable future projects in the area (Appendix D Past, Present and Reasonably Foreseeable Future Activities Relevant to the Cumulative Effects Analysis) found that the 410 Road Hazardous Fuels Project was within the Cougar Creek subwatershed. No measurable effects on the hydrologic condition are expected to occur from the recent fuels reduction along the 410 Road and the effects of the two projects are expected to have no temporal or spatial influence on each other.

In Elk Creek- McKenzie River, East Fork -South Fork McKenzie River, and Cougar Reservoir-South Fork McKenzie River subwatersheds, approximately 20, 14, and 3 acres respectively will be impacted all outside of riparian reserves. No cumulative effects are expected to occur in these three subwatersheds.

Projects that are ongoing (7-Thin Stewardship Reoffer, Buck Thin, and the Bonneville Power Administration’s ongoing maintenance of their transmission line) were considered when analyzing effects on the environment for the Lang Dam project and were included in the analysis of effects to riparian conditions.

The Lower South Fork Floodplain Enhancement project will be located in the Cougar Creek-South Fork McKenzie River subwatershed. This project will harvest trees in the subwatershed on approximately 88 acres in two units. The combined effects of the ongoing timber harvest projects, Lang Dam project, and the South Fork Floodplain Enhancement project will have beneficial effects to riparian conditions by thinning these densely stocked stands. This will improve riparian conditions by encouraging riparian hardwoods to grow. The South Fork McKenzie Watershed Analysis (1994) found that the subwatershed

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below Cougar Dam has been losing hardwood trees since the completion of dam construction in 1963. In addition, the South Fork McKenzie Floodplain Enhancement project will improve riparian habitat conditions on approximately 700 acres in the subwatershed by further encouraging the growth of riparian hardwood trees like red alder and cottonwood.

**Affected Environment – Stream Shade and Temperature**

Major road construction and timber harvest began in the project area in the 1940s, peaking in the 1970s and 80s. Much of the activities that occurred prior to implementation of the Northwest Forest Plan resulted in removal of riparian vegetation that provided shade for streams.

Most of the intermittent (class IV) and non-fish bearing perennial (Class III) streams within the project area have one or more sections that flow subsurface. The South Fork McKenzie River is the largest stream within the project area, but temperatures are controlled through releases from Cougar Dam. Cougar Creek (fish bearing) is the second largest stream within the project area and averages 14.8°C near the mouth which is below the 16 °C Department of Environmental Quality (DEQ) cold water criteria. Pond Creek was not measured for temperature due to the difficulty in finding a deep enough pool to capture summer low flow temperatures.

The streams are typical of those found in the characteristically warmer West Cascades geology. These streams exhibit intra-annual variability greater than 0.3° C despite the fact that there has been no additional vegetation management along these streams during the time they were monitored. Changes in the range of maximum temperatures from one water year to the next are attributable to annual differences in precipitation and stream flows. The annual timing of the maximum temperature occurs between July and August.

Under section 303(d) of the 1972 Clean Water Act, states are required to develop lists of impaired waters. Lower reaches (river mile 0-4.5) of the South Fork McKenzie were listed as 303(d) for temperature (12.8° C) prior to the 2010 revision.

**Environmental Consequences – Stream Shade and Temperature**

**Direct and Indirect Effects**

*Alternative 1 – No Action*

Activities that affect shade vegetation would not occur. The increased risk of high severity wildfire, which is carried more easily through dense stands, may affect water quality in the future. The corresponding loss of vegetation and duff may affect temperatures and microclimates around the edges of the streams and wetlands. Intermittent (class 4) streams and seasonal wet meadows go dry during the summer when temperatures are typically an issue, so increased stream temperature at the current vegetation conditions or after a high-severity fire is not expected in most of the class 4 streams in the project area. However, temperatures in perennial streams would be effected as would microclimates. See the Fire and Fuels Section in Chapter 3 for more specifics on the probability and effects of wildfires in the project area.

*Alternative 2*

The system of Riparian Reserves under the ACS provides zones around streams, wetlands, and water bodies that contribute to protecting or restoring the physical, chemical, and biological integrity of these waters, which is the major goal of the Clean Water Act. For all action alternatives, treatments within riparian areas have been designed to comply with the “Northwest Forest Plan Temperature Total Maximum Daily Load (TMDL) Implementation Strategies – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards” (TMDL 2012).
To comply with the stream temperature standards, no-harvest buffers were developed to eliminate management effects. These buffers were developed based in part by calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading, known as the primary shade zone; and the width of the riparian area that provides shade in the morning and afternoon, considered the secondary shade zone. Research has shown that in many cases major changes in stream temperature are not observed with partial no-harvest buffers within the Riparian Reserve width (Levno and Rothacher 1967, Brown and Krygier 1970, Swift and Messer 1971, Macdonald et al. 2003). In several cases, buffer distances less than one site potential tree have been shown to protect water temperature. Typically the primary shade zone is half of the site potential tree height. Gomi et al. (2006) reported maximum daily temperatures in headwater streams did not increase dramatically when 30- and 90-foot buffers were applied.

In overly dense riparian stands, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to no shade since trees in the primary shade zone are already blocking the sun’s solar radiation. In all of the units with proposed thinning in the Riparian Reserves, conifer densities are high and will benefit from thinning. Where Riparian Reserves are to be actively managed, a minimum of 50% canopy closure (approximately 40% canopy cover) is preserved in the outer portions (outside the no-harvest buffer) to help protect microclimate also. Some of the streams in the project area are less than 3 feet wide and others have very coarse substrate. The effective shade is typically less for these streams. In addition, several papers have been published recently indicating that hyporheic flow (water flowing through gravel), not just shade, has an influence on stream temperature. Janishch et al. (2012) found that the canopy cover of “buffers” was not a strong variable for temperature in small (<7 feet wide) headwater streams. Instead, the streams with coarse-textured streambeds tended to be thermally unresponsive as compared with fine-textured streambeds or those with small, near-stream wetland areas. This re-emphasizes the important role gravel and large wood play in stream temperatures and was used to further establish no-harvest buffer recommendations.

The development of no-harvest buffer widths also took into account the stream classification. Intermittent (Class 4) streams are dry during the portion of the year when elevated temperatures occur and therefore temperature is not as major an issue. However, bank stability trees and no-harvest buffers of 30 feet which were designed for other resource objectives will provide substantial shade when water is present regardless. Much of the stream-influenced microclimate will also be preserved since the gradients are strongest within the first 20-30 feet (Anderson 2007) and a portion of the canopy cover throughout the rest of the Riparian Reserve will be maintained. No-treatment buffers on perennial streams have varying widths developed, in part, to accelerate species and structural diversity while protecting effective shade.

The majority of perennial streams class 1 and 2 (fish bearing) are provided with a minimum of a 180 foot no-treatment buffer to retain effective stream shade and other resource needs. Some of the narrower class 3 (non-fish bearing perennial) streams within the proposed harvest units have a minimum 60-foot no-harvest buffer to retain effective stream shade and terrestrial microclimates (Anderson 2007) while still providing the opportunity to thin the rest of the Riparian Reserve for other desired characteristics. However, where thermal loading, soil stability, desired stand characteristics, etc. is present; no-treatment buffers are wider, and most of the class 3 streams have a full 180 foot buffer.

There are 3 proposed temporary class 4 (intermittent) stream crossings as part of Alternative 2 treatment activities. Class 4 streams are typically dry during the summer when water temperature is a concern. When there is water in the streams however, the width of the clearing needed to establish the crossings will not create a detrimental change in temperature or shade because the primary and secondary shade zones of the surrounding riparian area will retain sufficient canopy closure to provide shade to these narrow streams, and because the topographic location further enhances protection from solar radiation. A few short segments of other temporary roads will enter the outer portion of the
Riparian Reserves but not cross any streams. This will allow for historically compacted areas to be reused then properly sub-soiled and re-vegetated. The reduction in canopy closure of the secondary shade zone is taken into account in the overall calculations of canopy closure on Riparian Reserve thinning treatments. Based on implementation of the design features outlined in Chapter 2, Table 6 which reduce the acres of disturbance due to temporary roads and skid trails as well as field observations during project reconnaissance; a minimal direct effect is anticipated at a localized level within a few feet downstream of the temporary road crossings.

Additional road decommissioning and storage analyzed under this EA are expected to be accomplished within the subwatersheds during the time period of this project and its direct effects. In general, these activities help restore streamside vegetation which will provide additional shading of streams previously impacted by human activities.

No short-term (5-10 years) or long term (>5-10 years) increases of stream temperature are anticipated within the project area as a result of these alternatives. Additionally, no short-term (1-5 years) increases in stream temperature are anticipated since no shade trees will be removed by this project. Where Riparian Reserves are actively managed, a minimum of 50 percent canopy closure (approximately 40 percent canopy cover) is preserved in the outer portions (outside the no-harvest buffer) to help that will also protect microclimate. Many of the treatment units are over-stocked plantations with small diameter riparian trees. Thinning within the secondary shade zone will increase growth of the remaining trees. Additionally, thinning of dense stands and managing fuel loading helps reduce the risk of high severity wildfire. This, in turn, reduces the risk of impacts to stream shade and microclimate.

**Cumulative Effects**

**Alternative 2**

All recent and planned timber harvest and hazardous fuels reduction projects were and will be designed with similar protection measures, design features, and Best Management Practices that will prevent effects to stream temperature. For example, all primary shade trees will be protected and 50 percent canopy closure will be maintained in the secondary shade zone. This will prevent any temperature affects to streams. Each of the past projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix D) were analyzed for effects to stream temperature and were found to have no effect or a slight beneficial effect from all treatments.

**Affected Environment – Stream Flows/Disturbance History**

Projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage or ARP, as specified by the Forest Plan. The ARP model compares the acres of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed and are intended to represent a minimum safe level of vegetative recovery in the sub-watersheds to prevent considerable alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters average more than 8 inches dbh (diameter breast high) and crown closures exceed 70 percent. The analysis is based on data extracted from the Forest’s VEGIS database, which includes information about all past harvest activities in the sub-watershed. Currently, ARP levels in the project area are far above the Forest Plan Midpoints of 75 for the Cougar Creek subwatershed (see Table 40 below).
Environmental Consequences – Stream Flows/Disturbance History

Direct and Indirect Effects

Alternative 1 – No Action
Current ARP values are well above midpoint. Alternative 1, No Action, would result in no changes to existing peak flows based on vegetation removal. However, several miles of roads are in poor condition and funnel water to stream crossings or into alternative drainages. These alterations to stream flows would not be improved with the implementation of this Alternative due to the lack of road maintenance, storage, or decommissioning. However, the effect would be localized to a few yards down-stream in most cases.

Alternative 2
Table 40 summarizes levels of recovery immediately after implementation of the project for each of the alternatives. Completion of implementation is estimated to occur by 2021. The Midpoint ARP value for the Cougar Creek sub-watershed is 75.

Table 40 Aggregate Recovery Percentage for the Lang Dam Project

<table>
<thead>
<tr>
<th>Cougar Creek Subwatershed 170900040109</th>
<th>Alternative 1 (No-Action)</th>
<th>Alternative 2 (Preferred Alt)</th>
<th>Watershed Minimum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARP 2016 (pre-project)</td>
<td>84.6</td>
<td>84.6</td>
<td>75</td>
</tr>
<tr>
<td>ARP 2021 (post-project estimates)</td>
<td>87.8</td>
<td>82.4</td>
<td></td>
</tr>
</tbody>
</table>

ARP levels are maintained above recommended values for all alternatives in the affected sub-watersheds even immediately after implementation when the potential for adverse impacts to vegetation will be greatest. Therefore, no altered peak stream flows are anticipated from implementation of the proposed actions.

Overall, there will be no adverse impact to stream flow timing or duration through the implementation of these alternatives.

Cumulative Effects
ARP levels will remain well above the midpoint so effects to peak flows throughout the watershed are not expected by vegetation removal. Each of the past and future projects listed in the Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis (Appendix D) were analyzed for effects to peak flow and were found to have no effect or a slight beneficial from all treatments.

Affected Environment – Sedimentation

Direct and Indirect Effects
The majority of the geologic terrain and soils within the Lang Dam Project Area are not inherently prone to extensive erosion unless disturbed as discussed in the Soils Specialist Report (located in the project file). However, unit 130 does contain a debris chute tract that started from much higher on the slope, and signs of old, naturally occurring debris chutes can be found coming off the upper portions of Deathball Mountain (see Soils Section 3.2).

Most of these intersect the area where the stored portion of road 1900399 is located. The majority of the stream crossing culverts along this stretch have already been removed to reduce the hazard to the aquatic ecosystem.
Roads have the potential to be a large source of human-related sediment input to streams, and road densities can affect the over-all health of the aquatic ecosystem in an area. Road densities over 3.5 miles of road per square mile are considered “Not Properly Functioning” according to Forest Ecosystem Management Assessment Team (FEMAT) (1993) and according to the “Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish within the Northwest Forest Plan Area (2004). Analysis conducted for this project and for the Biological Assessment for this project found that the road density is greater than 3.5 miles of road per square mile. This will be considered a “Not Properly Functioning” condition from a road density perspective.

Levels of compaction also have the potential to influence rates of human-related sedimentation to streams by decreasing rates of infiltration and increasing the potential for surface run-off and erosion. Field surveys indicated that two units approached or exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted, in this case by compaction. Unit 190 and Unit 60 both had transects at or above 20%. Since the aggregated compaction in these two units will exceed the threshold at the completion of harvest activities, subsoiling is required mitigation to ensure that cumulative levels will be below the 20% standard. The remaining units were sufficiently within the standard and compaction-related erosion is unlikely (see Soils Section 3.2).

Based on observations of existing road conditions during field reconnaissance for the project, sediment outputs from roads were estimated using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The current sediment yield from roads is estimated around 22 cubic yards per year for the project area. Actual yields cannot be accurately calculated since there are numerous annual and inter-annual variations that will need to be considered including weather conditions, timing of peak flow events, etc. Research comparing WEPP estimated sediment rates to actual rates has shown the model to over-estimate values. Therefore sediment predictions using WEPP modeling should only be used for relative comparisons between alternatives rather than actual values expected to be produced.

### Environmental Consequences – Sedimentation

#### Direct and Indirect Effects

**Alternative 1 – No Action**

Rates of road related sediment yield were estimated to remain relatively constant under Alternative 1 (No Action), reflecting no specific changes due to the lack of road upgrades. Alternative 1 would not correct existing road erosion problems which result in chronic sedimentation to streams. Without timber harvest related road maintenance, the existing budgetary trend would result in only the main roads being maintained. Culverts that are not maintained could plug and cause washouts. The resulting sediment plumes could be detrimental to fish and amphibians. Over several decades, these road issues would stabilize as the disturbed areas re-vegetate. However, no project-related storage or decommissioning would occur. Harvest activity on the portion of private land within the project area would continue, as would use of shared roads. Table 41 below provides a comparison of sediment outputs between all Alternatives.

**Alternative 2**

Past human activities have resulted in altered sediment regimes along many of the streams. Hydrologically disconnecting roads by installing or improving road drainage features is a fundamental practice for eliminating chronic water quality impacts from roads and other disturbances. At a minimum, these activities will include maintenance of proper drainage through maintaining existing structures, installing water bars, or restoring natural drainage features. Installation of new ditch-relief culverts and replacement of existing ditch-relief culverts that are currently in poor condition will also be included. These actions will reduce the likelihood of sediment leaving the road through runoff by reducing the average distance between drainage structures and consequently, the amount of water that each
structure needs to handle. Less water on the road and its ditches translates to less sediment-carrying capacity.

Field surveys indicated that two units approached or exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted, in this case by compaction. Unit 190 and Unit 60 both had transects at or above 20%. Since the aggregated compaction in these two units will exceed the threshold at the completion of harvest activities, subsoiling is required mitigation to insure that cumulative levels will be below the 20% standard. The remaining units were sufficiently within the standard and compaction-related erosion is unlikely (see Soils Section 3.2).

Road work associated with the Lang Dam Project will also include replacement of 4 culverts that are currently in poor repair or inadequately sized to pass 100-year flood flows (Q100). These culverts currently pose an elevated risk of fill failure. Discussion with engineering personnel indicated that the range of fill volume is around 100-250 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culverts fail.

However, replacement will require in-stream work in these locations. Work will be done during non-flow periods for intermittent streams, and engineering practices such as providing for sediment barriers and flow bypass will minimize impacts on perennial streams. Flows in perennial streams are all expected to be less than 1.0 cubic feet per second when work occurs, based on personal observation during project reconnaissance. It is not possible to do this work without some sediment delivery, and accurate estimates are not predictable. Depending on weather behavior and other variable factors, sediment yields should fall between 0.5 and 1.5 cubic yards per installation based on professional experience. This sediment will settle out within a few feet and is not in amounts that will harm aquatic insects or amphibians.

An analysis of estimated sediment outputs from roads in the project area was completed using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The same analysis was conducted for each alternative incorporating all project related road maintenance, temporary road construction activities, and haul route activity. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. Table 41 shows the estimates of sediment production rates based on WEPP.

For Alternative 2, annual sediment yield increases during harvest activities. This represents an incremental 19 percent increased contribution of sediment that cumulatively adds to sediment already produced under the existing road system. Alternative 2 shows the highest increase during operations when there is increased traffic on haul routes and freshly established temporary roads. By implementing the activities associated with the Lang Dam project, overall human caused sediment input will decrease (< 5 percent) from current levels.

<table>
<thead>
<tr>
<th>Table 41 Estimates of Sediment Production Rates for Lang Dam Project Area Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Gross Sediment Yield (yrd³)</td>
</tr>
<tr>
<td>Net increase/decrease</td>
</tr>
<tr>
<td>% increase/decrease</td>
</tr>
</tbody>
</table>

Approximately 2.2 miles of temporary road construction will occur with Alternative 2. However, only 1.2 miles will be proposed within Riparian Reserves. These represent approximately 2.4 acres of ground disturbance. All temporary roads will be stabilized with erosion control measures as necessary for the wet season to minimize accumulation of runoff and transport of sediment and will be fully decommissioned after the project is complete. In addition, 0.3 miles of road decommissioning and 3
miles of storage are proposed which will reduce current sediment inputs. Decommissioning will include activities such as the removal of culverts, de-compaction and re-contouring to surrounding topography of the road surface, and revegetation. Based on professional experience, each fill removed will produce on average <1 cubic yard of fine sediment that will leave the fill removal site and settle out in the first 100 feet below the fill removal during the first winter.

Table 42 below provides a summary of the culvert replacements and the potential amount of stabilized fill material that will have a reduced risk of entering streams. It also estimates the amount of sediment produced from the culvert replacements. The maximum estimate of sediment yields from the culvert replacements will be approximately six cubic yards for Alternative 2. In comparison, the estimated volume of fill stabilized is 775 cubic yards for Alternative 2. Alternative 2 will reduce the potential for runoff effects and culvert failures that may affect Riparian Reserves or water quality.

<p>| Table 42 Approximate Culvert Replacements in Perennial and Intermittent Streams by Alternative |
|---------------------------------------------------------------|---------------------------------------------------|-------------------------------------|-------------------------------------|</p>
<table>
<thead>
<tr>
<th>Stream Type</th>
<th>Number of Culverts Installed/Replaced/Removed</th>
<th>Cubic Yards of Fill Stabilized</th>
<th>Sediment Yields from Culvert Replacements (Cubic Yards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1  (No Action)</td>
<td>None 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>Intermittent 3</td>
<td>525</td>
<td>1.5-4.5</td>
</tr>
<tr>
<td></td>
<td>Perennial 1</td>
<td>250</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>775</td>
<td>2.0-6.0</td>
</tr>
</tbody>
</table>

The roads where wet weather haul could be requested are the 1900411 road (limited strength) and the 1900410 road (paved two-lane road). The 1900411 road will need improvements due to its “limited strength” status if wet weather haul were to be requested. Limited strength means that roads are likely to be damaged if used when adverse conditions exist in the roadbed. When authorized for use, placement of additional aggregate or other mitigation measures, at the expense and by the purchaser, shall be implemented to support haul during poor weather conditions. If wet weather haul was approved the purchaser will still be bound by the conditions found in the project design criteria which will prevent turbid water from entering waterways inhabited by listed fish (i.e. bull trout and spring Chinook salmon). The closest the 1900411 road gets to habitat with listed fish is at the junction with the 1900410 road (approximately 200 feet between the road junction and the South Fork McKenzie River).

Wet weather haul will be monitored by the Timber Sale Administrator, the District Road Manager, Fisheries Biologist, and/or Hydrologist. Inspections will focus on road surface condition, drainage maintenance, and sources of soil erosion and sediment delivery to streams. Timber transport operations will be stopped immediately if road use is causing rutting of the road surface, ponding of water on the road, failure of any drainage structure, or any other action that increases the sediment delivery to a stream.

Most harvest-related sediment input to streams comes from skid trails, historic roads that were poorly located, historic log culvert crossings, or historic skyline corridor crossings. Research has shown that by keeping these at least 33 feet from streams and following Best Management Practices (BMP) guidelines, essentially all of the harvest related sediment is eliminated (Roshin 2006, Lakel 2010). In addition, as discussed in the Soils section of this document, soils in the project area have naturally high rates of infiltration and low potential for overland flow. The Design Features for Alternative 2 designate additional equipment exclusion zones around streams and wetlands which are expected to essentially eliminate any routing of water from the logging operations (see Table 6 in Chapter 2).

The McKenzie River Sub-Basin, including the Lang Dam Project Area, provides municipal water to the City of Eugene by way of the Eugene Water and Electric Board’s intake at Hayden Bridge, approximately 60
miles downstream from the project area. Sedimentation and associated turbidity are the most likely consequences of the Lang Dam Project that could adversely affect municipal water quality, but with the design features that restrict the location of skid roads and temporary roads as well as best management practices, adverse effects are not anticipated.

Natural annual pulses of sediment would continue. In some years the sediment input will be greater than in other years, but overall the sediment input levels are expected to remain near current levels until a large flood event occurs. However, the risk of road and fill failures during major storm events will be reduced. With the additional activities that will be part of the Lang Dam Project, overall anthropogenic sediment input will decrease across the 6th field subwatersheds.

Cumulative Effects

Alternative 2

Ongoing timber haul on private lands as well as annual road maintenance will continue into the foreseeable future throughout the watershed. However, private lands are under the jurisdiction of the Oregon Forest Practice Rules which require a different set of standards and BMPs to reduce sedimentation into the waterways.

All recent and planned timber harvest, riparian habitat complexity development, and road decommissioning projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects listed in the Past, Present, and Reasonably Foreseeable Future Activities Relevant to the Cumulative Effects Analysis (Appendix D) were analyzed for effects to sediment.

The 410 Road Hazardous Fuels Reduction project is a “past action” in the subwatershed. This project was monitored in the field by the Willamette Forest Leadership Team (FLT), the forest interdisciplinary team (IDT), and the ranger district IDT on June 9, 2016. During that field review it was determined that no sediment entered any waterway with that project.

Projects that are ongoing (7-Thin Stewardship Reoffer, Buck Thin, and the Bonneville Power Administration’s ongoing maintenance of their transmission line) were considered when analyzing sediment effects on the environment for the Lang Dam project and were included in the WEPP model run.

Reasonably foreseeable future actions have been taken into account in the cumulative effects analysis. Based on the field review of the 410 Road Hazardous Fuels Reduction project, it is not expected that any sediment will enter waterways with the Lower 19 Road Hazardous Fuels Reduction project.

The Green Mountain project will produce sediment but it is located above (upstream) of Cougar Dam. Cougar Reservoir and Dam block sediment from reaching the South Fork McKenzie River therefore the effects of sediment from Lang Dam and Green Mountain do not overlap spatially.

The Lower South Fork Floodplain and Enhancement project will add approximately 250,000 cubic yards of sediment to a 4.5 mile stretch of the South Fork McKenzie River below (downstream) Cougar Dam to improve spawning habitat conditions for native fishes and to reconnect off-channel habitats and the floodplain to the South Fork channel. The Lang Dam project will produce approximately 36 cubic yards of sediment in addition to the 250,000 cubic yards that will be placed with the Lower South Fork project. At present the lower South Fork McKenzie River is severely sediment supply limited due to the presence of Cougar Dam since its construction in 1963. This has placed the sediment regime in the lower South Fork McKenzie River outside of the range of natural variability. Even with the addition of sediment from Lang Dam and the Lower South Fork project, the sediment regime in the lower South Fork will be within the range of natural variability.
Affected Environment – Fisheries, Aquatic Insects, and In-stream Habitat

Scale of Analysis
The geographic scale use to assess direct, indirect, and cumulative effects to aquatic resources for this project includes the project area and the South Fork McKenzie River/Cougar Creek 6th field sub-watershed. It also includes small portions of the South Fork McKenzie River/East Fork 6th field, the South Fork McKenzie River/Cougar Reservoir 6th field, and the McKenzie River/Elk Creek 6th field where units extend into these sub-watersheds (see Figure 19). However, there are no considerable drainage features that extend into these sub-watersheds from the units so the analysis will focus on the South Fork McKenzie River/Cougar Creek 6th field.

Affected Environment
A variety of fish species can be found the South Fork McKenzie River and Cougar Creek including Rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarkii clarkii*), mountain whitefish (*Prosopium williamsoni*), bull trout (*Salvelinus confluentus*), spring Chinook salmon (*Oncorhynchus tshawytscha*), Pacific lamprey (*Entosphenus tridentatus*), and brook lamprey (*Lampetra planeri*).

Management Indicator Species (MIS)
The Willamette Forest plan recognizes anadromous and resident salmonids as economically important species and designates them as management indicator species for riparian habitat and water quality. Salmonids are good indicators because they are predators in the streams ecosystem. This means that they are not only affected by the physical conditions of their habitat but also by the metabolic energy pathways in the watershed from primary production to decomposition. The most common salmonid sport fish on the McKenzie Ranger District are spring Chinook salmon, bull trout, rainbow trout, and coastal cutthroat trout.

Native coastal cutthroat trout are the most widely distributed fish in the McKenzie River Sub-basin, ranging from headwater streams to the mainstem South Fork McKenzie River. Cougar Dam combined with previous timber management in riparian areas has affected aquatic habitat quality by altering the quantity size, size and recruitment source of large woody material, which can affect substrate storage, habitat composition (e.g. riffles, pools, off-channel habitat, etc.) and water temperature.

Endangered Species Act (ESA) Listed Species
Cougar Dam has negatively affected migratory species like bull trout and spring Chinook salmon. The only location where bull trout have been documented spawning in the South Fork McKenzie is in Roaring River (a tributary) upstream of Cougar Dam. The lower South Fork McKenzie River has a coarse substrate and spawning size gravel is lacking. The South Fork McKenzie River is designated as critical habitat for both bull trout and upper Willamette River spring Chinook salmon. For more details see the Fisheries Biological Assessment located in the project file.

Strategic Species
Two aquatic insects, one freshwater snail, and a fish (Pacific lamprey) can all be found on the Regional Forester’s sensitive species list and have been document on the Willamette National Forest. These aquatic insects are caddisflies and little is known about them. In fact, the common name for all of these caddisflies is “a caddisfly”. The freshwater snail has only been documented on the Middle Fork Willamette River, and the Pacific lamprey has been documented in the South Fork McKenzie River below Cougar Dam. A short summary of the distribution and know habitat association are provided below. For a more detailed discussion on these species, see the Fisheries biological evaluation.
Caddisflies

*Rhyacophila leechi*: The entire *Rhyacophila* genus is confined to running water. *R. leechi* adults have been collected from springs and cold, spring-fed streams. This species appears to require colder water temperatures than the common and more widely distributed *R. verrula*, and is more likely confined to smaller, headwater streams and springs. Oregon sites range in elevation from 440 to 980 m (1,444 to 3,210 ft.).

This species is known from a small number of sites in southern Oregon and northern California, from the western Oregon Cascades south to the Klamath-Siskiyou Mountains. In Oregon, this species is documented to occur on the Willamette National Forest and on BLM land in the Medford District (USDA Forest Service and USDI Bureau of Land Management 2011 and 2012).

*Rhyacophila chandleri*: In the Cascade Mountains of Oregon, this species is associated with very cold, larger spring-fed streams. Elevations of known populations range around 1,219 to 1,700 m (4,000 to 5,600 ft.).

The range of this species is restricted to alpine areas of southern Oregon and northern California. In Oregon, this species is documented on the Willamette, Deschutes, and Umpqua National Forests (USDA Forest Service and USDI Bureau of Land Management 2011 and 2012).

Sampling for aquatic insects (macroinvertebrates) has taken place in the South Fork McKenzie River watershed. In 2005 and 2006 samples were taken above Cougar Dam and below the dam. Members of the genus *Rhyacophila* were collected in both places but neither of the species found are on the sensitive species list (SSL). In 2004, samples were taken in the East Fork of the South Fork McKenzie River and in Walker Creek. As with the other samples *Rhyacophila* were collected but not the species on the SSL.

Freshwater Snail

*Fluminicola virens* is a freshwater snail. It has not been documented on the McKenzie River Ranger District but has been documented on other ranger districts on the Willamette National Forest. Members of the genus *Fluminicola* are usually found in clear, cold waters with high dissolved oxygen content. Large species, such as *F. virens*, are typically found in streams. Generally, these species prefer cold, clear, streams with near-saturation amounts of dissolved oxygen, no or minor nutrient enhancement (oligotrophic waters); continual current; and coarse but stable substrate.

*Fluminicola virens* is known only from Oregon and Washington in the Northwestern United States. In Oregon, it is limited in distribution to the Willamette and lower Columbia River basins where it occurs in the lower Columbia River below Portland, the upper Deschutes River, the Umpqua River, the Willamette River including the Tualatin and Clackamas Rivers (USDA Forest Service and USDI Bureau of Land Management 2013).

Fish

The Pacific lamprey (*Entosphenus tridentatus*) is an ancient fish and has been documented in the McKenzie River. The following information on Pacific lamprey was obtained on the NatureServe Explorer web site (http://explorer.natureserve.org). This species is mainly anadromous; newly metamorphosed individuals migrate from parent streams to the Pacific Ocean. Upstream migrations may be as long as several hundred kilometers. Land-locked populations omit the oceanic phase but migrate between lakes and spawning streams.

The predatory phase of the life cycle (excluding land-locked populations) occurs in the ocean, primarily near stream mouths in estuaries and in other coastal areas but sometimes far away. Freshwater-resident populations exist in several areas in British Columbia and elsewhere.
Adults spawn in runs and riffles in rock, sand, or gravel-bottomed clear streams, in small, shallow depressions, or crude nests, at the heads of riffles. Water depth at spawning sites often is 30-150 cm. Eggs hatch in 2 or 3 weeks. Ammocoetes remain in stream, metamorphose in 4-6 years (late September-October). Ammocoetes inhabit shallow backwater and eddy areas along edges of streams in mud, silt and sand.

Pacific lamprey ammocoetes have been documented in the South Fork McKenzie River below Cougar Dam.

**Environmental Consequences to Fisheries, Aquatic Insects, and In-stream Habitat**

**Direct and Indirect Effects**

*Alternative 1 – No Action*

Riparian Reserves that are dominated by conifers and have little or no hardwoods near the stream channels, organic matter that is not as readily conditioned by microbes (i.e. conifer needles) will continue to be the dominant source of allochthonous material.

Nutritional energy becomes available to the stream community from two main sources: photosynthesis by aquatic plants in the stream itself (autochthonous sources) and decomposition of organic matter imported from outside the stream (allochthonous sources) (Murphy and Meehan 1991). The mix of energy sources has a major influence on the structure and function of stream ecosystems. Streamside vegetation provides large quantities of organic matter in the form of leaves, needles, and woody material. Leaves and needles usually contribute most of the readily usable organic matter in woodland streams (Table 43) (Murphy and Meehan 1991).

Leaves decay in four phases: they are leached by water, conditioned by microbes, and shredded by invertebrates and physical abrasion. Then residual fine particles are recycled within the benthic food chain by microbes and invertebrates. Rate of decay depends on chemical composition and is directly related to temperature. Generally, the greater the nitrogen and phosphorus content, the faster leaves and needles decay (Murphy and Meehan 1991).

Most animals require food with a carbon to nitrogen (C:N) ratio less than 17:1 (Murphy and Meehan 1991). During the first few days after a leaf enters the stream ecosystem, leaves lose about 15 percent of their weight as soluble matter that is leached into the stream. With a C:N ratio less than 5:1 leachate is highly liable and about 80 percent is quickly assimilated by stream bacteria. Leachate is taken up faster from deciduous leaves than from coniferous needles. Almost all (98 percent) red alder leachate is removed from the water within two days, whereas only 35-60 percent of Douglas-fir is removed in that time. This means that most leaf leachate is retained and rapidly processed in headwater streams, but some moves downstream without much processing (Murphy and Meehan 1991).

Leaves and needles need to be conditioned by microbes for about 30 days before invertebrates will consume them. Conditioning increases concentrations of nutrients in leaf detritus because microbes use nitrate and phosphate from stream water and carbon compounds from the leaf to build their own proteins thereby decreasing the C:N ratio of the detritus (Murphy and Meehan 1991). Almost all forms of allochthonous organic matter have a C:N ratio higher than 17:1 so they require microbial processing to enhance food quality. The quality of various forms of organic matter varies widely as measured by the C:N ratio or the percentage of lignin. At the low end of the spectrum are woody debris and conifer needles and at the high end are periphyton, macrophytes, and fast-decaying deciduous leaves (Murphy and Meehan 1991). See Table 43 below for more information on the differing C:N ratios of various types of organic matter that can enter the stream ecosystem.
The following table provides information on the various forms of organic material (i.e. allochthonous material) that can enter a stream ecosystem. This table shows how hardwood leaves are more readily conditioned by microbes than are conifer needles and woody material due to their lower Carbon to Nitrogen ratio. Hardwood leaves are critical to stream ecosystem function and without thinning Alternative 1 would perpetuate the continued delivery of organic material that is of lower quality than hardwood leaves.

<table>
<thead>
<tr>
<th>Type of organic matter</th>
<th>C:N ratio</th>
<th>Lignin (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Woody debris (Douglas-fir)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twigs</td>
<td>235:1</td>
<td>34</td>
</tr>
<tr>
<td>Bark</td>
<td>324:1</td>
<td>10</td>
</tr>
<tr>
<td>Wood</td>
<td>1,343:1</td>
<td>48</td>
</tr>
<tr>
<td>Needles</td>
<td>97:1</td>
<td>14</td>
</tr>
<tr>
<td><strong>Leaves</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red alder</td>
<td>23:1</td>
<td>10</td>
</tr>
<tr>
<td>Big-leaf maple</td>
<td>62:1</td>
<td>17</td>
</tr>
<tr>
<td>Vine maple</td>
<td>77:1</td>
<td>8</td>
</tr>
<tr>
<td>Aquatic macrophytes</td>
<td>8:1</td>
<td></td>
</tr>
<tr>
<td>Periphyton</td>
<td>1-11:1</td>
<td></td>
</tr>
</tbody>
</table>

In the plantation units that are heavily stocked with monocultures of Douglas-fir, Alternative 1 would perpetuate the continued delivery of organic material that is of lower quality than that provided by hardwoods. In plantation units where a mix of hardwoods and conifers was observed, a beneficial variety of organic matter would continue to be delivered to streams. Relative to the Riparian Reserves where little or no hardwoods were observed, this variety of allochthonous material would provide a diverse set of materials available to the stream community as sources of energy.

No shade trees to perennial streams would be removed under this alternative so there would be no change in stream temperatures. In addition, without any activities occurring, no change is expected in the sediment regime and therefore, no effects to fish or aquatic invertebrate habitat would take place.

**Alternative 2 – Proposed Action**

**Riparian and In-channel Habitat Conditions**

Timber harvest is prohibited in Riparian Reserves as directed by the Northwest Forest Plan (NWFP) except as needed to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS Objectives (NWFP Standards and Guides, TM 1(c)). Based on data gathered through field observations and stream reach assessments, it was determined that current conditions in some portions of the Riparian Reserves are outside the natural range of variability and are not meeting desired vegetation characteristics need to attain ACS Objectives. Thus, there is a need to treat parts of the Riparian Reserves to accelerate attainment of desired conditions. However, there are other areas within the project area which are currently meeting desired vegetation characteristics and treatment is not necessary.

There are some studies that have looked at the effects of thinning and gaps on riparian and aquatic habitats. One study by Wilzbach and others (2005) looked at the production of resident fish (rainbow and cutthroat trout) by adding salmon carcasses and by removing all the red alder and other hardwoods.
on both sides of the stream along a 100 meter (328 feet) reach. One of their findings was that in light-limited settings where temperature gains associated with canopy opening are not problematic for aquatic resources, gains in salmonid production might be achieved by selective trimming of riparian hardwoods (Wilzbach et. al. 2005). This is not what is being proposed in the Lang Dam project (i.e. removing hardwoods). In fact, the concern with some of the Riparian Reserves in the project area is that there are little to no hardwoods so 120 acres of Riparian Reserve thinning is being proposed. By thinning along certain streams we expect that hardwoods will colonize the site and if they did not within 4 years, then hardwoods will be planted (e.g. red alder, vine maple, and big leaf maple) to improve the quality of allochthonous sources of energy for the aquatic community. This improvement in the quality of allochthonous material will improve conditions for aquatic insects in the stream ecosystem.

A recent study by Ruzicka and others (2014) looked at the management of riparian buffers and upslope thinning with downslope impacts. In their conclusion they write that they found an edge effect below upland thinning treatments that extended up to 15 meters (49 feet) into untreated riparian buffers. They stated that their study demonstrates that upland management can be used to influence riparian forests at the upland edge but only to a limited spatial extent. Such management practices may be enough to support the functional goals of riparian buffers such as maintaining potential in-stream coarse woody debris, stream temperature moderation, and nutrient uptake. Finally they found that maintaining lower tree densities directly above riparian areas may be especially beneficial if other methods to increase tree growth and vigor such as thinning are not allowed directly in riparian management areas. Thinning in Riparian Reserves is being proposed to improve structural and vegetative diversity, not necessarily for improved tree growth in the no-cut buffer as Ruzicka (2014) found. It will, however, be a benefit to some of the stands in very dense plantations where we have prescribed no cut buffers.

There will not be direct effects to MIS fish, ESA listed fish, or Strategic Species. This is due to the distance between harvest units and habitat for these species. In addition, no cut buffers will prevent direct effects. Thinning will have beneficial indirect effects to MIS fish, ESA listed fish, and Strategic Species because thinning will improve the quality of allochthonous sources of energy (i.e. increasing hardwood abundance) that reach stream channels.

It is not expected that stream temperatures will rise because of the no cut buffers that will remain, the steep gradient of the streams, the hyporheic activity caused by the complexity of cascade habitat, the condition of the stands downstream of thinning sites where shade will aid in recovery, and the eventual establishment of a hardwood stand that will provide effective shade in 5 to 10 years.

Road work associated with the timber operations could generate sediment that could reach stream channels. This is especially true for replacement of culverts needed to bring the road into a condition that could accommodate timber haul.
Table 44 Stream Culvert Installation or Replacement

<table>
<thead>
<tr>
<th>Road Number</th>
<th>New Culvert Diameter</th>
<th>Streamflow</th>
<th>Height of Fill to be Removed</th>
<th>Distance to LFH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900411 (MP 1.15)</td>
<td>18&quot;</td>
<td>Intermittent</td>
<td>4 feet</td>
<td>5,280 feet</td>
</tr>
<tr>
<td>1900411 (MP 1.70)</td>
<td>24&quot;</td>
<td>Perennial (non-fish)</td>
<td>8 feet</td>
<td>9,240 feet</td>
</tr>
<tr>
<td>1900447 (MP 0.34)</td>
<td>18&quot;</td>
<td>Intermittent</td>
<td>4 feet</td>
<td>2,600 feet</td>
</tr>
<tr>
<td>1900447 (MP 0.37)</td>
<td>18&quot;</td>
<td>Intermittent</td>
<td>6 feet</td>
<td>2,600 feet</td>
</tr>
</tbody>
</table>

Sediment delivery from road work is not expected to adversely affect MIS fish, ESA listed fish, or Strategic Species due to the distance of the treatments from streams with these species. The one culvert replacement (1900411 road MP 1.70) that is on a perennial stream is about 1.75 miles away from water with listed fish or designated critical habitat. This culvert is on non-fish bearing tributary to Cougar Creek. Some sediment will enter the creek when the culvert is replaced. The amount will be minimized by requiring that the stream be diverted around the road crossing and by implementing the work during the in-water work period for fish which is July 1- August 15 for this area. The same is true for the 1900411 (MP 1.15) and it is expected that there will be less impact due to the lower amount of fill to be removed and since it is an intermittent stream.

The culvert replacements on the 1900447 road (MP 0.34 and 0.37) are on intermittent streams but are closer to listed fish habitat than the culverts on the 1900411 road. It is not expected that any of the sediment from the culvert replacements on the 1900447 road will reach any creek with MIS fish, ESA listed fish, or Strategic Species. This is because the streams on the 1900447 road drain into a swale that was created by the fill material placed on Strube Flat. Water from these creeks drains into a vegetated swale where it is ponded up against the fill on Strube Flat. It then enters the ground water system before reaching the South Fork. That is, there is no overland or surface flows from these two channels to streams where MIS fish, ESA listed fish, or Strategic Species reside.

Cumulative Effects

**Alternative 1**
There are no expected cumulative effects from the No Action alternative to fish, aquatic insects, or aquatic snails.

**Alternative 2**
All recent and planned timber harvest, riparian habitat complexity development, and road decommissioning projects were and will be designed with similar protection measures, design features, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the projects listed in the Past, Present, and Reasonably Foreseeable Future Activities Relevant to the Cumulative Effects Analysis (Appendix D) were analyzed for effects to sediment.

The 410 Road Hazardous Fuels Reduction project is a “past action” in the subwatershed. This project was monitored in the field by the Willamette Forest Leadership Team (FLT), the forest interdisciplinary team (IDT), and the ranger district IDT on June 9, 2016. During that field review it was determined that no sediment entered any waterway with that project and that all riparian vegetation was protected.

Projects that are ongoing (7-Thin Stewardship Reoffer, Buck Thin, and the Bonneville Power Administration’s ongoing maintenance of their transmission line) were considered when analyzing sediment effects on the environment for the Lang Dam project and were included in the WEPP model run.

The ongoing thinning projects were analyzed for their effects to listed fish and designated critical habitat and it was found that those projects “may affect but will not adversely affect” listed fish or their designated critical habitat. Cumulatively, it is not expected that any effects will be realized when taken
into account with the Lang Dam project due to project design criteria found in those Environmental Analyses. The aggregate recovery percentage (ARP) analysis conducted for Lang Dam shows that there will not be any considerable increase in peak flows in the project area due to ongoing actions and Lang Dam.

Reasonably foreseeable future actions have been taken into account in the cumulative effects analysis. Based on the field review of the 410 Road Hazardous Fuels Reduction project, it is not expected that any sediment will enter waterways with the Lower 19 Road Hazardous Fuels Reduction project and that riparian vegetation will be protected.

The Green Mountain project will produce sediment and improve organic material that is delivered to streams but it is located above (upstream) of Cougar Dam. Cougar Reservoir and Dam block sediment and coarse organic material from reaching the South Fork McKenzie River therefore the effects of sediment and vegetation improvements from Lang Dam and Green Mountain do not overlap spatially.

The Lower South Fork Floodplain and Enhancement project will add approximately 250,000 cubic yards of sediment to a 4.5 mile stretch of the South Fork McKenzie River below (downstream) Cougar Dam to improve spawning habitat conditions for native fishes and to reconnect off-channel habitats and the floodplain to the South Fork channel. The Lang Dam project will produce approximately 36 cubic yards of sediment in addition to the 250,000 cubic yards that will be placed with the Lower South Fork project. At present the lower South Fork McKenzie River is severely sediment supply limited due to the presence of Cougar Dam since its construction in 1963. This has placed the sediment regime in the lower South Fork McKenzie River outside of the range of natural variability. Even with the addition of sediment from Lang Dam and the Lower South Fork project, the sediment regime in the lower South Fork will be within the range of natural variability.

The South Fork McKenzie River Watershed Analysis (1994) found that riparian vegetation below Cougar Dam was being lost due to the effects of the dam on the disturbance regime. The Lower South Fork Floodplain and Enhancement Project will restore off-channel habitats and will improve the connectivity of the South Fork McKenzie River to its floodplain. This will improve conditions for hardwood trees that are typically riparian dependent (e.g. red alder and cottonwood). Cumulatively, the effects of the Lower South Fork and the Lang Dam project will increase the area and number of hardwood trees in the Cougar Creek – South Fork McKenzie 6th field subwatershed and will be beneficial to the stream ecosystem.

Compliance with the Forest Plan and Other Regulatory Direction

*Endangered Species Act (ESA)*

Bull trout and Upper Willamette River spring Chinook salmon are both listed as threatened on the Endangered Species list. Both species can be found below Cougar Dam. The fisheries Biological Assessment (BA) found that the Lang Dam project “may affect, but is not likely to adversely affect” (NLAA) bull trout, Upper Willamette spring Chinook salmon, or their designated critical habitat. The BA is available upon request and is located in the project records.

The rationale for this finding is: The amount of sediment delivered to streams from past, present, and foreseeable future use would not affect adversely affect habitat downstream of the dam due to the distance of the actions to listed fish habitat. No shade trees on perennial streams would be removed and no adverse impacts to peak flows would be realized.

On June 22, 2016 the Forest Service presented the Lang Dam project to the National Marine Fisheries Service and the US Fish and Wildlife Service to determine if they concur with the effects determination of NLAA. At that meeting the two fisheries agencies agreed with the effects determination of NLAA. A Biological Assessment (BA) will be submitted by the Forest Service to the two fish services. They will write the Forest Service a letter of concurrence (LOC) that will complete the ESA consultation process.
Magnuson-Stevens Fishery Conservation and Management Act:

Essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams (Cougar Dam in the South Fork McKenzie River; and Blue River Dam), and natural migration barriers. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for essential fish habitat that requires Federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect essential fish habitat. Essential fish habitat for the Pacific coast salmon fishery means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The species designated in the McKenzie River is spring Chinook salmon.

Essential Fish Habitat would not be adversely affected by the Lang Dam project due to the same reasons there would be no adverse effects to listed fish or their habitat.

Management Indicator Species

The Willamette Forest Plan recognized anadromous and resident salmonids as economically important species and designated them as management indicator species for riparian habitat and water quality. Salmonid fish are good indicators because they are predators in the stream ecosystem. This means that they are not only affected by the physical conditions of their habitat but also by the metabolic energy pathways in the watershed from primary production to decomposition. The most common salmonid sport fish that have habitat on the McKenzie River Ranger District are spring Chinook salmon, bull trout, rainbow trout, and coastal cutthroat trout.

Management Indicator Fish Viability Statement: The Lang Dam Project would maintain habitat conditions for aquatic management indicator species in the project area. Riparian Reserve design measures would serve to prevent direct and indirect effects to management indicator fish species and their habitat in the South Fork McKenzie River and Cougar Creek. Based on conditions inventoried during stream surveys, the road network in the project area has not had effects that have created conditions that have substantially affected spawning habitat, embryo incubation, and emergence of trout fry. Therefore, the Lang Dam Project would not contribute to a negative trend in viability on the Willamette National Forest for these management indicator fish species.

3.13 Climate Change

Summary of Effects Analysis

The proposed action will affect about 630 acres of forest. This includes 467 acres to be thinned, gap creation of 39 acres, 25 acres of Dominant Tree Release (DTR) and leave skips of 25 acres. The commercial thinning of smaller trees from most units will result in the retention of about 40 percent of the original trees. The 39 acres of gaps and 26 acres of DTR’s in multiple units will retain some existing trees, and about 17 acres of the gaps will be planted to preferred species to increase diversity. See Appendix E for detailed unit treatments.

Climate change is a global phenomenon because major greenhouse gasses (GHG) mix well throughout the planet’s lower atmosphere (IPCC, 2013). Considering emissions of GHG in 2010 were estimated at 49 ± 4.5 gigatonnes globally (IPCC, 2014) and 6.9 gigatonnes nationally (US EPA, 2015), a project of this magnitude makes an infinitesimal contribution to overall emissions. Therefore, at the global and national scales, the proposed action’s direct and indirect contribution to greenhouse gasses and climate change will be negligible. In addition, because the direct and indirect effects will be negligible, the proposed action’s contribution to cumulative effects on greenhouse gasses and climate change will also be negligible.
The Intergovernmental Panel on Climate Change (IPCC) has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC, 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas emissions came from several sectors:

- Industry, transportation, and building – 41%
- Energy production – 35%
- Agriculture – 12%
- Forestry and other land uses – 12%

There is agreement that the forestry sector contribution has declined over the last decade (IPCC, 2014; Smith et al., 2014; FAOSTAT, 2013). The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC, 2000).

This project does not fall within any of these main contributors of greenhouse gas emissions. Forested land will not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports trees, and sequesters carbon long-term. U.S. forests sequestered 757.1 megatons of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA, 2015). However there is growing concern over the impacts of climate change on U.S. forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western United States. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which will have a major effect on these forests’ role in the carbon cycle (Joyce et al., 2014).

The Lang Dam project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce et al., 2014). Here specifically, the project proposes to reduce stand densities to increase stand health, vigor, species diversity, and resiliency (see Vegetation section for additional objectives). The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar et al., 2007). This project is also consistent with 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. Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith et al., 2014).

The proposed action is consistent with these recommendations because thinning accelerates the development of large diameter trees and promotes vigorously growing, healthy stands (Tappeiner et al., 2007). Planting 69.5 acres with blister rust-resistant sugar pine and western white pine, as well as incense cedar (all are drought and fire tolerant species) from gap and complex early seral habitat creation will result in a more resilient and diverse tree species mix.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). 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, respectively (IPCC, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The proposed action falls into this category.
3.14 Economics

Summary of Effects
Alternatives 2 will have a positive benefit/cost ratio which will generate sufficient stumpage funds to pay for restoration activities. Alternative 2 will have a benefit/cost ratio of 1.33. In a matter of fiscal return on investment, Alternative 2 will cover all costs associated with implementation of the project, and additionally return approximately $1.1 million to the treasury.

Alternative 1 would not contribute to local economy, forest sector jobs, or the National Forest Fund (NFF) which in turn contributes directly to local governments. Alternatives 2 and 3 would have beneficial direct effects to the local economy, forest sector jobs, and the NFF.

Scale of Analysis
The scale used to evaluate Economics associated with the Lang Dam project is Lane County, Oregon. The project lies entirely within the county and funds generated will contribute towards county payments. A majority of the purchasers who participate in timber sales on the McKenzie River Ranger District have offices and/or manufacturing facilities in Lane County.

Affected Environment
The Lang Dam project area straddles the end of National Forest Road 1900, Aufderheide Drive, south of Highway 126 between the communities of McKenzie Bridge and Blue River, Oregon. Highway 126, a major travel route for commercial and recreation traffic passing through this community, follows along the McKenzie River.

The economy of the local communities from the Springfield urban-growth boundary to McKenzie Bridge depends on a mixture of tourism, recreation, timber industry, and Forest Service jobs for stability. Local businesses that rely on tourism and recreation include: multiple inns and lodges, restaurants, stores, and gas stations, along with outfitters and guides. Forest industry jobs include logging and mill jobs, but also include other natural resource specialists, for example wildlife biologist, botanist, hydrologist, archaeologist, and fisheries biologist. Tourism and recreational activities connected with National Forest lands have been increasing in recent years in the upper McKenzie River area. Employment connected with tourism and recreation-related services has also increased.

The current level of timber harvesting on the Willamette National Forest has dropped substantially from the levels of the mid-1980s. This decrease has contributed to a decline in the number of local jobs associated with the wood products industry, as well as the jobs which are dependent on other industries to spend money. The economic impacts of forest sector jobs contribute approximately 5.4 percent, or 6,595 jobs to Lane County, in addition to approximately 11.5 percent or $1.2 billion to the county’s economic base (OFRI 2012, pg. 55). Approximately 10.8 jobs are created with each incremental increase in million board feet made available for harvest (OFRI 2012, pg. 41). These jobs are direct effect jobs, or those associated with the harvest, indirect effect jobs, or those businesses that supply goods associated with harvest, and induced effect jobs, or those who work in the broader economy who benefit when people with direct or indirect jobs spend money (OFRI 2012, pg. 21).

Environmental Consequences
Direct and Indirect Effects
The direct economic effects of the alternatives are displayed in Table 45. A standard criterion for deciding whether a government program can be justified on economic principles is present net value (NPV) – the discounted monetized value of expected net benefits (OMB A-94). Another standard criterion for economic efficiency is the benefit/cost ratio (B/C ratio) which is the product of the present
value of benefits divided by the present value of costs. The B/C ratio shows the return (positive number) or loss (negative number) associated with every dollar spent for the project.

**Alternative 1**
The no action alternative would not harvest any timber, and therefore, would not support direct, indirect, and induced employment. It would not result in increased income to the regional or local economy (including the counties). Current levels of employment in the wood products sector would not change under this alternative. If the Lang Dam project were not replaced by another project, the no action alternative could contribute to a continued decline in forestry and milling related jobs.

**Alternative 2**
Alternative 2 is economically viable, considering current selling values, timber volume per acre, yarding systems required, the proposed temporary road construction and system road maintenance needed, and the identified post-timber harvest projects identified in this analysis. The economic analysis used to make this determination is available in the Lang Dam project record at the McKenzie River Ranger District office. Based on the expected return to the Federal government plus the value of restoration activities potentially funded by stumpage shown in Table 45, Alternative 2 will provide a beneficial benefit/cost ratio.

In general, the primary effect on timber harvest-related employment will occur from commercial timber harvest associated with the action alternative from an estimated selling year of 2017. As Table 45 indicates, Alternative 2 will provide some opportunity for timber harvest-related employment, and higher revenues with a Net Present Value (NPV) value of approximately $1,113,857.

The combined economic benefit from implementation of Alternative 2 is expected to be positive, and will be expected to have a localized beneficial effect for the socio-economic environment of western and central Oregon with a greater impact to Lane County. Alternative 2 will also have a benefit in the form of revenues going towards the National Forest Fund (NFF). Portions of revenue generated by the sale of timber from Alternative 2 will be available to the county for roads and schools.

**Table 45 Estimated Economic Alternatives**

<table>
<thead>
<tr>
<th></th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Timber volume produced (MMBF)</td>
<td>0</td>
<td>~ 8</td>
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<tr>
<td>Discounted Cost</td>
<td>$0</td>
<td>$3,363,143</td>
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<tr>
<td>Discounted Revenues</td>
<td>$0</td>
<td>$4,477,000&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Net Present Value (NPV)</td>
<td>---</td>
<td>$1,113,857&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>NPV per acre</td>
<td>---</td>
<td>$2,094</td>
</tr>
<tr>
<td>Benefit/Cost Ratio</td>
<td>---</td>
<td>1.33</td>
</tr>
</tbody>
</table>

<sup>1</sup> - Revenue based on the 2016 1<sup>st</sup> quarter Oregon Department of Forestry pond values that have been discounted at 4 percent from 2015 until implementation.

<sup>2</sup> - All values are for comparative purposes only. Actual values will be dependent on market values during time of sale and cost of associated activities at that time.
Cumulative Effects

Alternative 2

Alternative 2 will not have any economic cumulative effects, because there is no overlap in space and time with effects from any past, present or reasonably foreseeable future actions.

3.15 Agencies and Persons Consulted

The Forest Service consulted many individuals, federal, state, tribal, and local agencies during the development of this environmental assessment. Scoping emails and letters were sent out to approximately 150 individuals and organizations.

Tribal consultation information and non-Forest Service individuals with whom the agency engaged in discussions as part of the EA can be found in Chapter 1 under Tribal Consultation and Public Involvement Efforts. Structured consultation with agencies such as the State Historic Preservation Office, US Fish and Wildlife Service, and other state agencies can be found in Appendix A: Compliance with Forest Plan, Laws, and Regulations. This list of contacts can be found in the project record and is available upon request at the McKenzie River Ranger District.

The Table 46 contains the names and positions of who contributed to the Lang Dam analysis and EA.

**Table 46 Core Interdisciplinary Team Members:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>James Rudisill</td>
<td>Silviculturist</td>
</tr>
<tr>
<td>Mei Lin Lantz</td>
<td>Fire/Fuels</td>
</tr>
<tr>
<td>Cara Kelly</td>
<td>Archeologist</td>
</tr>
<tr>
<td>Bonny Hammons</td>
<td>Hydrologist</td>
</tr>
<tr>
<td>Rob Lawler</td>
<td>Hydrologist</td>
</tr>
<tr>
<td>Nick Grant</td>
<td>Hydrologist</td>
</tr>
<tr>
<td>Elyzaz Retzlaff</td>
<td>IDT Leader, NEPA Planner</td>
</tr>
<tr>
<td>Joanie Schmidgall</td>
<td>IDT Leader, NEPA Planner</td>
</tr>
<tr>
<td>Dean Schlichting</td>
<td>IDT Leader, NEPA Planner</td>
</tr>
<tr>
<td>Suzanne Schindler</td>
<td>Acting District Ranger</td>
</tr>
<tr>
<td>Shane Kamrath</td>
<td>Natural Resources Staff Officer</td>
</tr>
<tr>
<td>Kenny Gabriel</td>
<td>Engineering</td>
</tr>
<tr>
<td>Ruby Seitz</td>
<td>Wildlife Biologist</td>
</tr>
<tr>
<td>Shadie Nimer</td>
<td>Forester</td>
</tr>
<tr>
<td>Dave Sanders</td>
<td>Recreation</td>
</tr>
<tr>
<td>Burt Thomas</td>
<td>Botanist</td>
</tr>
<tr>
<td>Doug Shank</td>
<td>Geologist</td>
</tr>
<tr>
<td>Terry Baker</td>
<td>District Ranger</td>
</tr>
<tr>
<td>Ray Rivera</td>
<td>Fish Biologist</td>
</tr>
</tbody>
</table>
Appendix A – Compliance with Laws, Regulations and Executive Orders

This appendix describes how the action alternative complies with applicable state and federal laws, regulations, and policies.

The Preservation of Antiquities Act, June 1906 and the National Historic Preservation Act, as amended, October 1966 – Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the foremost legislation governing the treatment of historic properties (a.k.a. heritage or cultural resources) during project planning and implementation. Other legal framework used to consider the effects of the action alternative on heritage resources are listed below:

36 CFR Part 800 (Protection of Historic Properties),
36 CFR Part 63 (Determination of Eligibility to the National Register of Historic Places),
36 CFR Part 296 (Protection of Archaeological Resources), and
Sacred Sites Executive Order 13007

The 1995 Programmatic Agreement (PA) between the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service (amended in 2004) provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project.

The Lang Dam Cultural Resource Inventory Report project file was reviewed by a Forest Heritage Specialist. In accordance with this PA, an appropriate inventory was conducted during the summers of 2014 and 2015 and was documented under the “Cultural Resource Inventory Report for the Lang Dam Project Area”. Through project design, all known cultural sites in the Area of Potential Effect (APE) were protected by avoidance, resulting in a determination of “Historic Properties Avoided Determination”. Documentation was provided to SHPO and concurrence for this project was received by SHPO on copies were retained on file in the Forest and District Heritage files.

Should previously unknown cultural resource sites or objects be discovered during project activities, contract provisions would provide protection. All activities in the vicinity of the find would cease immediately, while the McKenzie River Ranger District Archaeologist is notified to assess the find.

The importance of consultation and coordination with Indian Tribes was affirmed through Presidential Memoranda in 1994, 2004 and 2009, and in Executive Order “Consultation and Coordination with Indian Tribal Governments” EO 13084, issued in 1998 and replaced by EO 13175 in 2000, as well as in numerous statutes and policies. The value of collaboration is fully recognized within the USDA for all of its constituents, including Tribes. (USDA Department Regulation: 1350-002, http://www.fs.fed.us/spf/tribalrelations/documents/policy/consultation/Final_DR.pdf)

The Endangered Species Act (ESA), December 1973 – The ESA establishes a policy that all federal agencies would seek to conserve endangered and threatened species of fish, wildlife, and plants. Biological Evaluations for plants and wildlife have been prepared which describe possible effects and
impacts of the proposed action on sensitive and other species of concern that may be present in the project area.

The 1995 Programmatic Agreement (PA) between the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service (amended in 2004) provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project.

In accordance with this PA, an appropriate inventory was conducted during the summers of 2013 and 2014 and was documented under the “Cultural Resource Inventory Report for the Lang Dam Project Area”. Through project design, all known cultural sites in the Area of Potential Effect (APE) were protected by avoidance, resulting in a determination of “Historic Properties Avoided” on January 26, 2016. SHPO concurred with the Forest Service finding on February 16, 2016. Documentation has been retained in the Forest and District Heritage.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires the identification of habitat “essential” to conserve and enhance the federal fishery resources that are fished commercially. The Pacific Fishery Management Council designated Essential Fish Habitat for Chinook, coho, and Puget Sound pink salmon in their Amendment 14 to the Pacific Coast Salmon Plan, issued September 27, 2000. The interim final rule implementing the Essential Fish Habitat provision of the MSA (62 FR 66531) requires federal agencies to consult with the National Marine Fisheries Service for any action that may adversely affect Essential Fish Habitat.

An essential fish habitat assessment was done for this project under this act. The project was found “not likely to adversely affect” essential fish habitat and no consultation was required.

The National Forest Management Act (NFMA), 1976 - NFMA reorganized, expanded, and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements that relate to perspective project planning).

The action alternative was developed to be in full compliance with NFMA via compliance with the Willamette National Forest Land and Resource Management Plan (1990), as amended. Throughout the environmental analysis and various specialist reports in the project record, there are references to Forest Plan standards and guidelines and how those standards and guidelines were met in the various aspects in the design of the action alternative.

Appropriate public disclosure and opportunity to comment has occurred in the form of public scoping and the associated comment period.

Forest Plan Consistency – Actions analyzed in the Lang Dam Project EA are consistent with a broad range of Forest Plan standards and guidelines that have been discussed and disclosed throughout the
document. The treatments associated with the project are consistent with the goals and management
direction analyzed in the Willamette National Forest Land and Resource Management Plan FEIS and
Record of Decision. Road improvements are designed to be consistent with the 1994 Northwest Forest
Plan amendments to the Forest Plan and the Aquatic Conservation Strategy objectives.

**Survey and Manage** – The proposed action alternative complies with the Northwest Forest Plan as
amended by the 2001 Record of Decision and standards and guidelines for amendments to the survey
and manage, protection buffer, and other mitigation measures standards and guidelines. Pre-
disturbance and site management were consistent with the January 2001 species list. See the Botany
and Wildlife sections of Lang Dam EA and the project record for full discussions.

**Northwest Forest Plan Aquatic Conservation Strategy** - The Aquatic Conservation Strategy (ACS) is an
integral part of the Northwest Forest Plan and was developed to maintain and restore the ecological
health of watersheds and aquatic ecosystems on public lands through implementation of four
components: 1) Riparian Reserves 2) key watersheds 3) watershed analysis 4) watershed restoration.
Based on the analysis presented in Appendix C of the EA, the ACS Objectives would be met in the action
alternative.

**The National Environmental Policy Act (NEPA), 1969** – NEPA establishes the format and content
requirements of environmental analysis and documentation. Preparation of the Lang Dam EA was done
in compliance with these requirements.

**Wilderness Act, 1964, as amended 1978** - The Wilderness Act established the National Wilderness
Preservation System. The Secretary of the Interior was directed to review every roadless area of 5,000
acres or more and every roadless island within the National Wildlife Refuge and National Park systems
for possible inclusion. The act also included some National Forest lands in the system and directed the
Secretary of Agriculture to recommend others. Over 100 million acres have been included in the
National Wilderness Preservation System to date. No project activities are proposed in designated
Wilderness, potential Wilderness, or Inventoried Roadless Areas.

**The Clean Water Act, 1987** – This act establishes a non-degradation policy for all federally proposed
projects. Compliance with the Clean Water Act would be accomplished through planning and application
and monitoring of Best Management Practices (BMPs). Based on the analysis presented in this EA, Total
Maximum Daily Load (TMDL) requirements for the South and Middle Santiam watersheds would be met
in each alternative (See Aquatics Section 3.12 and Appendix C: ACSO).

**Clean Air Act Amendments, 1977** – The action alternative was designed to meet the National Ambient
Air quality standards through avoidance of practices that degrade air quality below health and visibility
standards. This project is consistent with the 1990 Clean Air Act and the 1977 Clean Air Act and its
amendments (see Fire/Fuels section).

**Civil Rights Act, 1964** – In regards to consumers, civil rights, minority groups, and women, contracting
procedures would ensure that projects made available to contractors through this project would be
advertised and awarded in a manner that gives proper consideration to minority and women-owned
business groups. Because of this consideration, there would be no direct, indirect, or cumulative effects
to consumers, civil rights, or minority groups with implementation of the action alternative.

**Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164.**
Development of Rock Quarries would conform to the requirements of the act, which sets forth
mandatory safety and health standards for each surface metal or nonmetal mine. The purpose for the standards are to protect life by preventing accidents and promoting health and safety.

**Executive Order 13186: Migratory Birds** – This Executive Order directs federal agencies to avoid or minimize the negative impact of their actions on migratory birds and to take active steps to protect birds and their habitat. This Executive Order also requires federal agencies to develop Memorandum of Understandings (MOU) with the US Fish and Wildlife Service to conserve birds, including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible. A Memorandum of Understanding was signed between the USDA Forest Service and US Fish and Wildlife Service in 2009 to complement the January 2001, Executive Order. The purpose of this MOU is, “to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the Parties, in coordination with State, Tribal, and local governments.”

The Lang Dam project area contains populations of migratory land birds typical of the Western Cascades. See the Effects to Migratory Birds subsection within the Wildlife section of the EA for further discussion of effects to migratory birds and migratory bird species of concern identified by US Fish and Wildlife Service.

**Executive Orders 11988 and 11990: Floodplains and Wetlands** – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values provided by floodplains. Proposed treatments would not occur within active floodplains.

EO 11990 requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside riparian areas, seeps, springs, and other wet habitats exist in the Lang Dam project area. These areas would either be avoided or managed according to the amended Willamette Forest Plan standards and guidelines. Riparian Reserves would also be protected with design features and no harvest buffers. As a result, proposed treatments would be consistent with Executive Orders 11988 and 11990.

**Executive Order 13112: Invasive Species** - This 1999 order requires federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, “(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species... (iii) monitor invasive species populations... (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;...(vi) promote public education on invasive species... and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species... unless, pursuant to guidelines that it has prescribed, the agency had determined and made public... that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm would be taken in conjunction with the actions.”

The action alternative implements the direction from the Willamette Forest Plan and the Integrated Weeds Management EA. The action alternative includes design criteria which would limit the spread of invasive weeds. These include the cleaning of off-road equipment between infested work sites, pre-treating roads before road maintenance, and road reconstruction, re-vegetating all disturbed areas with native seed, and monitoring weed infestations following treatments.
Executive Order 12898: Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs Federal agencies to address environmental justice by identifying and disclosing the effects of the proposed activities on minority and low-income populations. The effects of the alternatives on the economic conditions of the State and county are disclosed in the Economics section of this chapter.

According to 2013 statistical data for Lane County, about 10% of the population is made up of minorities. Unemployment and poverty in the county is higher than the State average. The project occurs well away from any large population center that would be directly affected by the project. Several small communities are located along the haul routes, some of which may see an increase in business during logging operations and an increase in traffic. The ongoing and reasonably foreseeable activities may also contribute to log truck traffic; overall, this increase in traffic may be measurable, but would not be comparable to the logging that occurred in the area in the late 1980s. No other adverse direct, indirect, or cumulative effects to these communities are expected to occur.

Areas that would be treated by the project may have some recreational value, as described in the recreation section. Where there is dispersed recreation, the effects to those recreating in the area would be greatest. Minority groups or low-income groups that use these areas may be impacted during logging operations by the increase in log truck traffic. These groups may choose to recreate elsewhere. Adverse impacts to these groups would end when logging and other connected actions are completed. Overall, none of the action alternatives imposes any other additional hardships on minority or low-income communities; therefore, there would be no direct, indirect, or cumulative effects to environmental justice with any action alternative. Alternatives would have no direct, indirect, or cumulative effects to any low-income or minority populations that utilize the area for recreation.

Executive Order 12962: Recreational Fishing – The June 7, 1995, Executive Order requires government agencies to strengthen efforts to improve fisheries conservation, provide for more and better recreational fishing opportunities, develop a new policy to promote compatibility between the protection of endangered species and recreational fisheries, and develop a comprehensive Recreational Fishery Resources Conservation Plan. The Lang Dam action alternative would protect sport fishing opportunities in adjacent streams by implementing no-treatment buffers of 180 feet.

Executive Order 13443: Facilitation of Hunting Heritage and Wildlife Conservation – The August 17, 2007, Executive Order requires Federal agencies “to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.” The proposed treatments would open up canopies with the potential to improve forage for game species and provide better hunting opportunities for the public.

Energy Requirements and Conservation Potential – Some form of energy would be necessary for projects requiring use of mechanized equipment. Treatment units would involve both heavy and small machines for cutting, yarding, and processing potential forest products during the implementation period. Projects such as road reconstruction and maintenance would require heavy machinery for a small amount of time. Both possibilities would result in relatively minor energy consumption.

Prime Lands - The Secretary of Agriculture issued memorandum 1827 which is intended to protect prime farm lands and rangelands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There
would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, “Land Use Policy”.

Unavoidable Adverse Effects – Implementation of any of the alternatives, including the no action alternative, would inevitably result in some adverse environmental effects. The severity of the effects would be minimized by adhering to the direction in the management prescriptions, standards and guidelines in Chapter IV of the Willamette Forest Plan, and design features proposed in this document. Potential adverse environmental effects are discussed under each resource section.

Irreversible and Irretrievable Effects – “Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An “Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource uses.

The soil and water protection measures identified in the Forest Plan standards and guidelines, Design Features in this document, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management actions.

No irreversible and /or irretrievable loss of soils or geologic resources is anticipated, beyond that which has been previously identified in the Willamette National Forest Land and Resource Management Plan, as amended. See the Lang Dam Soils report for discussion of soils and geologic stability.

Concerning threatened and endangered plant, wildlife, and fish species, a determination has been made that the proposed action would not result in irreversible or irretrievable commitment of resources that foreclose formulation or implementation of reasonable or prudent alternatives.

In regards to the action alternative, tree removal would result in an irretrievable loss of the value of removed trees for wildlife habitat, soil productivity, and other values. No irreversible loss of soil should occur due to extensive design features associated with treatment activities and prescribed fire (e.g. tractor treatment only on slopes less than approximately 30 percent, etc.).

Alternative 1 (no action) would present an irretrievable loss of growth to individual trees within the untreated, overstocked forest. The ability to protect forest and structures within the project area from stand-replacing fire could be irretrievably lost as well. There would be the potential for irreversible loss of timber value due to declining tree diameter growth related to crowded stand conditions and loss of potential growth from insects and disease.

Other Jurisdictions – There are a number of other agencies responsible for management of resources within the Lang Dam project area. The Oregon Department of Fish and Wildlife is responsible for management of fish and wildlife populations; the Forest Service manages the habitat for these animals. The Oregon Department of Fish and Wildlife has been contacted regarding this analysis.

A memorandum of understanding (MOU) between the Forest Service and Oregon Department of Environmental Quality (DEQ) (reauthorized 2014) outlines DEQ and Forest Service responsibilities for water quality protection under the Clean Water Act. As outlined in the MOU, DEQ completed the Willamette Basin Water Quality TMDL in September 2006, and the Willamette and Umpqua National Forests jointly completed a Water Quality Restoration Plan for all its managed lands in the North Santiam, South Santiam, McKenzie, Middle Fork Willamette, and Coast Fork Willamette sub-basins in April 2008. This Water Quality Restoration Plan (WQRP) serves as the TMDL Implementation Plan for the Willamette Basin TMDL pursuant OAR chapter 340, division 42. This WQRP outlines the use of both the Aquatic Conservation Strategy of the Northwest Forest Plan (USDA 1994) and the Northwest Forest Plan
Temperature TMDL Implementation Strategies (Updated 2012) as the basis for protecting and recovering stream shade in riparian areas, thereby protecting and enhancing water quality.

Through the use of Riparian Reserve no-treatment buffers, this project fully complies with Clean Water Act requirements as outlined in the DEQ/Forest Service MOU.

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry, and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning would comply with the State of Oregon’s Smoke Management Implementation Plan and, for greater specificity, see the memorandum of understanding mentioned above.
Appendix B – Proposed Treatment Descriptions for the Action Alternative

Proposed treatments for the Lang Dam project area are thinning, gaps, skips, Dominant Tree Release (DTR), and various post-harvest fuels reduction treatments.

Activities Common to Thinning

Thinning would maintain/increase the health and vigor of the remaining trees not harvested. Skips and openings ranging between 1-3 acres (see Gaps, and DTR description below) would be placed in many of the stands to promote vertical and horizontal diversity (see Appendix E for a unit by unit prescription). The use of skips and gaps would be part of an un-even aged management approach. Un-even aged management, which is a stand ultimately with more than two age class, would not be applied to all stands; some may not contain any gaps.

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees. Sugar pine and white pine would not be removed from the stand; however they may be cut for operational purposes. Generally, remnant large woody debris on the forest floor would be maintained or increased throughout the stand. Snags would be maintained on site if not a hazard to logging operations.

Project generated fuels may be removed with treatments such as yarding tops attached during harvest, biomass utilization, piling and burning, underburning, mastication, firewood collection, or chipping. However, not every acre harvested would have fuels treatments prescribed. Areas which are projected to be below the standards and guidelines (FW-212 and 252) presented by the Forest Plan would likely have minimal fuels treatments prescribed. All post-harvest fuels treatments would reduce fuel loads within the stand.

Thinning Descriptions

**Thinning**: Thinning treatments would reduce canopy cover within a stand between approximately 30-60 percent. The residual stand, post-harvest (not including gaps put in the stand), would have approximately 25-55 percent of the maximum Stand Density Index (SDI) (see Section 3.1 in Chapter 3 for discussion on SDI). The prescription aims to stay below 55 percent SDImax, which is where inner tree mortality likely begins to occur (Tappeiner et al. 2007). Gaps, dominant tree releases, as well as skips (areas not harvested) would likely be placed in the stands being commercially thinned.

Thinning would increase the health and vigor of the remaining trees and help increase the stands ability to adapt to environmental changes. Additional light, from reduced canopy cover, reaching the forest floor would help promote a second cohort of trees. Both shade-tolerant and intolerant species may be established; however, shade-tolerant species would thrive over time as the overstory crown closes. The canopy cover is estimated to increase 2 percent per year (Chan et al., 2006). This second generation of trees growing under the overstory canopy is expected to provide vertical, horizontal, age, and species diversity in the stand by primarily harvesting Douglas-fir which is over represented in the project area because of planting densities.

Conifer trees would be removed through commercial thinning across all size classes, but would primarily consist of smaller diameter trees with an emphasis on retention of sugar pine and white pine; however these species may be cut for operational purposes. This prescription would also maintain or increase
vegetative diversity in the understory by opening the canopy to allow for growth of seedlings, as well as the development of understory shrubs and forbs which have broad ecosystem benefits.

Thinning provides growing space for new trees to increase age, size and height diversity in a stand and at the project area scale. Young uniform stands such as the plantations and many fire regenerated stands proposed for treatment in the Lang Dam project can be diversified with early thinning by allowing new generations of trees to establish. Early commercial thinning has been shown to be beneficial to the future development of understories, the promotion of natural regeneration, and in enhancing biodiversity (Muir et al. 2002). With early thinning, overstory trees can develop deep canopies and large-diameter branches in open stands (McGuire et al. 1991). Low overstory density facilitates the establishment of understory trees (McGuire et al. 1991, Bailey and Tappeiner 1998, Miller and Emmingham 2001).

Treating mature stands in the Lang Dam project is expected to increase availability of resources such as sunlight to the forest floor for increased diversity of shrubs, herbs, and understory tree establishment and growth with the effects lasting up to about 15-20 years as the overstory crown closes in (Chan et al., 2006). In addition to the understory response, increased growth in the overstory is expected to last up to about 25 year (Latham and Tappeiner, 2002). Williamson (1982) found that 19 years after heavy thinning, a 100 year old thinned stand, had a 30 percent higher response to volume growth than did the control units. Thinning across all crown classes in a stand provides the longest term benefits to both large and small trees because of the time it takes to fill in the overstory canopy (Williamson and Price 1966).

More intensive thinning would likely promote rapid growth of trees with characteristics normally associated with old trees in old-growth stands. The large older trees in a stand often showed signs of rapid growth in lower densities when they were young (30-100 years), producing large stems and crowns. Evidence (Franklin et al 1981, Tappeiner et al. 1997) suggests that growth rates of some older forests indicate slow regeneration and at low densities over a long period with little tree-to-tree competition. Old-growth stands typically have multiple canopy layers, and thinning promotes a second cohort, or canopy layer, by allowing for natural regeneration to occur (Tappeiner et al. 1997).

Some old-growth forests appear to have developed from relatively even-aged cohorts that have undergone long-term suppression mortality, little understory regeneration of Douglas-fir, and episodic release of established tolerant conifers (Winter et al. 2002a, 200b). Therefore, stand management can follow multiple routes that emulate natural processes to move dense young stands towards structure similar to old-growth forest.

A short-term (less than one year) impact to understory vegetation and below ground fungi could occur from logging. These short-term adverse effects would be expected to recover within two years post-harvest as regrowth of herbs and shrubs occur. The removal of host trees and soil disturbance from the yarding operation impacts below ground fungi (Courtney et al. 2004). This adverse effect is reduced by minimizing additional soil impacts with the use of designated skid trails with ground–based yarding systems and log-suspension capabilities of skyline and helicopter yarding systems.

**Gaps (GS):** Gaps would be randomly placed unless it was necessary to strategically place the openings within a stand for other resource benefits such as minimizing conflict for current and/or expected future logging operations or avoiding weed infections. Gaps may also be placed to provide higher quality early seral habitat for wildlife species like big game, or to provide scenic vistas. The gaps would be randomly shaped following features of the landscape when available, and would range in size from approximately 1-3 acres. When a root rot pocket is identified, a gap would be placed with a 50-foot buffer established around the outside of the root rot pocket which could result in a gap larger than three acres.
Appendix B – Proposed Treatment Descriptions for the Action Alternative

Gaps would be placed in stands to provide for horizontal and vertical diversity, or in stands that have been identified as potentially higher quality early seral habitat areas by our district wildlife biologist. A thinning prescription would be applied to the area outside the gaps.

Gaps would not be a conventional clear-cut treatment. Although not always, to provide diversity, 1-4 green trees in either scattered pockets and/or scattered would be retained throughout the opening post-harvest. These retention trees would be released to grow to encourage large tree development, future snag development, diversity in future stand structure, and development of future large down woody debris. In 30 to 60 years the stand structure would be more complex with at least a two cohort stand making up the overstory. This would better mimic some late successional characteristics than what the current stand is projected to produce in the same time frame if no treatment occurred (Andrews et al. 2005).

Retention trees would be left in openings to function as legacy trees that would benefit a variety of resources. Live retained trees would be released for several reasons including aesthetics, to encourage large tree development, future snag creation, diversity in future stand structure, and development of future large down woody debris.

Retention trees may be spaced both sparsely throughout the opening and also in clumps, increasing the diversity across the landscape. Emphasis would be placed on retaining multiple desired retention tree species where feasible. Live trees with ‘elements of wood decay’ may be selected as retention trees, which could include trees with features like dead tops, broken tops and heart rot. This would increase the diversity of the prescriptions across the landscape.

Live retention trees may or may not be used as snag (wildlife) enhancement projects; however, retention trees meeting criteria for wildlife trees (i.e. having Phellinus pini conks or other elements of wood decay) would serve as a wildlife tree and offset the need for further enhancement. In stands where snags or down woody material would be created after harvest, additional trees may be left that can be utilized. Snags would be maintained on site, if not a hazard to logging operations.

**Dominant Tree Release (DTR):** DTR is a method that replicates small disturbances and increases structural variability. This prescription would provide for growth of a dominant tree or group of five to ten trees to promote larger trees scattered throughout the stands. The area around the dominant tree would be cut to a radius of 66 feet from the bole of an individual tree, or each tree in a group. Around an individual tree, the 66 feet equates to approximately ¼ acre (accounting for drip-line of trees) when one tree is identified. When five to ten trees in a clump are identified, the opening size would vary depending on the number and spacing of trees retained but would likely range from an estimated 1/3 to ½ acre. Sugar pine, and white pine would not be cut in the DTR. DTR trees would be randomly placed throughout stands, including riparian areas when the objective within the riparian area includes treatment.

Trees selected for DTR would be the largest trees that best represent site potential in a given area. When under represented species are identified in a stand, the DTR may target these species such as sugar pine, white pine, and western red cedar as the dominate tree to be released. Although the underrepresented species may not be a dominant tree, they would represent the dominant trees of their particular species and help increase diversity. Occasionally a group of two trees would be selected in one DTR. The canopy cover of the stand would be adjusted based on the ¼ acre DTR having a canopy cover of 4 percent.

Within all units, a sugar pine, when identified, would be used as the dominant tree in an effort to help promote sugar pine’s health and vigor as well as regeneration. Sugar pine that are 24” dbh and larger with a maximum of 5 trees selected per 10 acres would be used as Dominant Tree Release. All trees
within a radius of one chain from the bole of the sugar pine would be cut and removed regardless of species with the exception of another sugar pine located within the cut area or a tree greater than the DBH of the sugar pine selected.

**No Harvest Skips (NH):** No harvest skips are areas within units that would not have trees removed however some trees within a skip may have trees cut and left on site such as in skyline corridors. There may also be wildlife trees or down wood created within these areas. These areas are include no harvest buffer around Riparian Reserves, sensitive botanical species, or are areas that are randomly selected to allow for natural succession to take place.

**Post-Harvest Tree Planting**
Reforestation would be expected to occur within five years of harvest, and occur from both tree planting and natural regeneration. Post-harvest densities would be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity with the ingrowth of species such as western white pine and western red cedar. Skid roads in planting areas are expected to be subsoiled to a depth of 18-22 inches to reduce the effects of compaction with the exception of soils under a retention tree canopy because the roots of the given tree would be less disturbed. Compaction from skid roads has not shown a reduction in residual tree growth (Miller et al. 2007). Slash and other debris would be utilized as shade and as a deterrent to browse by ungulates. Planting in identified root rot pockets would be species that are less susceptible to root rot like western red cedar, sugar pine, white pine or red alder. No additional effects would be realized by completion of this project because planting has been accounted for in the Forest and Stand Structure analysis.

Natural regeneration is unpredictable based on timing of cone crops and occupation of the site by competing vegetation, therefore surveys would occur around three years after treatment to verify minimum stocking levels in the natural regeneration. If surveys show less than 200 trees per acre are present, planting with western red cedar, white pine, sugar pine, and/or Douglas-fir would occur to augment the natural regeneration.

**Fuels Treatments Description**
Post-harvest fuels treatments are intended to reduce fuels following harvest. Treatments are guided by the Forest Plan standards and guidelines for Maximum Acceptable Fuel Loadings of downed woody material. These guidelines are as follows (FW-212 and FW-252):

Within the proposed harvest units it is estimated (from field surveys and photo series) that current surface fuel loading on average is below the Forest Plan standards and guidelines. However, in many stands post-harvest fuel loadings are projected to be above standards and guidelines.

<table>
<thead>
<tr>
<th>Guidelines for Downed Woody Material</th>
<th>Tons/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td></td>
</tr>
<tr>
<td>0-3”</td>
<td>7-11</td>
</tr>
<tr>
<td>3”-9”</td>
<td>8-12</td>
</tr>
<tr>
<td>9”-16”</td>
<td>18-20</td>
</tr>
<tr>
<td>&gt;16”</td>
<td>8-15 pieces/acre &gt;20ft.</td>
</tr>
</tbody>
</table>

Proposed post-harvest fuels treatments would consist of yarding tops, hand piling, mechanical treatments and/or underburning. The implementation of fuels treatment may vary in method from what is the proposed in the alternatives to meet standards and guidelines (i.e. grapple piling instead of underburning). However, the implemented fuels treatments would remain within the range of effects analyzed in the Environmental Analysis.

**Hand Treatment and Mechanical Treatments:** Hand treatment require manually hand piling created slash that is ≥1 inch in diameter and ≥3 feet in length. Mechanical treatments use machines to pile or chip/mulch fuels. Slash piles may occur within the unit or at landing(s). Piles would generally be placed in locations to minimize the damage of residual standing snags or live trees; however some piles could be
located to cause tree mortality to create snags for wildlife habitat. Hand, grapple, and landing piles are covered with approved plastic following construction and burned at a later date after the slash has sufficiently dried (1-2 years post-harvest). This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall or early winter when there is very low risk of the piles spreading into other fuels surrounding the piles.

**Yarding Tops:** Yarding tops occurs during harvest operations. Tree tops are removed from the harvest unit to the landing areas. The tops are then separated where they can either be utilized (i.e. firewood or biomass) or piled for burning within a few years post-harvest. This treatment aids in reducing the post-harvest fuel loading within the harvest unit.

**Post-Harvest Underburn:** Post-harvest underburns are intended to reduce fuels created by harvest activities and help promote structural and biological diversity in stands. Underburning would comply with Forest Plan standards and guidelines in regards to consumption of fuels and maintaining down-woody material, duff cover, and snags. Underburns would be conducted during optimal weather and fuels conditions, most likely in the spring or fall. The weather and fuels conditions would be specific to the unit’s location and fuel loading and tempered speeds of ignition to reduce mortality of residual canopy. An objective for the post-harvest underburning would be to minimize overstory tree mortality; however, some mortality of 0 to 10 percent would be acceptable and would also aid in wildlife snag enhancement. Mortality trees that occur adjacent to roads may be removed for safety reasons.

Underburns may require the construction of firelines around the unit perimeter. These are created prior to the burn and aid in containing the prescribed fire within the unit boundaries. Firelines are created with the use of hand tools, or equipment, by scraping fuel back to an approximate 18” mineral soil line and scattering fuels that lie within about 10 feet of the proposed line. If units are located on a steep slope waterbars are created within the fireline to reduce erosion potential.

**Roads Treatments**

**Road Maintenance:** For all action alternatives, existing forest roads needed for harvest activity would be maintained to allow safe access to harvest areas and to reduce adverse impacts to resources. Road maintenance associated with haul routes would result in decreased maintenance cost, improved safety, and reduced potential for resource damage related to degraded roads that would be needed for current and future resource management. Road maintenance activities may include felling danger trees, clearing and grubbing, replacing drainage structures, asphalt pavement patching, repairing holes in the roadbed, reconstructing ditches, application of dust abatement material, and placement of aggregate surfacing.

**Temporary Road Construction and Decommissioning:** Temporary roads would be created in both action alternatives. These roads would be placed in areas to minimize impacts to resources and would be decommissioned after use. Previously disturbed sites would be utilized where possible. The initial effects of the construction would be compacted soils; however those effects would be offset by decommissioning. The effects of decommissioning would be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction and root growth, so increased growth is possible along skid trails and landings that have treatment.

**System Road Storage and Decommissioning:** Roads would be closed with a physical barrier and non-drivable water bars installed as needed. Culverts would be removed from stream channels with fills of shallow to moderate depth. Fill depth would be reduced for culverts in deep fill locations, and side cast material would be pulled back. Roads identified for decommissioning may include any of the following treatments described with road storage but may also include removal of culverts from stream channels in deep fills, slope recontouring, and sub-soiling. These roads are no longer needed and will be removed from the transportation system.
Appendix C - Consistency with the Aquatic Conservation Strategy

Introduction
The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A goal of this strategy is to maintain a "natural" disturbance regime. In addition, management activities must comply with nine objectives that are included in the strategy and any associated standards and guidelines. A variety of tactics to accomplish these goals and objectives are incorporated into four primary components. These components are:

- Riparian Reserves
- Key Watersheds
- Watershed Analysis
- Watershed Restoration

These four components, along with Late Successional Reserves, are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl - USFS, BLM 1994, (ROD), pages B9-B12).

1. Riparian Reserves

The Northwest Forest Plan defined Riparian Reserves as “portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply” (ROD page B12). Riparian Reserves include those portions of a watershed directly coupled to streams, ponds, lakes, and wetlands - that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water (ROD pgs. B-12 and B-13).

The Riparian Reserve network in the South Fork McKenzie watershed totals over 65,570 acres which is over 47% of the entire land base (South Fork McKenzie Watershed Analysis 2010). The Watershed Analysis made no final recommendations to adjust Riparian Reserve widths for the streams in the watershed, retaining the initial reserve widths (of one site potential tree height) from the ROD for all streams.

The Lang Dam project area is 7,195 acres of which 2,443 acres are Riparian Reserves. At the unit level, there are a total of 645 acres of which 209 acres are Riparian Reserves. Of those 209 acres, the proposed action would thin 120 acres and not cut, or “skip,” 89 acres.

During the analysis for the Lang Dam Project, no reductions of Riparian Reserve widths along any streams were proposed. However, silvicultural treatments were proposed within Riparian Reserves for some units in order to improve structural diversity and vegetative diversity. Timber harvest is prohibited within Riparian Reserves but there are 3 exceptions provided in the ROD. One of which is Standard and Guideline TM-1(c).
Standards and Guidelines (S&Gs)

TM-1(c). Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Standard and Guideline TM-1(c) in the Northwest Forest Plan (1994) provides direction on when silvicultural activities can take place in Riparian Reserves. Members of the interdisciplinary team reviewed all the Riparian Reserves in the project units and conducted a “hardwood analysis” at the sub-watershed level to determine if treatment is warranted. Based on this analysis recommendations for treatment were developed for each Riparian Reserve in project units.

There are no-cut buffers of varying width (30 feet to 180 feet) depending on stream class, presence or absence of hardwoods, and density of the conifers in the Riparian Reserve. See Table 4 in Chapter 2 for the no-cut buffer widths for units with Riparian Reserves. Thinning Riparian Reserves means there will be an effect on the supply of coarse woody material and ACS objective 8 states that the Forest Service must maintain and restore amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. The plantations where thinning is proposed are dense and there is a need to control stocking in order to maintain a healthy stand of trees. The number of total trees per acre (i.e. this number includes trees less than 7 inches in diameter) range from 234 to 503. Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al 1997; Poage & Tappeiner 2002). Having a no-cut buffer adjacent to every stream would maintain a high level of trees per acre compared to what has been found in these studies. In the thinned areas, there would still be more trees per acre left after thinning than found in the studies. The previously harvested stands proposed for treatment in the Lang Dam Project Area were harvested and replanted using direction that pre-dates the Willamette Land and Resource Management Plan (1990) and the Northwest Forest Plan (1994). As a result, the majority of these forest stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominated stands, with tree densities above the range of natural variability expected in this area. Per field investigations, the buffer was determined from stream size, stream class, gradient, channel complexity, and how functional the existing coarse woody material was in the stream channel. It is expected that the amount of woody material left in the no-cut buffer and the remainder of the Riparian Reserve would be sufficient to sustain physical complexity and stability. Fish bearing streams have wider no-cut buffers (i.e. from 30 to 180 feet) so thinning in these Riparian Reserves would have limited effects on fish and caddisflies.

The South Fork Watershed Analysis (SFWA) (1994) described past conditions, current conditions, and trends in riparian vegetation in the watershed. Fires, road construction, and timber harvest on some land types, and flooding can accelerate debris flow occurrence. Conditions of riparian stands will depend on previous timing of fires and pulses of debris flows. It is reasonable to speculate that the extensive fires of the mid-1800’s would have created open riparian stands in many of the South Fork’s drainages. Further, the fires combined with the great flood of 1861 would have triggered debris flows in many first to third order streams during that period, with some affecting larger streams. By the year 1900, many small riparian areas would have shown mixed conifer / red alder stands with conifer about to go into a period of rapid height growth. For larger streams recovering from the impacts of 1800’s fires and the 1861 flood, some red alder, cottonwood, or willow may have persisted near the active channel shelf, but conifers would have established and by 1900 have overtopped the deciduous trees to dominate
floodplains. By the time of the 1945 flood (25 year flood event), most of the stands would have lost remnants of red alder and little evidence of these events would remain. With fire suppression few large fires had occurred since the early 1900’s. It is estimated that 50 fires have been suppressed in the watershed since the arrival of the Civilian Conservation Corps (CCC) in the 1930’s with the majority being caused by lightning.

The SFWA (1994) also discussed trends in riparian vegetation for the entire watershed. Given the Riparian Reserve network established by the Northwest Forest Plan (1994), the SFWA found that the riparian areas within the watershed will have an increase in conifer dominance tree communities. Unlogged areas will continue recovery from the 1964 flood (a 130-year flood event in the South Fork McKenzie). Alder stands initiated during the 1945 and 1964 floods will persist until the middle of the next century (i.e. 21st century) when they will decline under emerging conifers. Older floodplains reset during the 1861 flood will be old growth by that time. A major flood would reset succession along floodplains and would affect the least confined valleys the most.

Cougar Dam, constructed in 1963, has had a significant impact on the riparian vegetation community downstream of the dam due to the changes in the flow regime, the sediment regime, and the large woody material (LWM) regime. The South Fork Watershed Analysis (1994) discussed trends in riparian vegetation below the dam. Riparian vegetation patterns below the dam are reacting to the flow and sediment deposition changes since construction of the dam. Vegetation communities once found near secondary channels, on depositional bars, and on floodplains are shifting due to natural successional processes as well as altered disturbance regimes. Data from a 962-foot long transect across the reach suggest trends in vegetation below the dam will be most significantly affected by: (1) abandonment of secondary channels; (2) transformation of depositional bars into floodplains; and (3) transformation of old floodplains into terraces. All of this will mean a reduction in hardwoods downstream of the dam.

A “hardwood analysis” was conducted for the South Fork McKenzie River-Cougar Creek watershed. For this analysis, satellite imagery (WorldView 2) and Google Earth imagery were used to determine the percentage of deciduous trees in Riparian Reserves.

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<thead>
<tr>
<th>Class Name</th>
<th>Acres</th>
<th>Percent of the Riparian Reserve Network</th>
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</thead>
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<tr>
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<tr>
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<td>Other</td>
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2. Key Watersheds
The Northwest Forest Plan created an overlay of Key Watersheds that are intended to provide refugia for at-risk stocks of anadromous salmonids and resident fish species. Refugia are a cornerstone of the
Appendix C – Consistency with the Aquatic Conservation Strategy

conservation strategy for these species, consisting of watersheds that provide high quality habitat or are expected to provide habitat. There is no Key Watershed designation in the Lang Dam project area.

3. Watershed Analysis and Watershed Restoration

South Fork McKenzie Watershed Analysis (WA) was prepared for the McKenzie River Ranger District in 1994 and updated in 2010. The watershed was characterized in terms of past and current conditions, and a synthesis discussion was provided to guide development of management proposals to maintain and restore watershed conditions.

The Lang Dam Project has incorporated information from the WA into the project design. Current vegetative landscape patterns reflect past management activities that did not consider what the landscape might look like under natural disturbance regimes. The presence of Cougar Dam since 1963 has affected the riparian plant community along the South Fork McKenzie below the dam. Many of the proposed projects seek to create vegetative patterns, late successional stand structures, increased hardwoods in the area, and fuel loadings that would have been typical of this landscape under the natural disturbance regimes that historically occurred in the area.

Watershed restoration has been ongoing in the South Fork McKenzie River since 1994. For example, large wood placement project have been implemented since 1996 and 841 trees have been added to the channel upstream of Cougar Reservoir. In 2010, a Watershed Restoration Action Plan (WRAP) was developed for the Cougar Creek-South Fork McKenzie sub-watershed. Most of the essential projects recommended in the WRAP have been implemented. A project has been proposed – the Lower South Fork McKenzie River Floodplain Enhancement Project – that would implement the final projects proposed in the WRAP. That project would essentially spread water out over a greater area in the sub-watershed which would hypothetically increase the number of hardwoods. Lang Dam would thin 120 Riparian Reserve acres of out of a total of 1,775 Riparian Reserve acres in the sub-watershed. This, along with the floodplain enhancement project, would help to increase hardwoods in the sub-watershed.

Aquatic Conservation Strategy Objectives

The previous discussions highlighted the consistency of the Lang Dam Project with the four components of the Aquatic Conservation Strategy. This section will outline how the activities proposed in the action alternative conforms to the nine objectives of the ACS. The information presented is summarized from Chapters 2 and 3 of the Environmental Assessment, where greater detail can be found if needed.

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.

Thinning treatments were developed so that they would, to the extent possible, emulate the effects of the natural fire regime that historically occurred in the vicinity as well as maintain existing habitat near streams and wetlands. Creating structural and species diversity within dense, homogenous Riparian Reserve stands were key drivers in the proposed treatments. The objective is to provide a balance between the maintenance of existing habitat for species, populations, and communities, with
opportunities to develop landscape scale features with distribution, diversity and complexity of the historical landscapes. This includes aquatic and riparian elements of the landscape.

**Objective #2 - Maintain and restore spatial and temporal connectivity within and between watersheds.** Lateral, longitudinal, and drainage network connections include floodplains, wetlands, up slope 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.

Riparian Reserves, as established by the Record of Decision for the Northwest Forest Plan and reassessed in the South Fork McKenzie Watershed Analysis have been incorporated into the design of all treatment units where streams occur. Treatments are proposed within Riparian Reserves, where they have the potential to enhance functions such as the development of future large wood, stand structural diversity, vegetative species richness and diversity, and other late successional characteristics. Road treatments include upgrade of stream crossings to accommodate 100 year flood events, so that these events can flow through the landscape unimpeded and without the risk of catastrophic fill failures.

The only man-made barrier in the sub-watershed is Cougar Dam. At present, it has an adult “trap and haul” facility at the base of the dam. Safe downstream passage has not been established at Cougar Dam but the Army Corps of Engineers has studied the need and is developing a plan to implement downstream passage.

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

All proposed treatments were designed with channel stability in mind. All harvest activities restrict the use of ground disturbing equipment in and around streams, and provide for retention of all vegetation that is contributing to the stability of banks and channels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors within the Riparian Reserve would be retained on site as down woody material.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Lang Dam Project addresses this concern by not implementing permanent road construction and upgrading at least 11 culverts (4 stream cross ing and 7 ditch relief). Approximately 11.5 miles of maintenance and reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms. Approximately 2.2 miles of temporary roads will be constructed on stable locations, and all of these will be obliterated following harvest activities. Additionally, approximately 0.3 miles of existing permanent road (1900399 road) would be decommissioned and left in a hydrologically stable condition and 2.7 miles of open roads would be closed and put into storage with water bars and bermed at the entrances.
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 over-all objective of any treatment within the Riparian Reserves is to maintain compliance with the Regional TMDL Implementation Strategy so that stream temperatures are not detrimentally impacted. Where vegetative treatments are proposed within Riparian Reserves, effective stream shading is retained at levels sufficient to maintain water temperature. A minimum of 50% canopy closure (approximately 40% canopy cover) is preserved throughout the Riparian Reserve to maintain microclimates. No-harvest buffers were developed to preserve the primary shade zone. Most of the class 3 and all of class 2 streams have a minimum 180-foot no-harvest buffer and a few have a minimum of 60-foot no-harvest buffer. Class 4 streams have a 30 or 60 foot no harvest buffer with a few exceptions at 230 feet.

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.

Project design elements are intended to maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations, as discussed above under Objective 3. These design elements will also provide protection to water quality from the introduction of sediment into streams and resulting effects on stream turbidity.

As stated in #3 above, roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion.

All proposed treatments were designed with sediment transport potential in mind. All harvest activities follow Best Management Practices (BMP) guidelines and restrict the use of ground-disturbing equipment in and around streams. This reduces the potential of water routing along skid roads or the creation of overland flow due to high compaction levels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors within the Riparian Reserve would be retained on site as down woody material.

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.

This alternative maintains current canopy cover at levels well above the maximum mid-point for Aggregate Recovery Percentage (ARP). Therefore, no altered flows are anticipated from implementation of this alternative.

Objective #7 – Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.
Implementation of a landscape design that is intended to restore vegetative structures, landscape patterns, and disturbance regimes to a more natural condition will result in watershed conditions that more closely resemble those under which historic stream flow conditions developed.

Floodplains and wetland areas were excluded from consideration for harvest activities and where treatment units occur adjacent to these features, ground-based equipment that could impact the soil and result in altered groundwater movement are restricted.

Cougar Dam is the human created feature in the 6th field watershed that significantly impacts the flow regime and floodplain inundation. The Forest Service cannot do anything to remove Cougar Dam in order to restore the flow regime.

**Objective #8** - Maintain and restore the species compositions and structural diversity of plant communities in riparian areas 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 distribution of coarse woody debris sufficient to sustain physical complexity and stability.

As discussed in the Riparian Reserve section of this ACS analysis, the vegetation in this sub-watershed has changed due to the presence of Cougar Dam. The Lang Dam project would increase the amount of hardwoods in the sub-watershed by thinning out overly-stocked conifers. This activity will have the short term effect (years to a couple of decades) of reducing coarse woody material loading in the Riparian Reserve outside the no-harvest buffer. However given the unnaturally over-stocked conditions of these managed stands, in the long term (decades to a century) there will still be adequate woody material to maintained volumes within the natural range of variability.

Wetlands and floodplain areas that are critical to nutrient filtering are eliminated from treatment areas and use of ground disturbing equipment adjacent to them is restricted. New hardwood trees will help improve the nutritional quality of organic matter delivered to streams.

Use of low severity fire is restricted to the edges of Riparian Reserves where the risk of adverse effects on ground cover and duff retention cannot impact water quality.

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

This project complies with the Northwest Forest Plan and all of its applicable standards and guidelines. Option 9 was expected to maintain and restore late-successional and old-growth forest ecosystems, and provide adequate viability levels for all late successional species including species listed in the FEIS ROD Table C-3. As discussed in the other Objectives above, some stands in Riparian Reserves are proposed for treatment to encourage development of large wood and late successional stand structure. This would help to create a rich variety of habitats for native species. Adequate amounts of down woody debris will be retained on site.

The South Fork McKenzie and its numerous tributaries provide excellent habitat for native fish. This is due to the cold, clean water. This habitat will be maintained by the implementation of no-cut buffers
along fish bearing streams. Additionally, upgrades to several culverts will provide better dispersal opportunities to aquatic invertebrates and salamanders. Roads that are decommissioned will restore stream channels so that there will be unobstructed passage at the former road crossing.

Map of Cougar Creek – South Fork McKenzie River Sub-watershed Hardwood Results

Cougar Creek – South Fork McKenzie River Sub-watershed Hardwood Results with Lang Dam Units
Appendix D - Past, Present and Reasonably Foreseeable Future Activities Relevant to the Cumulative Effects Analysis

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

The table below provides a summary of past, present, and reasonably foreseeable future actions that overlap in time and space with the Lang Dam project and could contribute cumulative effects to the resources in the project area.

<table>
<thead>
<tr>
<th>Action</th>
<th>Agency</th>
<th>Description</th>
<th>Resources Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Past Actions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>410 Road Hazardous Fuels Reduction</td>
<td>USFS</td>
<td>Approximately 94 acres of fuels reduction completed in 2015 to create defensible space and reduce fire potential around the 410 Road area and near-by structures south of Highway 26 near Cougar Reservoir.</td>
<td>Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants</td>
</tr>
<tr>
<td><strong>Present Actions</strong></td>
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## Appendix D – Past, Present and Reasonably Foreseeable Future Activities

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<th>Action</th>
<th>Agency</th>
<th>Description</th>
<th>Resources Affected</th>
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</thead>
<tbody>
<tr>
<td>7-Thin Stewardship Reoffer (Bridge EA)</td>
<td>USFS</td>
<td>Originally sold in 2014, the 7-Thin Stewardship Reoffer project is anticipated to operate in 2016. Approximately 80 acres of thinning and three acres of gaps.</td>
<td>Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management, Invasive Plants</td>
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<tr>
<td>Buck Thin (Horse Creek EA and the Castle Project CE)</td>
<td>USFS</td>
<td>Originally sold in 2014, Buck is a timber sale which includes units from the Horse Creek EA and the Castle Project CE. Only units from the Castle Project which fall with the Lang Dam Project Area are addressed. Approximately 51 acres of thinning.</td>
<td>Fuels, Vegetation, Soil, Water, Recreation, Wildlife, Fisheries, Roads and Access Management.</td>
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<tr>
<td>Transmission and Electric Line</td>
<td>Bonneville Power Administration and Lane Electric</td>
<td>Installation and ongoing maintenance of about 4 miles (~9 acres) of transmission line.</td>
<td>Wildlife, Invasive Plants, Vegetation</td>
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### Reasonably Foreseeable Future Actions

<table>
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<th>Action</th>
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<tr>
<td>Green Mountain EIS</td>
<td>USFS</td>
<td>The project proposes to harvest approximately 4,398 acres. Proposed harvest treatments include thinning, gap creation, dominant tree release, regeneration harvest, and skips. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Transportation related activities would include temporary road construction, road maintenance, road decommissioning, road storage, and bridge replacement. Field surveys and effects analysis for this project are completed. Final EIS and Record of Decision are anticipated in 2017. Implementation anticipated to begin in 2018.</td>
<td>Vegetation, Soil, Water, Recreation, Wildlife, Scenic Quality, Fisheries, Road and Access.</td>
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<tr>
<td>Lower South Fork Floodplain Enhancement EA</td>
<td>USFS</td>
<td>Placement of wood in channels and floodplain, stream reconstruction, levee removal, and sediment augmentation in the Lower South Fork McKenzie River below Cougar Dam. To provide wood for the in-stream work, the project proposes to harvest 655 acres via thinning and gap creation.</td>
<td>Fisheries, Wildlife, Recreation, Water, Soil, and Vegetation.</td>
</tr>
<tr>
<td>Action</td>
<td>Agency</td>
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### Appendix E - Detailed List of Project Activities by Unit for the Proposed Action

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<tr>
<th>Unit</th>
<th>Total Stand Acres</th>
<th>Age</th>
<th>Total RR¹ Acres</th>
<th>Thin Acres</th>
<th>RR¹ Thin</th>
<th>Gap Acres</th>
<th>DTR Acres</th>
<th>Skips</th>
<th>Skips in RR¹</th>
<th>Net MBF for Unit</th>
<th>Net MBF per Harvest Acre</th>
<th>Initial CC²,³</th>
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¹RR – Riparian Reserve  
²CC – Canopy Cover  
³Based on trees seven inch diameter breast height and greater.
Appendix F – References

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Chapters 1, 2, and Appendices


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USDA Forest Service and USDI Bureau of Land Management. 1994b. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, OR


Appendix F – References


**Climate Change References**


Appendix G – Detailed List of Changes to Project activities from Draft EA to Final EA.

1. Unit 210 consisted of 15 acres that was dropped entirely due to Red Tree Voles (RTV).
2. Unit 220 consisted of 38 acres and 12 acres was dropped due to RTV. Twenty-six acres of this unit is proposed to be managed (see Figure 1 below).

Figure 1. Proposed changes to Unit 220