ThunderKat Timber Management Project

Environmental Assessment and Finding of No Significant Impact

EA Number: DOI-BLM-OR-S040-2014-0002-EA

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United States Department of the Interior
Bureau of Land Management, Oregon State Office
Salem District, Cascades Resource Area
Linn County, Oregon

T. 10 S., R. 02 E., Section 5, W.M.

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BLM
Salem District

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BLM/OR/WA/AE-15/009+1632

FINDING OF NO SIGNIGICANT IMPACT (FONSI)

1. INTRODUCTION

The Bureau of Land Management (BLM) has conducted an environmental analysis for a proposal to regeneration harvest 58 acres of 93 year old forest stands and an alternative to commercially thin 58 acres of 93 year old forest stands. The project is located on BLM lands in T. 10 S., R. 02 E., section 5; W.M. in Linn County, Oregon and spans two seventh field watersheds: approximately 48 acres in Bear Creek and 10 acres in Criminal Creek (EA section 7.0). The ThunderKat Environmental Assessment (EA) (# DOI-BLM-OR-S040-2014-0002-EA) documents the environmental analysis of the proposed timber management alternatives.

The analysis in this EA is site-specific and supplements analyses found in the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement*, September 1994 (RMP/FEIS). The EA evaluates two "action" alternatives, the Proposed Action and Alternative A. A No Action alternative is also evaluated. The Resource Area Interdisciplinary Team (IDT) has designed the proposed harvest activities to conform to the *Salem District Record of Decision and Resource Management Plan*, May 1995 (RMP) and related documents, which direct and provide the legal framework for management of the BLM lands within the Salem District (EA section 1.6).

2. FINDING OF NO SIGNIFICANT IMPACT

The Finding of No Significant Impact (FONSI) is defined in 40 CFR 1508.13 as a document briefly presenting the reasons why an action will not have a significant effect on the human environment which includes the natural and physical environment and the relationship of people with that environment.

If the agency "finds" that the action has "no significant impact", the agency is not required to prepare an Environmental Impact Statement (EIS) for the project. 40 CFR 1508.27 defines the factors to consider in determining whether a project is anticipated to "significantly" impact the human environment. The following FONSI documents the BLM's evaluation of the potential impacts of the ThunderKat Timber Management Project.

Based up my review of the ThunderKat EA and supporting documents, I have determined that neither action alternative (Proposed Action; Alternative A) are a major federal action and would not significantly affect the quality of the human environment, individually or cumulatively with other actions in the general area. No environmental effects meet the definition of significance in context or intensity as defined in 40 CFR 1508.27. Therefore, supplemental or additional information to the analysis in the RMP/FEIS in the form of an environmental impact statement (EIS) is not needed. This finding is based on the following discussion:

CONTEXT [40 CFR 1508.27(a)] refers to the suitable scale for analysis. Potential effects resulting from the implementation of either action alternatives (Proposed Action; Alternative A), have been analyzed within the context of the project area boundaries, and the following watersheds: Thomas Creek, Middle Thomas Creek. The project area would affect less than 0.5 percent of the Thomas Creek Watershed and 2 percent of the Middle Thomas Creek Watershed.

INTENSITY [40 CFR 1508.27(b)] refers to severity of impact. The following ten sections refer to the specific conditions/concerns addressed in §1508.27 and document the BLM's consideration of the intensity (severity) of the impacts as assessed in the ThunderKat EA.

PROJECT DESIGN (EA section 2.5): An interdisciplinary team of resource specialists (IDT) developed the proposed treatments described in EA section 2.3.1 (Proposed Action, including the project design features described in section 2.5; Table 2-6) and EA section 2.3.2 (Alternative A, including project design features described in section 2.5; Table 2-6) to conform to the RMP Management Direction and be within the effects analyzed in the RMP/FEIS. Refer to EA section 2.4; Table 2-5, for a comparison of the action alternatives (Proposed Action; Alternative A).

VEGETATION AND FOREST STAND CHARACTERISTICS (EA section 3.1): Effects to these resources would not have significant impacts because:

- The stands proposed for the action alternatives are not presently functioning as late-successional old growth habitat.
- Existing snags, remnant older trees and coarse woody debris (CWD) would be retained to the greatest extent possible. The snags that are felled for operational or safety purposes would be reserved on site as CWD.
- There would be no identifiable effects on the T/E species or habitat within the project area because there are no known populations or habitat in the project area.
- There would be no identifiable adverse impacts to suitable Special Status Species (SSS) or Survey & Manage Species (SMS) because there are no known populations in the project area.
- Noxious Weeds – Increases in the number of invasive/non-native plants are expected to be short lived because all areas with ground disturbing activities will be re-vegetated with native species (EA section 2.3.1; Table 2-6 Project Design Features (Numbers 52, 53)); and native species would naturally re-vegetate the disturbed areas and shade out invasive species. (EA section 3.1.2.1).

HYDROLOGY; FISHERIES AND AQUATIC HABITAT (EA section 3.2; 3.3): Effects to this resource are not significant because:

- No timber harvests will occur within riparian areas and/or stream protection zones.
- Timber haul and road maintenance project design features (PDFs) (EA Table 2-6) would prevent sedimentation delivery to streams in quantities that would exceed Oregon Department of Environmental Quality (DEQ) requirements.
- There would be no peak flow effects to listed fish habitat due to maintaining canopy closures equal to or greater than 30 percent in the Criminal Creek watershed and due to the relatively small amount of openings <30 percent canopy closure in the Bear Creek watershed (EA section 3.3.2.1 Peak Flows effect).
- Action alternatives would abide by and meet State of Oregon water quality standards.
- The Proposed Action would maintain a minimum of 15 to 17 trees per acre (TPA) to maintain canopy closure above 30 percent within the Criminal Creek watershed for the purpose of minimizing potential impacts to peak flows during rain on snow events (EA section 3.2.2.1). In addition this level of retention will satisfy RMP objectives for green tree retention, future snag recruitment, and coarse woody debris (EA section 3.5.2.1).

- The Proposed Action would maintain a minimum of 15 TPA within the Bear Creek watershed to meet the RMP objectives for green tree retention, future snag recruitment, and coarse woody debris retention (EA section 3.5.2.1). The risks to peak flows in this watershed are low because this area has adequate canopy cover within the watershed to minimize this risk (EA section 3.2.2.1).

SOIL (EA section 3.4): Effects to this resource are not significant because:

- Soil compaction is limited to no more than 12 percent of the project's acreage. Additionally a large portion of pre-disturbance conditions would likely recover within one to several decades following disturbance (EA section 3.4.2.1).
- The action alternatives would not lead to any measureable increase in surface erosion, and soil erosion would remain within the range of background rates (EA section 3.4.2.1).

WILDLIFE (EA section 3.5): Effects to this resource are not significant because:

The action alternatives (and No Action Alterative) would have trade-offs in effects in both the short and long term which would be beneficial to some species and detrimental to other species. The variation within the action alternatives and maintaining untreated forest stands adjacent to all treated stands would provide a range of habitat conditions to balance the trade-offs of effects.

- Stands proposed for both action alternatives are not presently functioning as late-successional or old growth habitat and no remnant trees (greater than 35 inches dbh) would be cut and removed.
- The Proposed Action would retain existing snags and CWD on site. Up to 90 percent of existing snags could be lost during falling, yarding and site preparation. All snags felled or knocked over for safe and efficient logging would be retained as dead/down wood and CWD. The additional green trees over and above the six to eight required (RMP p. 21) would be left to compensate for snag and CWD deficit conditions and loss of up to 90 percent of snags in the proposed action and peak flow cumulative effects (EA section 3.2.2.1).
- Alternative A would retain existing snags and coarse woody debris (CWD) on site. Less than 10 percent of the existing large (≥15 inches and ≥15 feet tall) snags that would be felled for safety or knocked over by logging operations. All snags felled or knocked over for safe and efficient logging operation would be retained as dead/down wood and CWD. Fewer than 12 percent of CWD would be impacted by logging, based on 12 percent of the unit area being directly impacted (landings, skid trails, skyline corridors). All existing CWD would remain on site (EA section 3.5.2.2).
- No suitable habitat for the BLM Special Status Species (SSS) that are known or likely to be present would be lost. Therefore, the project would not contribute to the need to list any of the BLM Special Status Species (EA section 3.5.2.1).
- Habitat for species such as the pileated woodpecker, which use snags in late successional habitat, would be adversely impacted. Conversely, habitat would improve for species such as the western bluebird that utilized snags in more open environments. No species would be extirpated in the project area as a result of either action alternative.
- The amount of dispersal and suitable spotted owl habitat within the provincial home range of known spotted owls would not be changed as a result of implementing either action alternative.

AIR QUALITY, FIRE RISK, AND FUELS MANAGEMENT (EA section 3.6): Effects to this resource are not significant because:

- Air quality are predicted to be localized and of short duration for both action alternatives (Proposed Action; Alternative A). Both action alternatives will comply with the Clean Air Act and the State of Oregon Air Quality Standards and neither will produce significant impacts.
- No significant impacts to fuels accumulation or fire risk effects will occur from either action alternative.

CARBON STORAGE, CARBON EMISSIONS AND CLIMATE CHANGE (EA section 1.7.5):

- No significant impact to carbon emissions and climate change will occur from either action alternative. The carbon emissions (as opposed to carbon storage) attributable to the projects, both individually and cumulatively, and the difference in calculated total carbon storage are of such small magnitude that they are unlikely to be detectable at any scale (global, continental or regional) and thus would not affect the results of any models now being used to predict climate change.

RECREATION, RURAL INTERFACE, AND VISUAL RESOURCES (EA section 3.7): Effects to these resources are not significant because:

- Recreational access to the public is effectively prohibited in the project area being landlocked by private landowners. Therefore, the action alternatives would have no effect on recreational opportunities in the general area (EA section 3.7.2).
- No portion of the project area is visible from roads that are not gated, based on visual analysis. Evidence of harvest activities would not be observable within five years as understory vegetation returns to a more normal appearance and the remaining stand continues to mature (EA section 3.7.2).
- Implementing the action alternatives will have no effect on existing wilderness, wilderness study areas, or Lands with Wilderness Characteristics as there are none in or near the project area (EA section 3.7.2).

[40 CFR 1508.27(b) (2)] - The degree to which the proposed action affects public health or safety: The proposed project would not adversely affect public health or safety because the public does not have vehicular access to the project area during project operations and the project would not create hazards lasting beyond project operations (EA section 3.7).

[40 CFR 1508.27(b) (3)] - Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas: The proposed project would not significantly affect historical or cultural resources because there are no known cultural resources that require protection within the project area including harvest units. Any cultural resources discovered in the future would be protected as determined by the BLM Archaeologist. The project would not affect parklands, prime farmlands, wild and scenic rivers, wilderness, or ecologically critical areas because these resources are not located within the project area (EA Section 1.7.5, 3.7, 3.8, 5.1).

[40 CFR 1508.27(b) (4)] - The degree to which the effects on the quality of the human environment are likely to be highly controversial: The proposed project is not unique or unusual. The BLM has experience implementing similar actions in similar areas without highly controversial effects over the course of many decades of managing timber resources.

[40 CFR 1508.27(b) (5)] - The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks: The BLM has experience implementing similar actions in similar locations and has designed the project, including project design features, to avoid highly uncertain, unique and unknown risks (EA section 2.0). See # 4, above.

[40 CFR 1508.27(b) (6)] - The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration: The proposed action would not establish a precedent for future actions nor would it represent a decision in principle about a further consideration for the following reasons: 1. The project is in the scope of proposed activities and resource objectives documented in the RMP EIS and RMP; and 2. the BLM has experience implementing similar actions in similar areas without setting a precedent for future actions or representing a decision about a future consideration.

[40 CFR 1508.27(b) (7)] - Whether the action is related to other actions with individually insignificant but cumulatively significant impacts: The activities proposed for implementation are prescribed in the RMP for implementation under the conditions found in the project area. Any other proposed projects and connected actions will need to be consistent with the provisions of the RMP and any cumulative effects disclosed. All other analyses determined that there would be little to no indirect or direct effects; therefore, there would be no cumulative effects.

[40 CFR 1508.27(b) (8)] - The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources: The project would not affect these resources because cultural resource inventories of the affected area have occurred and no resources were found (EA section 1.7.5 #3).

[40 CFR 1508.27(b) (9)] - The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973: ESA Consultation is described in EA section 5.1. The proposed project is not expected to adversely affect ESA listed species or critical habitat for the following reasons:

- *ESA Wildlife - Northern spotted owl (EA Section 3.5): Wildlife:* Effects to this resource are not significant because the ThunderKat project proposal was submitted for formal consultation with U.S. Fish and Wildlife Service (USFWS) as provided in Section 7 of the Endangered Species Act (ESA) of 1973 (16U.S.C. 1536 (a)(2) and (a)(4) as amended) during the FY 2015 consultation process.
  The Biological Assessment of Likely to Adversely Affect Projects with the Potential to Modify the Habitat of Northern Spotted Owls, Willamette Planning Province – FY2015 (BA) was submitted in July 2014. Using effect determination guidelines, the BA concluded that the ThunderKat proposal may affect and is likely to adversely affect the northern spotted owl due to modification of suitable habitat (BA pp. 31, 33) but would have no effect on spotted owl Critical Habitat.

The Biological Opinion (BO) Regarding the Effects of Habitat Modification Activities on the Northern Spotted Owl and its Critical Habitat within the Willamette Province, FY2015 associated with the ThunderKat Project was issued in October 2014 (FWS reference #01EOFW00-2014-F-0221). The BO concurred that the habitat modification activities described in the BA, including the ThunderKat Project, are not likely to jeopardize the continued existence of the spotted owl and are not likely to adversely modify spotted owl critical habitat (BO p. 132).

Furthermore, the proposed action is not likely to diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat on federal lands within its range (BO p. 132).

The timber harvests and connected actions described in this EA have incorporated the applicable General Standards that were described in the BA (pp. 9-10) and BO (BO, pp. 22-24); and comply with all reasonable and prudent measures outlined in the BO (BO, pp. 134-135). This includes delaying proposed activities to avoid disrupting owls at known owl sites until after the critical nesting season, and monitoring/reporting on the implementation of this project to the U.S. Fish and Wildlife Service.

- *ESA Fish – UWR Chinook salmon and UWR steelhead trout. (EA Section 3.3)* Effects to these species will not be significant. Consultation with the National Marine Fisheries Service (NMFS) on the effects of the ThunderKat timber harvest project on Upper Willamette River (UWR) Chinook salmon and UWR winter steelhead trout is not required because the project would have no effect on these species or on essential fish habitat. The harvest units are greater than or equal to 2.2 miles from listed fish habitat (LFH) in Thomas Creek, and streams in the harvest units would have no-disturbance buffer widths of 200 feet.

[40 CFR 1508.27(b) (10)] - Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment: The proposed thinning activities have been designed to follow Federal, State, and local laws (EA sections 1.3, 1.6, 3.8).

John Huston, Cascades Resource Area Field Manager – Unsigned, for Review and Comment.

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1.0 INTRODUCTION

This Environmental Assessment (EA) analyzes the effects on the human environment of a proposed timber management and harvest project with two action alternatives and connected actions. The EA provides the decision-maker, the Cascades Resource Area Field Manager, with current information to aid in the decision-making process. Chapter 1 of this EA provides context for what we will analyze in the EA. It briefly describes the kind of actions we are considering; defines the project area; describes the need for the action and what the proposed action and alternative(s) need to accomplish (purposes/objectives) to meet the need for action; identifies the criteria that we will use for choosing the alternative that will best meet the need for and purpose of the proposed project; and describes the statutes and other authorities which govern the proposed project.

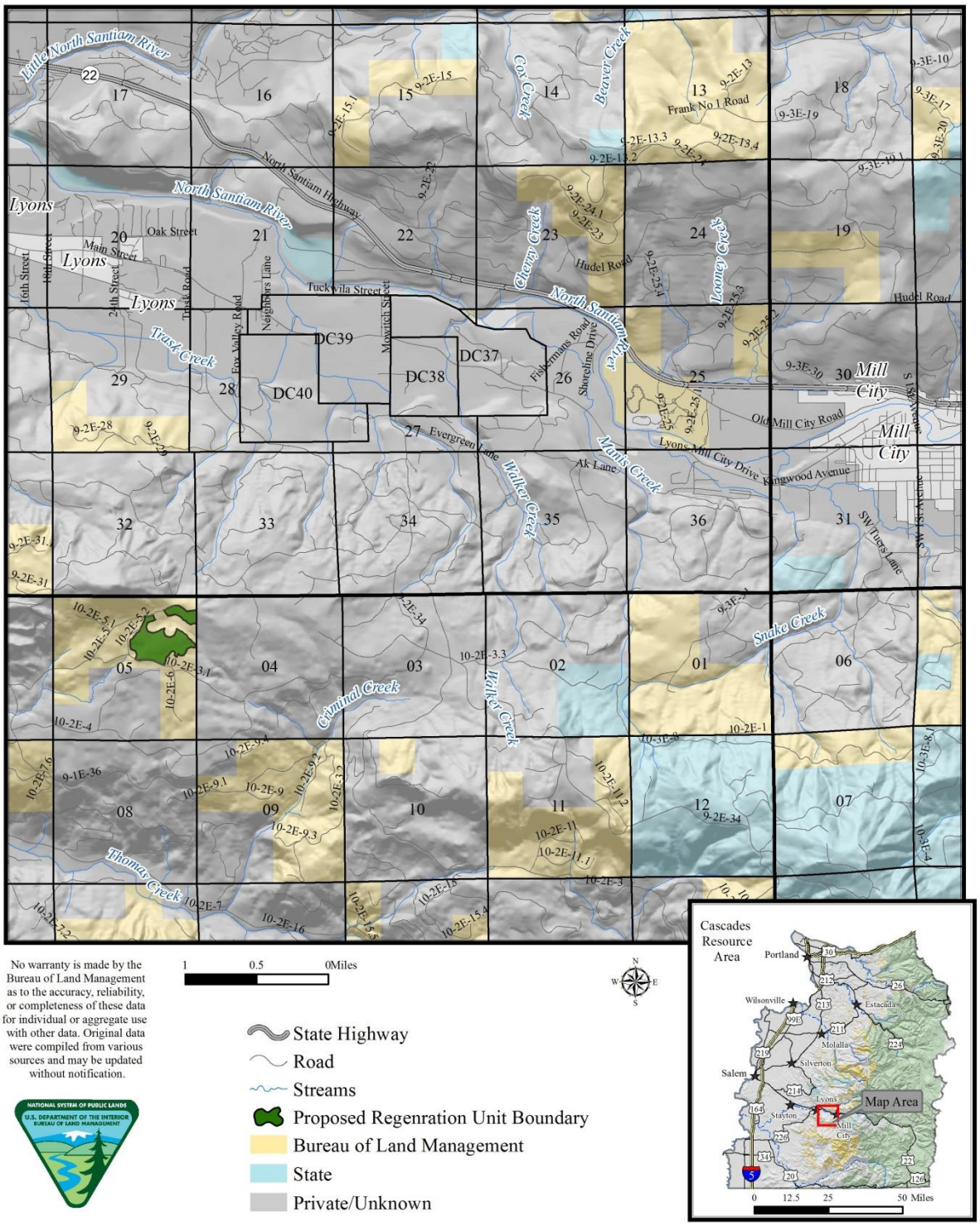
1.1 PROJECT COVERED IN THIS EA

One project will be covered in this EA: the ThunderKat Timber Management Project. This project proposes to perform regeneration harvest on 58 acres of 93 year old forest stands within the Matrix (General Forest Management Area) land use allocation. In this EA, the Bureau of Land Management (BLM) will analyze the No Action alternative, the Proposed Action (regeneration harvest), and Alternative A (commercial thinning). Alternatives and associated connected actions are described in full in Chapter 2 of this EA.

1.2 PROJECT AREA LOCATION AND VICINITY

The ThunderKat Timber Management project is located in Middle Thomas Creek sixth field watershed, Linn County, Oregon. It is located within section 5 of Township 10 South, Range 2 East, approximately three miles south of Lyons, Oregon. The project would occur on approximately 58 acres of the 440 acres that the BLM manages in the section. Figure 1-1 on the following page shows the relation of the project area to neighboring communities and other BLM-managed lands.

Figure 1-1. ThunderKat Timber Management Project Location Map



1.3 PURPOSE AND NEED FOR ACTION

The BLM purpose in this proposal is to manage timber resources consistent with the applicable laws, rules, and regulations (EA section 1.6).

1.3.1 Need for the Action

1.3.1.1 General Need for a Timber Sale

The BLM's policy for management of the National System of Public Lands has been established through legislation, regulations, executive orders or other Presidential, Secretarial or Director approved documents. Laws relevant to the management of these lands include the Federal Land Policy and Management Act (FLPMA), and the Revested Oregon and California Railroad and Reconveyed Coos Bay Wagon Road Grant Lands Situated in the State of Oregon" (O&C Act). Other applicable statues include the Endangered Species Act, and the Clean Water Act.

The BLM's regulations, found at 43 CFR, provide in part that in order to maximize resource values for the public through a rational, consistently applied set of regulations and procedures which promote the concept of multiple use management and ensure participation by the public, Resource Management Plans are to be prepared. The relevant Resource Management Plan in this case is the Salem District Record of Decision and Resource Management Plan dated May, 1995 (RMP).

The RMP provides a detailed framework of what resource management activities are to occur and where they may be conducted for the Salem District. The RMP lists Objectives and Management Actions/Direction for each Land Use Allocation (LUA) within the district. In addition, the RMP details Objectives and Management Actions/Direction for the various Resource Programs the BLM manages within the Salem District. This RMP direction was used to develop the ThunderKat Timber Management Project objectives detailed below.

The BLM has analyzed forest inventory data and conducted field examinations to identify specific forest stands in the project vicinity that need treatments, including timber harvests, to meet the objectives defined in the RMP. Many stands were reviewed while the proposed action was being developed, and this proposal reflects the site-specific needs of the area.

1.3.1.2 Site-Specific Needs for Action

The BLM Resource specialists have identified specific forest stands in the ThunderKat project area that meet criteria in the RMP for management action/direction. These stands are stocked densely enough with conifer trees to benefit from thinning and reduce tree density and allow the remaining trees sufficient water, nutrients and space for growth to meet RMP objectives for Matrix lands (EA 1.3.2). These stands have also met the criteria for proposing regeneration harvest as outlined in the RMP (RMP p. 48). This specific management direction for the General Forest Management Area within the Matrix LUA includes scheduling regeneration harvest in stands that have reached culmination of mean annual increment (CMAI) (RMP. 48). The ThunderKat proposed action is consistent with this direction (see EA section 3.1.1).

BLM resource specialists on the Interdisciplinary Team (IDT), which developed this project proposal, examined these stands in the field and analyzed data from stand exams using a growth and yield tables (ORGANON). Using professional judgment and data from modeling, the IDT analyzed expected stand growth rates, timber products yield, species composition, and elements of stand structure to compare stand development with and without treatment. Stands determined to meet criteria for treatment to meet RMP objectives for the Matrix LUA are analyzed in this EA and compared to expected results if no treatment were done.

1.3.2 Project Objectives

The area proposed for harvest falls entirely within the Matrix LUA as detailed in the 1995 RMP (p. 8) and Northwest Forest Plan (NWFP) (pp. A-4, A-5). The 1995 RMP describes management direction for the Matrix (pp. 21-22). The Matrix consists of 107,300 acres within the 398,100 acres administered by the Salem District.

Project objectives were determined by reviewing the land use and resource programs objectives in the 1995 RMP for Matrix (RMP p.20) and for the Timber Resources Objectives (RMP p.46). Individual objectives were reviewed for appropriateness to the scale of the project, their consistency with the purpose and need for the project and applicability to the land use allocation. This resulted in the following project objectives:

- Produce a sustainable supply of timber and other forest commodities.
- Provide early successional habitat.
- Manage developing stands on available lands to promote tree survival and growth and to achieve a balance between wood volume production, quality of wood, and timber value at harvest.
- Manage timber stands to reduce the risk of loss from fires, animals, insects, and diseases.

1.4 DECISIONS TO BE MADE

The decision maker, the Cascades Resource Area field manager, will:

- Determine at what level, where, and how to implement regeneration harvest on BLM-administered lands to meet Matrix objectives and timber resources program objectives.
- Determine at what level, where, and how to implement the connected actions.
- Determine if a Finding of No Significant Impact (FONSI) is appropriate or if an Environmental Impact Statement should be prepared.

1.5 DECISION FACTORS

In choosing the alternative that best meets the need for action and the purpose (objectives) of the action, the Cascades Resource Area field manager will consider the extent to which each alternative would:

1. Provide timber resources to support local communities and industries, and to provide revenue to the government and the O&C Counties;
2. Provide for a sustainable supply of timber and other forest products on a predictable and long term basis;
3. Contribute to a healthy forest ecosystem with habitat that will support populations of native plant and animal species;
4. Maintain and restore water quality, hydrologic processes, and aquatic/riparian habitat that will support populations of native aquatic and riparian plant and animal species;
5. Provide safe, cost-effective and environmentally sound access for logging operations, other timber management operations, fuels management, fire suppression and public use of the land.

1.6 CONFORMANCE WITH LAND USE PLAN, STATUTES, REGULATIONS, AND OTHER PLANS

The BLM has designed these projects to comply with the O&C Act, the FLPMA and other relevant statutes and authorities (EA sections 1.6.1, 3.8) and the Salem District Record of Decision and Resource Management Plan, May 1995 (RMP) and related documents, which direct and provide the legal framework for management of BLM lands within the Salem District. The ThunderKat Timber Management Project conforms to the:

1. *Salem District Record of Decision and Resource Management Plan*, May 1995 (1995 RMP) as amended.

2. *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl*, April 1994 (the Northwest Forest Plan, or NWFP).

3. *The Record of Decision for Amendments to the Survey and Manage, Protection Buffer, and Other Mitigation Measures Standards and Guidelines, dated January 2001 (SM/ROD) with subsequent Annual Species Reviews.*

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 with the exception of the red tree vole. Red tree vole in the mesic zone remains Survey and Manage Category C as defined in the SM/ROD.

The analysis in the ThunderKat EA is site-specific, supplements and tiers to decisions found in the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement*, September 1994 (RMP/FEIS). The RMP/FEIS includes the analysis from the *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, February 1993 (NWFP/FSEIS). The *Final Supplemental Environmental Impact Statement for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,* November 2000 amends the RMP/FEIS.

The IDT incorporated information from the Middle Thomas Creek Watershed Analysis, 1996 (TCWA) into the development of the proposed action, into the description of the affected environment and into the environmental effects analysis (EA section 3.0) and is hereby incorporated by reference.

1.6.1 Relevant Statutes and Authorities

This section is a summary of the relevant statutes/authorities that apply to this project.

- Archaeological Resources Protection Act (ARPA) 1979 – Protects archeological resources and sites on federally administered lands.
- Clean Air Act (CAA) 1990 – Provides the principal framework for national, state, and local efforts to protect air quality.
- Clean Water Act (CWA) 1987 – Establishes objectives to restore and maintain the chemical, physical, and biological integrity of the nation's water.
- Endangered Species Act (ESA) 1973 – Directs federal agencies to ensure their actions do not jeopardize threatened and endangered species.
- Federal Land Policy and Management Act (FLPMA) 1976 – Defines BLM's organization and provides the basic policy guidance for the BLM's management of public lands.
- Healthy Forests Initiative (HFI) 2002 – Focuses on reducing the risk of catastrophic fire by thinning dense undergrowth and brush in priority locations that are identified on a collaborative basis with selected federal, state, tribal, and local officials and communities.
- Migratory Bird Treaty Act of 1918 – Protects migratory birds (16 U.S.C. 703).
- National Environmental Policy Act 1969 – Requires the preparation of EAs or EISs on federal actions. These documents describe the environmental effects of these actions and determine whether the actions have a significant effect on the human environment.
- Oregon and California Act (O&C) 1937 – Requires the BLM to manage O&C lands for permanent forest production in accordance with sustained-yield principles. Management of O&C lands must also protect watersheds, regulate stream flow, provide for recreational facilities, and contribute to the economic stability of local communities and industries.

Additional information on how the ThunderKat Timber Management project is in compliance with relevant authorities is included in Table 3-19 of this EA. Additional details pertaining to statutes, authorities and management direction are presented in the discussions of specific resources throughout the remainder of this EA.

1.7 SCOPING

1.7.1 Internal Scoping

The Interdisciplinary Team (IDT) of the BLM's resource specialists conducted internal scoping through the project planning process, which includes record searches, on-site field examinations of the project area, professional observation and judgment, literature review and IDT discussion. In the project planning process, the IDT considered elements of the environment that are particular to this project as well as elements of the environment that are common to similar timber management projects.

1.7.2 External Scoping

The BLM conducted external scoping for this project by means of a scoping letter sent out to approximately 59 federal, state and municipal government agencies, tribal authorities, and interested parties on the Cascades Resource Area mailing list on February 24, 2014. In addition an open house meeting was conducted in Gates, Oregon March 19, 2014 to present information on the project, to respond to questions and to offer a field trip to review regeneration harvest units from earlier BLM timber sales.

1.7.3 Scoping Comments Received

The BLM received five written comments letter/e-mail during the scoping period. One of these was from an individual KS and four from organizations. The organizations are, in alphabetical order:

- AFRC – American Forest Resource Council
- BFC – Benton Forest Council
- CW – Cascadia Wildlands
- OW – Oregon Wildlands

Comments received from public scoping were analyzed by BLM personnel to make sure that the substantive issues and information presented are addressed in this EA. Comments were received concerning the following topics:

1. Vegetation, forest stands, regeneration harvest, silviculture prescriptions and special status species.
2. Hydrology, water quality, Riparian Reserve treatments, snags and CWD.
3. Fisheries, listed fish, aquatic habitat and aquatic species.
4. Soil and slope stability.
5. Wildlife, terrestrial habitat, special status species (terrestrial/avian).
6. Air quality, fuel and fire.
7. Visual resources (VRM), recreation, public safety, quality of life.
8. Economic viability, socioeconomics, timber receipts.
9. Roads and logging.
10. O & C Act, maps delineating ownership.
11. Climate change and carbon storage.

12. Miscellaneous.

1.7.4 Relevant Issues

The IDT identified relevant issues based on applicable law, management direction contained in the RMP, and information gathered during the scoping and project planning process. Issues are considered to be relevant if they determine the appropriate range of alternatives to analyze, help determine whether the proposed action should be modified, or help determine the significance of the project's effects on elements of the environment. Analysis of these issues provides a basis for comparing the environmental effects of action alternative(s) and the no action alternative. It also aids in the decision-making process.

The IDT considered the following issues as it developed and refined the project alternatives, identified project design features (PDF), and analyzed the environmental effects.

Issue 1: The effects of a regeneration harvest of a timber stand compared to thinning on vegetation and forest stand characteristics.

How would the proposed management activities change vegetation and forest stand characteristics, both short-term and long-term, and how would these changes affect attainment of objectives for the Matrix land use allocation?

How would the proposed management actions affect distribution of age classes/seral stages across the landscape, both short and long term, and how would these changes affect attainment of RMP objectives?

How would proposed management actions influence structural complexity including overstory, understory, dead wood and spatial complexity?

How proposed management actions would affect identified populations of flora (plants, bryophytes, fungi) species with special status (Threatened/Endangered, Survey and Manage, sensitive, etc.).

How proposed management actions would affect invasive/non-native species populations.

Issue 2: The effects of regeneration harvest compared to thinning harvests on wildlife habitat, including early successional and late successional habitat, snags and coarse woody debris (CWD), stream buffers, and riparian habitats including fisheries.

How would the proposed management actions affect ESA listed fish, resident fish, and aquatic habitat?

Issue 3: The effects of timber management actions on water quality, including sediment from roads and harvest activities.

How would proposed management actions affect water quality including sediment from roads,

sediment from forest management activities, sediment from landslides, sediment caused by unauthorized OHV use, and water temperature?

1.7.5 Issues Considered But Not Analyzed in Detail

1. **Economic Viability of Management Actions:** The BLM did not analyze the economic viability of the sale because the project was designed to be economically viable in order to meet the purpose and need of the project.

2. **Carbon Storage / Emissions:** The BLM did not analyze carbon storage or emissions specifically for this project because it would not provide any additional information needed for a reasoned choice among alternatives for this project. The BLM has sufficient information from analysis of four previous commercial thinning projects[1] in the Cascades Resource Area for the Decision Maker to make an informed decision between alternatives, because the ThunderKat project falls within the range covered by the projects analyzed and is expected to have similar results. These projects are appropriate for comparison because of the similarity in size, treatment type, stand conditions, and scope of treatment analyzed in this EA.

The analysis of previous projects shows that:

- The calculated total carbon storage for the No Action alternative of each project is higher than the calculated total carbon storage for all action alternatives throughout the 30 year analysis period.
- The carbon emissions (as opposed to carbon storage) attributable to the projects, both individually and cumulatively, and the difference in calculated total carbon storage are of such small magnitude that they are unlikely to be detectable at any scale (global, continental or regional) and thus would not affect the results of any models now being used to predict climate change.

3. **Cultural Resources:** Cultural Resource inventories were conducted in 2015 for the ThunderKat project. No cultural resources were discovered during these inventories; therefore, there are no effects to be analyzed. Should any evidence of prehistoric or historic structures or items be discovered, work would stop immediately and the discovery would be reviewed by the Salem District Culture Resources Staff.

2.0 ALTERNATIVES

2.1 ALTERNATIVE DEVELOPMENT

Pursuant to Section 102 (2) (E) of the National Environmental Policy Act (NEPA) of 1969, as amended, federal agencies shall "…study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

[1] Airstrip, Gordon Creek, Highland Fling and Power Mill Projects.

The BLM has identified three alternatives to analyze in this EA. In addition to the no action alternative, the BLM has identified two action alternatives.

2.2 PLANNING AND IMPLEMENTATION PROCESS

2.2.1 Planning Process

The BLM planned this project using an Interdisciplinary Team (IDT) process. An IDT composed of experienced professional resource specialists developed and analyzed the range of alternatives, connected actions, and project design features. The IDT requested comments from the public and other interested parties and agencies during this process through "scoping" (EA section 1.7) and considered these comments when developing and analyzing the alternatives (EA section 2.1). The IDT analyzed the alternatives in specialist reports which are incorporated into this EA by reference. The IDT leader developed this EA from those reports. The IDT has reviewed this EA and now invites the public to review and comment on the project alternatives and information presented in this EA.

The IDT and the Decision Maker will evaluate and incorporate information from this process into the final project design (or selection of the No Action alternative) which will be described in the Decision Record, to be published later. The action alternative, including the project design features (PDF), form the best management practices (BMP), developed on a site-specific basis for the project analyzed in this EA (RMP Appendix C, RMP/FEIS Appendix G).

2.2.2 Implementation Process

The IDT compiled a set of PDFs that would guide implementation of the project. The actions analyzed in EA section 3.0, and the PDFs described in EA section 2.5, taken together, form the best management practices (BMP) for the ThunderKat project. These actions are based on the site-specific application of the principles outlined in Chapter 2 of this document, and the 1995 RMP including appendices C, D, G, and K.

The BLM would implement the selected actions and PDFs analyzed in this EA through project layout (physical delineation of treatment boundaries and road locations) and timber sale contract provisions. The timber sale contract would be written and administered by the BLM and requires the timber sale operator to accomplish the requirements of the contract in a manner that is consistent with the actions and PDFs analyzed in this EA and approved in any subsequent Decision Record.

The BLM developed a basic logging systems plan designed to comply with the 1995 RMP and be technically and economically feasible, environmentally sound, use equipment and logging systems known to be commonly available in the area, and comply with the BLM timber sale contract provisions and administration. There are many combinations of specific equipment and operating methods and the final logging plan implemented may be different than the plan analyzed in this EA.

Where there are recognized options, such as an area which may be logged with either ground-based or skyline systems, the EA analyzes the logging system with the highest potential impact

to the environment. The BLM would evaluate other logging systems, subsystems and methods which may be proposed by operators to ensure that the specific impacts and effects are within the scope of the impacts and effects analyzed in this EA. When the BLM determines that the impacts and effects are within the scope analyzed, the BLM could approve the proposed logging plan.

Examples of this principle include:

- Skyline yarding generally has less impact than ground based yarding, so skyline yarding an area analyzed for ground based logging could generally be approved.
- Not building a road generally has less impact than building one, so a logging plan that avoids building a road could generally be approved.
- A rocked road surface is generally more stable than a natural surface road, so rocking a road could generally be approved.
- Hand falling generally has less impact than mechanized falling with a processor, so hand falling could generally be approved.
- Fewer, but larger, landings than analyzed, or more but smaller landings than analyzed could likely impact no more area than was analyzed for landings and could generally be approved.

2.3 ALTERNATIVES

2.3.1 The Proposed Action

The BLM proposes to perform regeneration harvest on approximately 58 acres of culminated 93 year old forest stands within a portion of the General Forest Management Area of the Matrix land use allocation. A culminated stand is a forest stand that is at or above the age which produces maximum average annual growth over the lifetime of the stand. The project spans two seventh field watersheds: approximately 48 acres in Bear Creek and 10 acres in Criminal Creek (EA section 7.0).

The Proposed Action would maintain a minimum of 15 to 17 trees per acre (TPA) to maintain canopy closure above 30 percent within the Criminal Creek watershed for the purpose of minimizing potential impacts to peak flows during rain on snow events. In addition this level of retention will satisfy RMP objectives for green tree retention, future snag recruitment, and coarse woody debris. The Proposed Action would maintain a minimum of 15 TPA within the Bear Creek watershed to meet the RMP objectives for green tree retention, future snag recruitment and coarse woody debris retention. The risks to peak flows in this watershed are low because this area has adequate canopy cover within the watershed to minimize this risk.

Table 2-1. Acreage Distribution

Stand Age (Years)	Unit Number	Acres in the Matrix Land Use Allocation
93	5A	48
93	5B	10

Proposed Action (Regeneration Harvest) Silvicultural Prescription

- Tree marking would be based on Marking Guidelines found in the Silvicultural prescription. The Marking Guidelines do not apply to rights-of-way,
- Leave an average of 15 (up to 17) trees per acre. Favor retention of dominant or co-dominant trees larger than the average stand diameter.
- Retain all snags and coarse woody debris to the extent practicable.[2]
- Reserve bigleaf maple greater than 24 inches diameter at breast height[3] (dbh) and examples of uncommon tree species, including some cull and deformed trees.
- Three of the retained (leave) TPA may be hardwoods 24 inches in diameter or larger.
- Cut all remaining hardwoods.
- Favor Douglas-fir or grand fir for retention. Retain western hemlock where no Douglas-fir and grand fir are available.
- Retain trees 35 inches dbh and larger.
- All retained trees should be 20 inches dbh or larger.
- Distribute leave trees in both a scattered and clumped patterns.
- Do not retain Douglas-fir within 50 feet of *Phellinus weirii* pockets.
- Create up to two snags per acre (greater than 20 inches dbh) by base girdling or topping to increase snag and CWD presence.
- Cut one tree per acre (greater than 20 inches dbh) as needed to meet CWD requirements.

Connected Actions

Road Work:

Proposed road renovation is shown in Table 2-2.

Table 2-2. Road Renovation

Road (miles)				
Segment	**Blade Surface**	**Roadside Brushing**	**Ditch Cleaning**	**Spot Rocking**
9-1E-36	1.75	Yes	Yes	Yes
10-2E-06	1.28	Yes	Yes	Yes
10-2E-05	0.74	Yes	Yes	Yes
10-2E-05.2	0.35	Yes	Yes	Yes
Totals	4.12			

Road Construction

Two segments of road (totaling 0.40 mile) would be constructed within the project area to facilitate timber harvest, log transport out of the area, and fuel reduction actions. Construction involves clearing vegetation within the road right-of-way using road building heavy equipment.

[2] The BLM would retain snags and coarse woody debris the greatest extent possible. Refer to the wildlife report (section 3.5 of this EA) for further details.

[3] DBH: diameter breast height. Tree diameters are measured 4.5 feet above ground level on the uphill side of the tree.

Clearing would average approximately 30 feet wide and would avoid special wildlife habitats, unstable ground, and wet areas. No road construction would occur within the Riparian Reserves.

These road segments would be natural surface with an option to rock the road. Rocking the road surface would allow extended hauling operations into the wet season (Table 2-6). Roads that are rocked would be blocked to vehicle travel and left in place for future use after the completion of project operations. Naturally surfaced roads would be decommissioned following completion of project operations. Decommissioning of natural surface roads seeks to improve and restore hydrologic function and consists of the following actions:

- Tilling the running surface then seeding with native grasses and covering the roadbed with logging slash or approved sterile straw mulch to establish effective ground cover prior to the wet season;
- Reestablishing natural drainage patterns by using water bars or other drainage features to prevent water erosion of exposed soil;
- Blocking vehicle access, typically with earth/debris barricades.

Road Maintenance
The BLM and private landowners would perform routine maintenance on existing roads along the timber haul route.

Fuels treatments
Table 2–3 describes the fuel reduction treatments proposed for each unit. The preferred method of fuels treatment with a regeneration harvest is broadcast burning. This should occur under conditions that would consume the smaller surface fuels and minimize effects on the duff layer and coarse woody debris. In the event that broadcast burning is not possible then the area would be machine piled and burned.

Post-harvest fuels hazard surveys would be conducted and site-specific treatments would be recommended. The proposed fuel treatment strategies would be implemented in the harvest areas to prepare the site for replanting by reducing fine fuels and competing vegetation. Additionally, fuels treatments would reduce the hazards associated with natural or human-caused wildfire ignition by reducing both the intensity and severity of potential wildfire starts on or adjacent to the treatment units and reducing the potential for wildfire to cross property lines between the BLM and private lands.

Table 2-3. Proposed Action Fuels Treatments

EA Unit	Proposed Treatments
5A	Preferred Fuels Treatment: Construct approximately 7,400 feet of containment line and broadcast burn approximately 48 acres for silvicultural site preparation and fuels management purposes. Alternative Fuels Treatment: Mechanical pile, cover and burn approximately 48 acres. Burn all landing piles.
5B	Preferred Fuels Treatment: Construct approximately 2,400 feet of containment line and broadcast burn approximately 10 acres for silvicultural site preparation and fuels management purposes. Alternative Fuels Treatment: Mechanical pile, cover and burn approximately 10 acres. Burn all landing piles.

All prescribed burning would require a project level prescribed fire burn plan that would adhere to smoke management and air quality standards, meet the objectives for project, and maintain or restore ecosystem processes or structure. The burn plan would comply with the NWOR Fire Management Plan for the Eugene District BLM, Salem District BLM, Siuslaw National Forest, and the Willamette National Forest dated May 20, 2009. All burning would be coordinated with the local Oregon Department of Forestry, and would be conducted in accordance with the Oregon State Implementation Plan, the Oregon Smoke Management Plan and the Clean Air Act. These plans limit or prohibit burning during periods of stable atmospheric conditions (inversion conditions).

Reforestation
Reforestation of the harvest area would occur following completion of harvest activities. The following activities would occur:

- Plant with a mix of 75 percent Douglas-fir and 25 percent western red cedar. Plant at a rate of approximately 300 TPA.
- Plant *Phellinus weirii* infected areas with western red cedar.
- Protect all western red cedar from big game browsing damage.
- After planting *Phellinus weirii* pockets with western red cedar, plant the remaining western red cedar throughout the unit.
- Stocking maintenance, protection, and release treatments as needed to ensure stand establishment.

Landings
The BLM would require the timber sale operator to construct landings according to the approved logging plan.

Preventing Unauthorized Off-Highway Motor Vehicle (OHV) Use (RMP p. 41)
During operations, the timber sale purchaser would prevent unauthorized access, including OHV, during operations as part of their normal security measures. The BLM requires that the operator place physical barriers to block OHV access on roads and skid trails at the end of project

operations (EA section 2.5).

Special Forest Products (SFP) (RMP p. 49)
The BLM would make permits available to the public for collecting Special Forest Products such as firewood, mushrooms, ferns, etc. where collection does not interfere with the proposed project objectives or have effects beyond those analyzed in this EA and the 1995 RMP.

2.3.2 Alternative A

This alternative would commercially thin the same 58 acres as in the Proposed Action. Commercial thinning would remove approximately 125 TPA leaving 36 TPA, a Curtis Relative Density of 30 and approximately 52 percent crown closure. Ground-based yarding would occur in all harvest areas.

Alternative A (Commercial Thinning) Silvicultural Prescription

- Leave an average of 36 TPA. Favor retention of dominate or co-dominate trees larger than the average stand diameter.
- Retain all snags and coarse woody debris to the extent practicable.[4]
- Reserve big leaf maple greater than 24 inches dbh and examples of uncommon tree species, including some cull and deformed trees.
- Cut all remaining hardwoods.
- Favor Douglas-fir or grand fir for retention. Retain western hemlock when there are no Douglas-fir and grand fir available.
- Retain trees 35 inches dbh and larger.
- Distribute leave trees evenly.
- Create up to two snags per acre (greater than 20 inches dbh) by base girdling or topping to increase snag and CWD presence.
- Implement up to four low retention areas (up to one acre in size), leaving 10 to 12 trees per acre. Pile and burn logging slash and plant western red cedar and native shrubs.

Connected Actions

Road Work
Road management connected actions under Alternative A would be the same as detailed in the Proposed Action.

Fuels Treatments
Fuels hazard surveys would be conducted and site-specific treatments would be recommended. Fuels treatments would be limited to areas of the proposed treatment units along roads or adjacent to private property. These specific areas would be mechanically piled, covered and burned.

[4] The BLM would retain snags and coarse woody debris the greatest extent possible. See section 3.5 (wildlife) of this EA for more information.

Table 2-4. Alternative A Fuels Management Actions

EA Unit	Proposed Treatments
5A	Pile, cover and burn or pull back slash approximately 50 feet off roads and private property boundaries. Treat approximately 4 acres.
5B	Pile, cover and burn or pull back slash approximately 50 feet off roads and private property boundaries. Treat approximately 1.5 acres.

Reforestation
Reforestation activities would be limited to planning western red-cedar in the four one acre low retention areas. No other reforestation or planting activities would occur.

Landings:
The BLM would require the timber sale operator to construct landings according to the approved logging plan and would require the operator to place landings outside hydrologic features.

Preventing Unauthorized Off-Highway Motor Vehicle (OHV) Use (RMP p. 41)
During operations, the timber sale purchaser would prevent unauthorized access, including OHV, during operations as part of their normal security measures. The BLM requires that the operator place physical barriers to block OHV access on roads and skid trails at the end of operations (EA section 2.5).

Special Forest Products (SFP)
Each of these provisions would be the same as described for the proposed action.

2.3.3 No Action Alternative

The No Action alternative means that no timber management actions, fuel reduction treatments, or connected action activities would occur. Only normal administrative activities and other uses (e.g. road use, programmed road maintenance, harvest of special forest products on public land) would continue within the project area. On private lands adjacent to the project area, forest management and related activities would continue to occur on a rotational basis.

Selection of the No Action alternative would not constitute a decision to change the Land Use Allocations of these lands. Selection of the No Action alternative would not set a precedent for consideration of future action proposals.

2.4 COMPARISON OF THE ACTION ALTERNATIVES

Table 2-5 Timber Harvest Actions

Logging Systems	
Proposed Action	**Alternative A**
Ground-based logging Skyline logging	Ground-based logging Skyline logging
Silvicultural Prescriptions	
Proposed Action	**Alternative A**
• Leave an average of 15 (up to 17) TPA. Favor retention of dominate or co-dominate trees larger than the average stand diameter. • Retain all snags and coarse woody debris to the extent practicable. • Reserve bigleaf maple greater than 24 inches dbh and examples of uncommon tree species, including some cull and deformed trees. • Three of the (leave) retained trees per acre may be hardwoods 24 inches in diameter or larger. • Cut all remaining hardwoods. • Favor Douglas-fir or grand fir for retention. Retain western hemlock when there are no Douglas-fir and grand fir available. • Retain trees 35 inches dbh and larger. • All retained trees should be 20 inches dbh or larger. • Distribute leave trees in both scattered and clumped patterns. • Do not retain Douglas-fir within 50 feet of *Phellinus weirii* pockets. • Create up to two snags per acre (greater than 20 inches dbh) by base girdling or topping to increase snag and CWD presence.	• Leave an average of 36 TPA. Favor retention of dominate or co-dominate trees larger than the average stand diameter. • Retain all snags and coarse woody debris to the extent practicable. • Reserve bigleaf maple greater than 24 inches dbh and examples of uncommon tree species, including some cull and deformed trees. • Cut all remaining hardwoods. • Favor Douglas-fir or grand fir for retention. Retain western hemlock when there are no Douglas-fir and grand fir available. • Retain trees 35 inches dbh and larger. • Distribute leave trees evenly. • Create up to two snags per acre (greater than 20 inches dbh) by base girdling or topping to increase snag and CWD presence. • Implement up to four low retention areas up to one acre in size leaving 10 to 12 trees per acre. Pile and burn logging slash and plant western red cedar and native shrubs.
Connected Action	
Road Work	
Proposed Action	**Alternative A**
• Construction two new segments of road totaling approximately 0.40 miles • Renovation would occur on approximately 4.12 miles of existing roads	Same as Proposed Action.
Fuels Management	
Proposed Action	**Alternative A**
• Construct approximately 9,800 feet of containment line and broadcast burn approximately 58 acres	• Pile, cover and burn or pull back slash approximately 50 feet off roads and private property boundaries. Treat approximately 5.5

• Mechanical pile and burn approximately 58 acres if broadcast burn is not possible.	acres.
Reforestation	
Proposed Action	**Alternative A**
• Identify and map areas of *Phellinus weirii* infection. • Prescribe burn for site preparation. • Plant with a mix of 75 percent Douglas-fir and 25 percent western red cedar. • Plant *Phellinus weirii* infected areas with western red cedar. • Protect all western red cedar from big game browsing damage. • After planting *Phellinus weirii* pockets with western red cedar, plant the remaining western red cedar throughout the unit. • Stocking maintenance, protection and release treatments as needed to insure stand establishment. • Pre-commercial thin (PCT) to 14 foot spacing at approximately age 12.	• No reforestation activities beyond planting western red cedar in the low retention areas.
Other Connected Actions	
Proposed Action	**Alternative A**
• Landings constructed according to the approved logging plan • Preventing Unauthorized Off-Highway Motor Vehicle Use • Special Forest Products would be authorized where no interference with the project is anticipated.	• Landings: Same as Proposed Action. • Preventing Unauthorized Off-Highway Motor Vehicle Use: Same as Proposed Action. • Special Forest Products: Same as Proposed Action.

2.5 PROJECT DESIGN FEATURES

This section summarizes the project design features that would further reduce the project's effects on the affected resources described in ThunderKat Timber Management project EA.

The IDT of resource specialists developed and refined this set of site-specific Project Design Features (PDF) to serve as the best management practices for this project. The IDT selected or created these design features to implement management actions/direction and the principles of the design features and best management practices (BMP) described in the RMP/FEIS (pp. 2-35 – 2-37, 4-11 – 4-14, G-1 – G-2, S-1 – S2) and 1995 RMP (pp. 23-24, C-1 – C-2). The IDT selected this set of PDFs based on the teams combined experience, training, professional judgment, field observation and analysis of the project area and familiarity with ongoing published research.

The BLM would incorporate these design features into the project layout, contract requirements,

and contract administration to ensure that the project is implemented as analyzed in this EA and that the effects to the resources are no greater than those described in EA Chapter 3. The BLM would require the operator to implement each of the project design features, unless otherwise stated.

The BLM timber sale contract would require the operator to submit a written operations plan which identifies the personnel doing the work; the type of equipment to be used for operations, and describes how the operator proposes to use the equipment to accomplish the work in compliance, with contract provisions and in accordance with the project design features analyzed in this EA. Once approved by the BLM, this operations plan would become an enforceable part of the timber sale contract.

Performance would be monitored by authorized BLM personnel according to the BLM's regulations and contract administration procedures where Authorized Officers inspect for contract compliance, generally at least once each week during contract operations. The Contracting Officer enforces compliance with the contract and would suspend operations if the operator fails to perform the required preventive and restorative practices analyzed in this EA. The BLM timber sale contract requires bonding in an amount sufficient for the BLM to complete mitigation and restoration work if the operator fails to perform the preventive and restorative requirements of the contract.

The following project design features would:

- Protect special status species (Vegetation), soil productivity (Soil), water quality and quantity (Water), fisheries, listed fish and aquatic habitat (Fish), stand structure, habitat and species (Wildlife), air quality (Fire/Air), public safety, rural interface and recreation (Public), cultural resources (Cultural).
- Prevent or reduce: the spread of invasive/non-native plant species populations (Invasives), fire hazards and risks (Fire/Air)
- Achieve: Desired forest stand composition (Vegetation), economic efficiency (Economic), fuel reduction (Fire/Air)

Table 2-6. Project Design Features

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
	In Unit Layout and All Logging Operations: RMP/FEIS (pp. 2-34 –2-37; 4-11 –4-13; G-1,2)										
1	Limit the area compacted (greater than 20 percent increase in soil bulk density) by logging operations to less than twelve percent of the harvest area in each unit, outside of road rights-of-way. (IDT)	♦	♦	♦	♦	♦	♦		♦		♦
2	Locate skid trails and skyline corridors to avoid concentrating runoff water flows that could cause rill or gully erosion with potential to displace soil more than a few feet.	♦	♦	♦	♦						

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
3	Lift the leading end of all logs off of the ground during yarding (one-end suspension) to prevent the blunt ends of logs from displacing soil in order to prevent creating a channel for erosion. Applies to both skidding and skyline yarding inhaul, but may not be feasible for winching and lateral yarding.	♦	♦	♦	♦						
4	Limit landing size to the minimum area needed for safe and efficient operations. Size varies with terrain, equipment size and log size and usually averages less than 60 feet by 80 feet (approximately 0.1 acre) located on and adjacent to roads.	♦	♦	♦		♦	♦	♦			♦
5	Limit the number of landings to the minimum number needed for safe and efficient operations. Number of landings needed varies with terrain, equipment, log size and road access.	♦	♦	♦		♦	♦	♦			♦
6	Allow equipment with tracked carriages designed for forestry/logging use (such as commonly used for cut-to-length (CTL) processors, piling or shovel swing) to operate between designated skid trails when the following conditions are met: -Slopes are ≤45 percent. -The operator follows a plan approved by the BLM to prevent more than light soil compaction[5] and displacement based on soil conditions at the time of operation. -Potential techniques include: single round-trip equipment travel in any place; creating a slash mat in front of the tracks prior to travel; minimal turning; dry soils; low ground pressure tracks; etc.	♦	♦	♦	♦						♦
7	Generally limit landing equipment operations to the road prism or other approved portion of the landing designed and constructed for equipment operating area. Vegetation may be cleared, logs may be stacked, cables may be attached, anchors may be placed or installed, and equipment pads (i.e. yarder, processor) may be constructed outside of the equipment operation area when approved by the BLM.	♦	♦	♦		♦	♦	♦			♦

[5] Compaction categories for increases in bulk density compared to undisturbed soil, derived from text of Soils Report: Light less than or equal to10 percent; Moderate 10-20 percent; Heavy greater than 20 percent.

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
8	Implement erosion control measures where operations have exposed or disturbed soil to prevent rill or gully erosion that would displace soil more than a short distance (several feet). Typical measures include: shaping to modify drainage (water bars, sloping, etc.); tilling; placing logging slash and debris on exposed soil; and seeding with native species.	♦	♦	♦	♦	♦	♦				
9	Prevent unauthorized off-highway motor vehicle (OHV) use through security measures during operations and physically blocking access and/or making potential routes impassible after operations. Road and skid trail closure methods would be designed to avoid causing erosion, to avoid damaging retained trees and to allow closed roads to be opened if needed for firefighting.	♦	♦	♦	♦	♦	♦	♦	♦		
10	Directionally fall trees[6] in the harvest units so that they generally do not enter the Stream Protection Zone (SPZ) or adjacent untreated stands.	♦		♦	♦	♦					
11	When additional trees are identified for cutting to facilitate safe logging operations (hazard trees, skid trails and yarding corridors, attaching cables, etc.), the BLM would designate which trees are to be removed and sold and which trees are to be retained in place as woody debris (including CWD) according to the LUA objectives.	♦				♦					♦
	In Ground-based Logging Operations: RMP/FEIS (pp. 2-34 through 2-37; 4-11 through 4-13; G-2)										
12	Limit the area of skid trails (pathways created by dragging logs to a landing - FEIS 6-14) plus the portion of landings which are outside of road rights-of-way to ten percent of the surface area of harvest units. (1995 RMP C-2)	♦	♦	♦							
13	Limit the width of skid trails to 12 feet. (IDT, standard the BLM timber sale contract provision.)	♦	♦	♦							

[6] Directional felling means to cut trees so that they fall in a specific, desired direction to achieve objectives such as: to avoid impacts to the SPZ, roads, adjacent stands or private property; reduce fuel accumulation next to roads or property lines; and protect retained trees. Directional felling is also used to increase efficiency of operations and worker safety by orienting felled trees within a logging unit to facilitate yarding and prevent trees from rolling/sliding onto workers.

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
14	Allow skidding (dragging logs behind a skidder) and other ground based logging operations during periods of low soil moisture content (1995 RMP C-2), generally considered to be the dry season approximately June-October (IDT) (RMP/FEIS pp. 4 – 12-13).	♦	♦	♦	♦		♦				♦
15	Re-use existing skid trails whenever feasible for logging operations according to the approved logging plan.	♦	♦	♦	♦		♦				♦
16	Locate new skid trails generally on slopes not greater than 35 percent (RMP, p. C-2; RMP/FEIS, p. 2—35) to avoid gouging, soil displacement, and erosion with effects exceeding those analyzed in the RMP/FEIS.	♦	♦	♦	♦		♦				♦
17	Generally limit uphill skidding to slopes where skidders would not break traction to avoid soil displacement.[7]	♦	♦	♦	♦						♦
	In Skyline[8] and Other Cable Yarding[9] Operations: RMP/FEIS (pp. 2-34 through 2-37; 4-11 through 4-13; G-1,2)										
18	Design any skyline yarding layout so that corridors average at least 150 feet apart on at least one end of the corridors and to laterally yard logs to the skyline to limit the ground area impacted by yarding corridors.	♦	♦	♦	♦						♦
19	For lateral yarding operations fall trees to orient logs so that they cause the least soil disturbance and damage to retained trees during lateral yarding.	♦	♦	♦	♦	♦					♦
	In Other Operations: RMP/FEIS (pp. 2-34 -- 2-37; 4-8 -- 4-13; G-1,2)										
20	Hazardous fuels surveys would be conducted and site specific plans for hazard fuels reduction treatments would be implemented by the Authorized Officer following harvest operations.	♦						♦	♦		♦
21	A Prescribed Fire Burn Plan would be initiated and signed by the Authorized Officer prior to any prescribed burning activity.	♦	♦					♦	♦		♦

[7] Traction is a highly variable combination of the power required to skid logs, equipment characteristics and soil strength. The potential to break traction increases as slope steepness increases. The BLM's field experience confirms that 20 percent slope consistently provides for adequate traction when skidding uphill while steeper slopes can require additional site-specific evaluation.

[8] In skyline yarding operations, a cable is suspended above the ground (a line in the sky) which holds a carriage that uses another cable to pull logs sideways across the slope to the skyline (lateral yarding). A yarder (machinery with a tower, cables and winches) located on the landing then pulls the carriage up the skyline and pulls (yards) logs up to the landing. The leading end of the log is typically lifted off the ground while being moved (one end suspension). In some situations the entire log is lifted off the ground while being moved toward the landing (full suspension).

[9] "Other Cable Yarding" includes a variety of equipment which pulls logs to a landing or skid trail with cables, but may not use a skyline. Some common systems include a "Yoder" (**Y**arder L**o**a**der**), a "tong tosser", or simply winching to a skidder.

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
22	Burning would be conducted in accordance with the 1995 RMP, Oregon State Implementation Plan and Oregon Smoke Management Plan as administered by the Oregon Department of Forestry and would comply with the provisions of the Clean Air Act. It would be conducted under good atmospheric mixing conditions to lessen the impact on air quality in Smoke Sensitive Receptor Areas.	♦	♦				♦	♦	♦		♦
23	Prescribed burning may include broadcast burning, landing pile or machine pile burning, swamper burning, or hand pile construction and burning and may be used individually or in combination in areas where fuel loading is heavy or the fire risk is determined to be high.	♦	♦	♦	♦	♦	♦	♦			♦
24	When hand, machine, or landing piles are identified by the Authorized Officer as the specified fuels treatment the following requirements would apply: -Piles would be located as far as possible from large snags, green trees, and other reserved trees to minimize damage. -Large woody debris greater than six inches in diameter would be retained on site and not piled. -Piles would not be constructed on top of stumps or existing coarse woody debris (CWD). Piles would be covered with four mil (.004 inch thick) black polyethylene plastic. The plastic shall adequately cover the pile to ensure ignition and would be placed and anchored to help facilitate the consumption of fuels during the high moisture fall/winter burning periods. In skyline yarding areas: -Machine and landing piles would only be constructed within 25 feet of designated roads and landings. -Equipment used in the construction of machine and landing piles would remain on the roads or landings during the construction. In ground based yarding areas: -A track mounted hydraulic excavator shall be used to pile woody debris. -The excavator shall be equipped with a hydraulic thumb or a rotating controllable grapple head. The machine shall have a minimum reach of twenty-five (25) feet. -Operating techniques would be designed to prevent gouging, soil compaction and displacement, and	♦	♦	♦				♦			♦

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
	erosion. -Away from roads, the excavator shall be required to work on a slash mat in order to reduce compaction. -Machine operations would be limited on bare soils to dry conditions with less than 25 percent soil moisture content in the upper six inches of soil. (1995 RMP C-7) -Soil compaction would be limited outside of skid trails and landings to no more than two percent of the surface area of the unit – the amount of compaction analyzed for tractor-constructed fire trails. (1995 RMP C-9) -Machine piles would not be constructed within 25 feet of property lines and unit boundaries, or on slopes greater than 35 percent.										
25	Lopping and scattering of fuels would be incorporated where fuel loading is relatively heavy but not heavy enough to warrant burning.	♦						♦	♦		♦
26	Pullback of fuels would be incorporated where fuel loading is relatively light (especially along roads and property lines) but not heavy enough to warrant burning.	♦						♦	♦		
27	Oregon Occupational Safety and Health Administration and the BLM would require the operator to place signs, temporarily block roads with vehicles or moveable barricades, and/or use flaggers to ensure public safety during active logging, hauling, and fuel treatment operations.	♦						♦	♦		
	Road Use, Construction, Renovation, Maintenance, Stabilization and Closure: RMP/FEIS (pp. 2-22,68,69; 2-75,76; 4-11 -- 4-19; G-2 -- G-7)										
28	Locate, design and construct roads wherever feasible to drain surface water to adjacent slopes where it would infiltrate into the soil and groundwater; and to avoid collecting water (in ditches and on road surfaces) where it could be channeled directly to streams (Wemple et al. 1996).		♦	♦	♦						
29	Locate, design and construct roads in upland areas on stable ground with side slopes generally less than 30 percent that do not require extensive cut-and-fill construction methods, in order to avoid increasing mass failure (landslide) potential and to avoid intercepting groundwater.		♦	♦	♦						♦

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
30	Conduct all in-stream activities (e.g. culvert removal and/or installation) during the designated In-Water Work Period. If water is flowing, divert (pipe or pump) water around the work site.			♦	♦						
31	Install sediment traps and/or filters in ditches that drain to stream crossings to prevent sediment transport that would cause a visible increase in turbidity from entering streams wherever it is not feasible to drain water from roads directly onto adjacent slopes. Typical methods include: maintain vegetation in the ditch; create small settling basins; or install artificial filters such as straw bales or wattles.			♦	♦						♦
32	Haul logs on forest roads only during times and road conditions that would not generate sediment that would enter streams and cause a visible increase in stream turbidity.			♦	♦						♦
33	BLM authorized personnel would visually monitor turbidity (a visible reduction in water clarity)[10] caused by road-generated sediment entering the stream at stream crossings on the haul route to ensure ongoing compliance with Oregon Department of Environmental Quality (ODEQ) water quality standards of no visible (less than ten percent) increase in turbidity.			♦	♦						♦
34	BLM authorized personnel would check for turbidity beyond the mixing zone downstream (about 100 meters) if turbidity is visible in the stream at the crossing. If water clarity is visibly altered beyond the mixing zone, the BLM would suspend hauling and other operations immediately and implement site specific measures to reduce fine sediment runoff into the stream. Allow operations to resume when weather and road conditions, combined with measures taken to reduce sediment transport to streams are deemed sufficient to comply with State of Oregon turbidity standards.			♦	♦						♦

10 Turbidity is a measurement of water clarity and is not convertible into a volume measurement of sediment yield unless correlated to suspended sediment data. "A visible increase in turbidity" has been found in field experience to correspond closely to Oregon DEQ standards for turbidity.

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
35	If road-generated sediment transport to streams and the resulting turbidity does not comply with ODEQ water quality standards during the wet season, the BLM would not allow log hauling from this project in order to prevent adding to cumulative effects of sediment and turbidity.			♦	♦						
36	Close and stabilize natural surface roads after use to reduce changes to natural drainage patterns, prevent erosion, and prevent unauthorized use by motor vehicles (including OHV).	♦	♦	♦	♦	♦	♦	♦	♦		♦
37	To close roads, use techniques such as barricades, debris, or roughening to make these roads impassable for motor vehicles.	♦	♦	♦	♦	♦	♦	♦	♦		♦
38	To stabilize roads apply a site-specific combination of techniques such as: use water bars or other surface shaping to drain runoff water to vegetated slopes; sediment traps; surface tilling; seeding with native species; mulching, covering roadbeds with logging slash and debris; and/or other techniques to promote infiltration, to prevent erosion and sediment transport to streams that would cause a visible increase in turbidity, and to prevent increases in peak flows.	♦	♦	♦	♦	♦	♦	♦	♦		♦
39	Culverts and subgrades of closed and stabilized roads would be left intact so that the road can be renovated for future use or fire control with minimal disturbance and expense.	♦						♦	♦		♦
40	When natural surface roads would be kept intact over winter for use on this project the next year, use one or more of the following methods to prevent erosion and sediment transport to streams that would cause a visible increase in turbidity: matting, mulching, constructing water bars or other surface shaping to drain runoff water to vegetated slopes, seeding, sediment traps and blocking the entrance to prevent unauthorized motor vehicle use.		♦	♦	♦				♦		♦
41	Restrict road construction, renovation, maintenance and stabilizing operations to times, weather conditions and soil conditions when the subgrade would not be damaged by operations and no sediment laden runoff would be generated.		♦	♦	♦						♦

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
42	Seed and mulch all disturbed soil at stream crossings with native species seed approved by the BLM and sterile mulch (free of non-native seed). Place rock, logs or woody debris as necessary to stabilize disturbed soil.	♦	♦	♦	♦	♦	♦				
43	Provide appropriate traffic control and other protection measures as needed to provide for public safety. Potential measures include signs, flaggers or temporary barricades and provide for traffic to pass through within an appropriate time.								♦		♦
	Stand Structure, Wildlife Habitat, and other Vegetation: RMP/FEIS (pp. 2-17,21,22,26,32-33,37-38,59-62,80-92; 4-11 through 4-13; G-1,2; K-1--3)										
44	Retain existing snags of any size where operationally practicable and where they do not pose a safety hazard. Snags that are felled for operational or safety purposes would be reserved on site as down logs	♦				♦					♦
45	Retain and protect large remnant trees and early decay class snags. Generally protect them from logging damage. Individually designate such green trees that are found inside unit boundaries for retention.	♦				♦					♦
46	Retain existing Coarse Woody Debris meeting 1995 RMP standards of at least 20 inches diameter (large end) and 20 feet long wherever feasible and protect them from logging damage. Design skid trail location and operating techniques that require minimal movement of CWD to protect its physical integrity. (RMP p. 21)		♦			♦					♦
47	Plan road and landing locations to avoid impacts to snags larger than 15 inches diameter and taller than 15 feet whenever the BLM determines it is safe and feasible to do so.					♦			♦		♦
48	Plan road and landing locations to avoid impacts to large remnant trees and snags and other live trees larger than 35 inches dbh whenever the BLM determines it is safe and feasible to do so.	♦				♦					♦
49	As feasible, retain trees that have desirable characteristics for wildlife habitat (e.g. asymmetrical crowns with multiple or broken tops, large limbs, dead areas being used by cavity excavators, deep crevices and cavities).	♦				♦					

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
50	Avoid incidental unapproved damage[11] to more than two retained trees per acre using techniques such as: requiring extra precautions to prevent damage when falling and yarding during the spring growing season when bark is easily damaged (typically March through June); directional falling to lead with skid trail or skyline corridor alignment; lateral yarding to skylines; using selected "cut" trees as rub trees in locations where logs "turn a corner" during logging; or using protective bumpers on retained trees used as rub trees. Trees identified in the logging plan to be used to facilitate logging (e.g. lift or tail trees, intermediate supports, guyline anchors, rub trees, cribbing, etc.) may be in addition to the two per acre.	♦				♦					♦
51	Retain trees which have been girdled, topped, damaged, or felled to facilitate logging (up to two per acre each of standing and felled) in project units to provide snags and CWD, when retaining those trees is consistent with safe and efficient logging practices.	♦				♦					♦
52	Seed and mulch exposed soil using approved native plant species seed (such as Oregon certified blue wild rye (*Elymus glaucus*)) and sterile mulch, in order to stabilize the soil and prevent establishing invasive/non-native plant species on disturbed soil in the project area.	♦	♦	♦	♦	♦	♦				
53	Clean all ground-disturbing logging and road construction equipment to be free of off-site soil, plant parts and seed prior to entering the project area to prevent introducing invasive and non-native plants into the project area.	♦					♦				
55	Restrict or suspend operations, or modify project boundaries at any time if plant or animal populations that require protection are found during ongoing surveys or are found incidental to operations or other activity in the project area.	♦				♦					
	Cultural Resource Protection:										
56	Restrict or suspend ground disturbing activities immediately if prehistoric cultural resources are encountered during project implementation. Conduct a professional evaluation of the resource site and develop appropriate management practices to protect the site/cultural values.									♦	

[11] The standard for "damage" is bark damage on more than 50 percent of the tree's circumference.

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
	Regeneration Harvest Provisions:										
57	Retain an average of 15 (up to 17) green TPA (average, both aggregated and dispersed) for recruiting snags, CWD, developing a large green tree component and peak flows. Up to three per acre of these green trees may be hardwoods greater than 24 inches dbh.	♦				♦		♦			♦
58	Top or girdle up to two green conifer trees per acre to reduce windthrow potential and create cull trees per snags to meet short-term snag requirements. Would fall up to one additional tree per acre (greater than 20 inches dbh) for CWD based on post-harvest monitoring	♦				♦					♦
59	All flammable debris shall be removed from the area within a five (5) foot radius of retained green trees, and wildlife trees are marked with orange painted dots.	♦				♦		♦			♦
60	Seasonally restrict habitat modifying activities affecting migratory birds (falling and yarding) April 1–July 15, to reduce potential for unintentional take of migratory birds, their nests, eggs and nestlings.	♦				♦		♦			♦
61	For regeneration harvest, choose operating and site preparation techniques that retain organic material to the extent feasible.	♦	♦	♦	♦	♦	♦	♦			
62	Reforest regeneration harvest units by planting conifer seedlings.	♦	♦			♦	♦	♦			
	Project Design Features Applicable to Thinning Harvest										
63	In thinning units, retain organic material including duff, litter and logging slash on the forest floor in average amounts not less than are present in the stand prior to management operations to provide soil stability and nutrient cycling.	♦	♦	♦	♦	♦	♦	♦			
64	Maintain at least 90 percent of snags larger than 15 inches diameter and taller than 15 feet intact and standing during logging and site preparation activities.[12] (IDT BMP based on Wildlife Report)					♦					♦

[12] Some snags would be cut to provide for safe operations as required by Oregon Occupational Safety and Health Division (OR-OSHA, Oregon Occupational Safety and Health Standards, OAR Chapter 437, Division 7, Forest Activities).

PDF Number	Project Design Features (RMP/FEIS references for key points)	Applicable Resources									
		Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
65	Low retention areas (LRA) in Matrix would be located to provide small areas (up to approximately one acre each) of early seral habitat with approximately 10–12 trees per acre retained. Locations would be determined by the BLM based on site examinations. The LRA would generally be circular. Areas are proposed for this project would total up to one percent of the project area.	♦				♦					♦
66	Within LRAs: seed with forage species and/or plant with shrubs or tree seedlings as needed based on field surveys by the BLM resource specialists.	♦	♦			♦	♦	♦			
67	Within LRAs, pile and burn logging slash and debris as needed to provide access by big game species. Retain up to ten percent of the piles for habitat features.	♦	♦			♦		♦			

2.6 SEASONAL RESTRICTIONS

The seasonal restrictions and operating periods are summarized in Table 2–7.

Table 2-7. Summary of Seasonal Restrictions

Seasonal Restriction	Reason	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hauling on natural surface roads	Water quality and sedimentation, fish habitat	■	■	■	■	■					▒	■	■
Ground-based operations	Soil damage/erosion control	■	■	■	■	▒	▒				▒	▒	■
Road Construction / Decommissioning	Soil damage/erosion control	■	■	■	■	▒						▒	■
In-water work: stream crossings/ culvert work	Protect fish and aquatic habitat	■	■	■	■	■	▒			▒	■	■	■
Habitat modification activities	Prevent destruction of active Neotropical migratory bird nests.				■	■	■	■					
Logging operations	Fire season, ODF industrial fire precaution levels, and regulated use						▒	▒	▒	▒	▒		

Key	Operations generally allowed.	Operations restricted, modified, or allowed depending on conditions.	Operations generally restricted

2.7 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The BLM considered, but did not analyze in detail, an alternative that reserved the stands in the project area for carbon storage. The BLM did not analyze this alternative in detail for the following reasons. This Alternative:

- Does not respond to the purpose for the project (EA section 1.3);
- Is not in conformance with the 1995 RMP which sets the basic policy objectives for the management of the project area, in which Matrix lands are managed primarily for timber production; and
- Is substantially similar in design to the No Action alternative, which is analyzed in the EA.

2.8 ALTERNATIVES PROPOSED AND LATER DROPPED

The BLM described three harvest units during the public scoping period. Upon subsequent examination, the BLM found that the stand furthest to the west had not yet culminated as originally determined. The BLM elected to defer consideration for harvesting the unit within the ThunderKat Timber Management project for inclusion in a future project.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

This section of the EA describes the current condition and trend of the affected resources and the environmental effects of the alternatives on those resources. The IDT reviewed the elements of the human environment required by law, regulation, Executive Order and policy as well as the issues raised in scoping (EA section 1.7). The purpose of this section is to disclose the effects that would occur from implementing the various alternatives and to provide a description of the affected environmental in the context of each resource.

3.1 VEGETATION AND FOREST STAND CHARACTERISTICS

3.1.1 Affected Environment

Stand characteristics and history

Records indicate that the proposed units were logged in the late 1940s. The stand age indicates that they removed the overstory. Consequently, the remaining western hemlock and grand fir advanced regeneration grew into the stands present today. The stands were commercially thinned in 1967. Trees removed in both commercial entries, were predominantly Douglas-fir. The units are now dominated by western hemlock with components of Douglas-fir, grand fir, red alder, and big leaf maple. The shrub understory consists mainly of vine maple and sword fern. There are few old growth remnants in the units.

There is western hemlock advanced regeneration throughout the stands. The advanced regeneration is suppressed and growing very slowly. Crown closure is near 80 percent in all the units. The proposed units have reached culmination of mean annual increment (CMAI). Field surveys found one small patch of *Phellinus weirii* in unit 5A. Unit 5A also has small patches of western hemlock blow down.

Watershed Characteristics

Age class distribution is an important component in describing the structure of the watershed as an ecosystem. The Thomas Creek Watershed Analysis categorizes the age class distribution into five seral stages. These stages are: Grass/forb 0–14 years, open sapling/brush 15–34 years,

closed sapling 35–74 years, mature 75–200 years, and old-growth 200 years and older, as shown in Table 3-1.

Table 3-1. Seral Stage Definitions[13]

Seral Stage used for Watershed Analysis	Age Class	Birthdate	Seral Stage used for Wildlife Habitat	Age Class
Grass/Forb	0 - 14	1999-2013	Early Seral	0 - 30
Open sapling/brush	15 - 34	1979-1998	Early Mid Seral	30 - 40
Closed Sapling	35 - 74	1939-1978	Mid Seral	40 - 60
			Late Mid Seral	60 - 80
Mature	75 - 200	1813-1938	Early Mature Seral	80 - 120
			Mature	120 - 200
Old-growth	200+	1812 and earlier	Old-Growth	200+

The following tables demonstrate that early-seral stages (forests) are lacking on federal lands within the Thomas Creek 5th Field Watershed and the Middle Thomas Creek 6th Field Watershed, by comparing the age class distribution by acreage within the watershed.

Table 3-2. Thomas Creek 5th Field Watershed

Seral Stage	Age	Birthdate	Acres	Percent of Total
Grass/ Forb	0–14	1999–2013	28	0.2
Open Sapling/Brush	15–34	1979–1998	2,084	17.3
Closed Sapling	35–74	1939–1978	5,136	43
Mature	75–200	1813–1938	2,593	21.5
Old Growth	200 +	1812 and earlier	2,217	18
Total Forested			12,058	100

Table 3-3. Middle Thomas Creek 6th Field Watershed Seral Stages

Seral Stage	Age	Birthdate	Acres	Percent of Total
Grass/ Forb	0–14	1999–2013	28	1
Open Sapling/Brush	15–34	1979–1998	313	12
Closed Sapling	35–74	1939–1978	960	38
Mature	75–200	1813–1938	547	22
Old Growth	200 +	1812 and earlier	667	27
Total Forested			2,515	100

[13] Table 3-1 (Seral Stage Definitions) shows the difference between the naming convention of seral stages by age class between the Watershed Analysis and the 1994 RMP/FEIS (Chapter 6-13) which is used to define wildlife habitat in this EA.

Operations Inventory Data

Table 3-4. Unit 5A/B Operations Inventory Data

TRSU[1]	FOI[2]	Cover Type	100 Year Site Index	TPCC[3]	Total Acres
10-2-5 Unit 5A	950752	FCO H3D4=1922// H1=1994	165	RLR1/NP	**52**
10-2-5 Unit 5B	950752	FCO H3D4=1922// H1=1994	165	FSR2/RLR1	**10**

[1] TRSU: Township-Range-Section-Unit
[2] FOI: Forest Operations Inventory
[3] TPCC: Timber Production Capability Classification (pp. 56, 57)

The Operations Inventory Data depicts the TPCC classifications that are found in each of the proposed units. Following is a description of each type:

- RLR1: Restricted light. These are sites where hardwoods or brush species would limit seedling survival or growth by restricting available light.
- FSR2: Soil compaction. Soils on these sites have low water holding capacities because of limiting factors in the soils. These are typically shallow soils over bedrock or soils with a very high rock fraction.

Table 3-5. 50 and 100 Year Site Indices

Unit	TRS[1]	FOI[2]	Cover Type	50 Year Site Index	100 Year Site Index	Percent of unit	Site Potential Tree Height
5A,B	10-2-5	950752	FCO H3D4=1922// H1=1994	124	165	100	220

[1] TRS: Township-Range-Section
[2] FOI: Forest Operations Inventory

Riparian Reserve Width: The ROD refers to Riparian Reserve widths for non-fish bearing streams as the distance equal to the height of one site potential tree (220 feet). For fish bearing streams this height is doubled (440 feet). It further defines site potential tree height as the average maximum height of the tallest dominant trees (200 years or older) for a given site class (ROD p. C-31). There are no Riparian Reserves within the harvest units; all Riparian Reserves have been excluded from treatment.

Vegetation other than trees

Botanical Surveys

Two types of surveys were conducted within the proposed harvest areas and vicinities: known site surveys (data search) and field surveys (botanical inventory).

Known Site Surveys

Prior to field surveys, specific harvest areas and vicinities were evaluated for the presence of known Threatened & Endangered (T&E), Special Status Species (SSS), Survey & Manage

(S&M) and invasive/non-native plant species. Habitat requirements for T&E, SSS and S&M species were reviewed and the known habitat in the proposed harvest area(s) was evaluated for suitability.

Field Surveys

Comprehensive botanical inventories of the proposed harvest areas were conducted in May 2013 to look for species that require protection or special management.

Survey Results for Threatened & Endangered, Special Status and Survey & Manage Species

- No T&E vascular plant or suitable habitat was found during field surveys and there are no known sites within the proposed harvest area(s) as determined by a known site data search.
- No SSS species were found during field surveys and there are no known sites within the proposed harvest area(s) as determined by a known site data search.
- No S&M species were found during field surveys and there are no known sites within the proposed harvest area(s) as determined by a known site data search.

Survey Results for Invasive / Non-native Plant Species

During field surveys the following invasive/non-native species were found to occur adjacent to the proposed harvest areas within road corridors; tansy ragwort (Senecio jacobaea), Canadian thistle (Cirsium arvense), St. John's wort (Hypericum perforatum), evergreen blackberry (Rubus laciniatus), Himalayam blackberry (Rubus discolor) and scotch broom (Cytisus scoparius).

3.1.2 Environmental Effects

The table below provides a comparison of effects for the proposed harvest units by alternative.

Table 3-6. Effects Comparison

Effect	No Action	Proposed Action	Alternative A
Type	FCO H3D4-=1922//H1=1994	FCO H3D4-=1922//H1=1994	FCO H3D4-=1922//H1=1994
Age 2015	93	93	93
Approximate Acres	60	60	60
Exam Date	10/2011	10/2011	10/2011
Average dbh post-harvest	17.8”	20” +	28.5”
Average leave tree dbh in 20 years	20.4”	36.3”-35.6”	31.1”
Curtis Relative Density	66	16/18	30
Live Basal Area	277	90-100	160
Trees per acre post-harvest	161	15-17	36
Harvest Volume (MBF[1] per acre)	0	50.8-47.5	26.9
Crown Closure	80	32-35	52
Site Potential Tree Height	220	220	220
TPA ≥ 34 inches dbh post-harvest	4.5	4.5	4.5
Non-native invasive species	None	slight possibility of infestation – unlikely to spread	slight possibility of infestation – unlikely to spread
T&E[2], Survey and Manage, Special Status Plant Species	No effect	No effect	No effect

[1] MBF – Thousands of Board Feet

[2] T&E – Threatened and Endangered

3.1.2.1 THE PROPOSED ACTION - Regeneration harvest

Immediately following regeneration harvest the residual trees should appear healthy with minimal damage from harvest activities. The site should have minimal soil disturbance from yarding. There should be approximately 15 (up to 17) green trees per acre. These trees should be in a combination of clumps and scattered individual trees. The retained trees should be among the largest in the stand and should be 20 inches dbh and larger. They should consist of primarily Douglas-fir with a few grand fir and western hemlock. Within regeneration harvest units existing standing dead snags would be at risk of being knocked down by operations. The understory plantation would be predominately even aged Douglas-fir and western red cedar. Some western hemlock and grand fir is expected to naturally regenerate. This would create early seral habitat. Pioneer species would regenerate and occupy the site providing habitat for various wildlife species.

The understory plantation would continue to grow until it fully occupies the site. In 10 to 20 years a pre-commercial thinning would be scheduled. The stand should be thinned to approximately 220 trees per acre. Residual trees from the current stand would remain on site. Some may blow over, contributing to coarse woody debris while others may die and become snags.

Invasive/Non-Native Plant Species

Due to project design features (Table 2-6 Project Design Features (Numbers 52, 53)), it is not anticipated that areas of disturbed ground would become established with invasive/non-native species. If species establishment does occur, it is anticipated to be short lived (i.e. less than 10 years) as native species repopulate the disturbed areas and shade out the invasive species. As evidenced on private lands adjacent to the proposed project areas, no dramatic population increase in invasive/non-native species would occur if the proposed project proceeds as planned. Projects similar to that of the proposed project had little to no difference in their invasive/non-native species population composition or numbers, and these projects were completed without the project design features of this proposal.

A distinguishing difference between what has often occurred on early seral stage non-BLM lands treated to retard the establishment of non-conifer species and what would occur following the proposed action is that native plant species, including grasses, forbs and shrubs, would flourish on the BLM sites. Species and habitat richness would increase as the young seral[14] forest establishes and progresses over time, and the evolving habitat would provide the necessary niche needed by many species. As species fill these niches, increased population diversity of native species would occur.

Cumulative Effects

Table 3-7. Thomas Creek 5th Field Watershed (Post-harvest)

Seral Stage	Age	Birthdate	Acres	Percent of Total
Grass Forb	0 - 14	1999 - 2013	28	0.2
Open Sapling/Brush	15 - 34	1979 - 1998	2,142	17.8
Closed Sapling	35 - 74	1939 - 1978	5,136	43
Mature	75 - 200	1813 - 1938	2,535	21
Old Growth	200 +	1812 and earlier	2,217	18
Total Forested			12,058	100

Table 3-8. Middle Thomas Creek 6th Field Watershed

Seral Stage	Age	Birthdate	Acres	Percent of Total
Grass/ Forb	0 - 14	1999 - 2013	28	1
Open Sapling/Brush	15 - 34	1979 - 1998	371	15
Closed Sapling	35 - 74	1939 - 1978	960	38
Mature	75 - 200	1813 - 1938	489	19
Old Growth	200 +	1812 and earlier	667	27
Total Forested			2,515	100

[14] Young seral is a combination of early and early-mid seral.

Threatened & Endangered and Special Status Plant Species

No suitable habitat to support any T&E species was identified within or adjacent to the proposed project areas. Although suitable habitat to support some SSS and S&M species was identified within the proposed project areas, no SSS or S&M species were found. Due to the nature of the proposed project and the habitat modification that would occur, some suitable habitat to support some SSS and S&M species within the proposed project areas would be modified but not lost. Suitable habitat would remain in reserve areas adjacent to the proposed harvest areas and although indirect impact (i.e. increased sunlight, temperature increase, etc.) to reserve areas may occur, no impact to that habitat is anticipated.

3.1.2.2 ALTERNATIVE A – Commercial thinning harvests

Immediately following harvest the stands should appear thinned with additional room for crown expansion. Average diameter of trees would increase as many of the smaller diameter trees are removed from the stands. The stands would appear more uniform in spacing and tree size. Crowns of residual trees would be slow to expand. Diseased trees and trees of poor vigor would be removed from the stand. There would be minimum damage to residual trees from logging. Conifer species composition would remain the same leaving western hemlock as the dominant species. Low retention areas of up to one acre in size would provide additional light to the forest floor. Conifer regeneration should occur in low retention thinning areas, providing early seral habitat benefiting wildlife. Advanced regeneration already in the stands should increase in growth. Understory vegetation would initially increase in abundance, size and species diversity.

In the longer term, the growth rate of residual trees should increase then continue at a steady rate over the next 20 years. Crowns should expand and fill the gaps left in the canopy by the thinned trees until the site is fully occupied. An increase in the understory vegetation growth is expected initially but would become less vigorous as the canopy closes. Some conifer regeneration is expected initially in the low retention areas but would decrease in growth as the canopy closes. Growth of advanced regeneration already in the stands would decrease as the crowns expand and the canopy closes. Understory vegetation growth would become less vigorous as the canopy closes over time.

The low retention areas would retain 10 to 12 trees per acre. These openings would result in more vertical understory layering and ground cover, adding complexity to future forest stands.

Cumulative Effects

No cumulative effects are expected with regard to stand structure and development because the proposed thinning would maintain a forested setting in the same age class as before thinning. Positive cumulative effects at a landscape level include increased habitat diversity as treated stands develop differently from untreated stands and from recent plantations on private land.

No cumulative effects are expected with regard to invasive/non-native plants because the project would not contribute to the spread of invasive species populations or to the introduction of new

species. When similar projects have been implemented on the BLM lands in the vicinity, there has been little or no difference in the composition or numbers of invasive/non-native species populations.

Threatened & Endangered and Special Status Plant Species

No suitable habitat to support any T&E plant species was identified within or adjacent to the proposed project areas. Although suitable habitat to support some SSS and S&M species was identified within the proposed project areas, no SSS or S&M species were found. Due to the nature of the proposed project and the habitat modification that would occur, some suitable habitat to support some SSS and S&M species within the proposed project areas would be modified but not lost. Suitable habitat would remain in reserve areas adjacent to the proposed harvest areas and although indirect impact (i.e. increased sunlight, temperature increase, etc.) to reserve areas may occur, no adverse impact to that habitat is anticipated.

Invasive/Non-native Plant Species

Due to project design features (Table 2-6 Project Design Features (Numbers 52, 53)), it is not anticipated that areas of disturbed ground would become established with invasive/non-native species. If species establishment does occur, it is anticipated to be short lived (i.e. less than 10 years) as native species repopulate the disturbed areas and in turn out compete and shade out the invasive species. As evidenced on both public and private lands adjacent to the proposed project areas no dramatic population increase in invasive/non-native species would occur if the proposed project proceeds as planned. Projects similar to that of the proposed project had little to no difference in their invasive/non-native species population composition or numbers, and these projects were completed without the project design features of this proposal.

3.1.2.3 NO ACTION ALTERNATIVE

This option would leave the stands in their current condition. The trees would continue to compete for growing space. Crowns would decrease in size and growth rates would slow. Stands would continue to self-thin and snag numbers would increase. Increased numbers of snags would add to fire danger incrementally and provide some habitat for snag associated species. Understory vegetation would decrease in abundance and species diversity due to the lack of sunlight on the forest floor.

3.2 HYDROLOGY

3.2.1 Affected Environment

Project Area Precipitation and Basin Hydrology

The project area is located in the Oregon Western Cascades range at elevations between 1,900-2,000 feet[15]. The proposed harvest area is located in the transient snow zone (TSZ), an elevation

[15] Unless otherwise indicated, geographic information is an estimate derived from the BLM GIS database.

zone subject to rain-on-snow events (ROS) that have the potential to increase peak flows during winter or spring storms. This zone varies with temperature during winter storms but is estimated to occur between 1,500–3,000 feet in elevation. The project area receives approximately 85 inches of rain annually and has a mean 2-year precipitation event of 3.43 inches in a 24-hour period (estimated at: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm).

The project is in the Middle Thomas Creek sixth field watershed with approximately 20,826 combined acres (32.5 square miles) in drainage area. Thomas Creek is tributary to the fourth field South Santiam River (HUC #17090006). The South Santiam is the drinking water source for the City of Jefferson and thus the project lies within the municipal watershed.

Project area stream channels

The project area is situated in the Western Cascades physical province and streams reflect the geologic origin of the area[16]. Most of the terrain around the treatment units is composed of basaltic and andesitic volcanic rocks from the middle and upper portion of the Miocene epoch, deposited between 16–6 million years before present.

Stream channels immediately adjacent to, or in some cases within the proposed treatment units are a mix of first order headwater channels with intermittent flow that converge in 2nd - 3rd order perennial channels tributary to Thomas Creek.

Based on criteria provided in the BLM publication; *Riparian Area Management. A User Guide to Assessing Proper Functional Condition and the Supporting Science for Lotic Areas* (U.S.D.I., 1998)[17] and comparing conditions here to similar channels in Western Cascades, the Cascades Resource Area Hydrologist determined that channel reaches observed in the project area on the BLM are currently in proper functioning condition (PFC) because there is adequate vegetation, landform, or large woody debris present to: dissipate stream energy, filter sediment, aid ground water recharge, aid floodplain development, stabilize stream banks and maintain channel characteristics. A determination of "proper functioning condition" means that the channel elements and physical processes are in working order relative to an area's capability and potential. It does not mean that the channel is functioning at full biological potential or that nothing could be improved by human intervention (e.g. placing additional wood structure, repairing infrastructure, thinning adjacent forest, etc.).

Perennial channels

The small headwater tributaries adjacent to the proposed treatment units eventually reach larger perennial channels that flow to Thomas Creek. There is only one 2nd order perennial channel within the immediate project area; this stream flows just north of the main treatment unit and continues southeast to Criminal Creek on private ground.

The perennial channel in the project area is well shaded by dense stands of second growth

[16] For a more detailed description of stream channel formation and geomorphology the reader is referred to *Geomorphology of Steepland Headwaters: The Transition From Hillslopes to Channels* (Benda et al. 2005).
[17] See page 5, paragraph 1 for the definition of proper functioning condition.

conifer with a narrow band of hardwoods on the adjacent floodplain. Wood and shade are in moderate supply, banks are stable, and channel morphology is controlled by bedrock features with gavel-cobble sized substrates. This channel type is fairly resilient and unlikely to be altered significantly by disturbance. Utilizing the same PFC criteria described and comparing conditions here to similar channels in Western Cascades, the perennial channel is currently in proper functioning condition.

There are no road crossings on perennial streams in the immediate project area. There are several intermittent stream crossings with culverts and road ditch lines in moderately good condition (i.e. the channel has not been highly altered and sediment supply from the road surface and ditch is low). There are also no perched culverts in the project area; however, there are several on the access route to the project area on the McCully Mountain road. When culverts are replaced, current engineering standards require that passage of aquatic organisms be considered in the replacement design.

Project area wetlands

There are no wetlands in the project area identified on National Wetlands Inventory maps nor were wetlands identified during field review. A single area with high water tables was identified in the southeast portion of the project area. This area is excluded from treatment. All other wet areas are associated with streams.

Project area stream flow

During field review of project channels, the hydrologist noted no evidence that would indicate channel adjustments to increased peak flows such as channel incision, large particle size distribution or bank erosion; however, lower reaches of Criminal Creek (the only perennial channel in the project area) on private land were not field reviewed for this analysis.

Potential for peak flow augmentation due to forest harvest: Current Condition

A preliminary analysis for the risk of increases in peak flow as a result of forest harvest was conducted using the Oregon Watershed Assessment Manual watershed analysis methods for forest hydrology[18] (OWEB 1997).

Table 3-9 displays statistics in the Peak Flow Analysis Watersheds (Bear Creek Frontal and Criminal Creek seventh field watersheds) used for determining the current risk of peak flow augmentation in project watersheds. The proportion of the Bear Creek Frontal and Criminal Creek seventh field watersheds in the transient snow zone (TSZ) is 52 percent and 70 percent, respectively.

[18] http://www.oweb.state.or.us/OWEB/docs/pubs/OR_wsassess_manuals.shtm. Accessed 9/14/2015.

Table 3-9. Risk of Peak Flow Enhancement by Analyzed Watersheds[19]

7th Field Sub watershed Name	Watershed (acres)	Percent of Watershed in TSZ Areas	Percent of ROS[1] area with less than 30 percent Crown Closure	Peak-Flow Enhancement Risk
Bear Creek	1,924	52 percent (995 acres)	49 percent (448/995 acres)	Low
Criminal Creek	1,853	70 percent (1305 acres)	70 percent (1022/1305 acres)	Potential

[1] ROS: Rain on Snow

The risk of peak flow enhancement would vary with the proportion of the TSZ that has crown closure of less than 30 percent (see horizontal axis, Figure 3-1). At present, 49 percent of the TSZ in Bear Creek Frontal has been recently harvested (based on 2012 satellite imagery and LiDAR review), placing the watershed well below the line for "potential risk" (see blue marker on Figure 3–1). However, the risk analysis indicates that there is currently a potential risk for peak-flow enhancement due to forest openings in the Criminal Creek watershed (see red marker on Figure 3–1) because a large proportion of the TSZ on private lands has been recently clear-cut. It is likely that the remaining un-harvested private lands in this watershed will be harvested in the next year or two so that ultimately 90 percent of the analyzed watersheds would be in an open canopy condition during project operations.

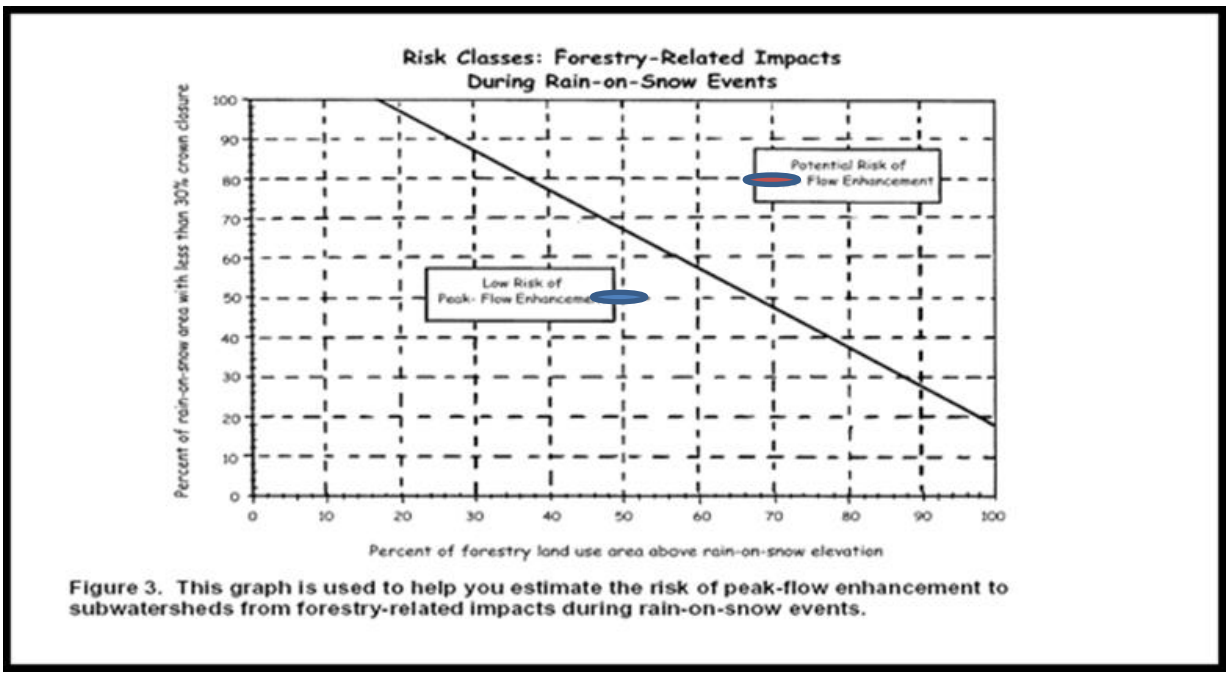


Figure 3-1 Graph for Determining Risk of Peak Flow Augmentation

Roads in the project area were inspected by Cascades Resource Area specialists. Most road surfaces are well-maintained and in good condition with little potential to contribute fine

[19] Analyzed Watershed(s) indicates the combined Bear Creek and Criminal Creek seventh field watersheds.

sediment to area streams. However, some exceptions to this were noted. Soils in this project area tend to be silty clay loams with high levels of clay size particles. During wet weather and exposure to truck traffic, fine sediment in these roads can be brought to the surface where it could be washed into local streams. Road surfaces that drain directly to local streams (i.e. connected) have the potential to raise turbidity levels and the supply of fine sediment. The potential for road surface sediment delivery was noted in a couple of locations along the McCully Mountain road which accesses the treatment unit.

Project area ground water

The State of Oregon's Department of Environmental Quality (DEQ) has not identified any groundwater pollution problems within project watersheds.

The deep soils in the project area uplands are well drained and generally lack horizons which impede water infiltration (EA section 3.4). Precipitation is thus free to saturate soil surface horizons and flow deep into the subsurface, as well as down-slope, under the influence of gravity. Soils in the project area have relatively high rates of water movement as indicated by infiltration rates between 0.25–2 inches per hour.

Designated Beneficial Uses and Water Rights[20]

Table 3-10. Beneficial Uses Associated with Thomas Creek

Stream(Watershed) Project Action	Beneficial Use	Information Source
Thomas Creek (South Santiam) Timber harvest: density management, road construction and reconstruction, log hauling.	Salmon rearing and spawning	Downstream from project area. See fisheries report.
	Resident fish & aquatic life	Downstream from the project area. See fisheries report.
	Irrigation & Domestic Drinking Water	Downstream from the project area. See WRIS1[21].
	Municipal Drinking Water	Intake in Lower North Santiam: source water assessment

Both resident and anadromous fish are downstream from some of the proposed treatment (see fisheries, EA section 3.3). Additional beneficial uses of Thomas Creek include: industrial water supply, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality.

Municipal Water Providers and Source Water Assessments

The City of Jefferson draws water from the Santiam River for drinking water. The source water

[20] Designated beneficial uses for the Willamette are available online: *http://www.deq.state.or.us/wq/standards/uses.htm.* Accessed 9/14/2015.
[21] WRIS: Water Rights Information System of the Oregon Department of Water Resources: http://www.wrd.state.or.us/OWRD/WR/index.shtml. Accessed 9/14/2015.

assessment identified 61 potential sources of contamination within the watershed; forestry related activities (road building, harvest, etc.) were cited once as a potential source of sediment due to surface erosion.

Water Quality Limited Streams

Thomas Creek is listed as not meeting water quality standards for summer stream temperatures and several other attributes. In response to the temperature listing, the ODEQ has developed a Total Maximum Daily Load (TMDL) for the Willamette basin.

Essentially, the TMDL requires the recovery or maintenance of full potential shade along all perennial streams in the Willamette basin. As part of the TMDL, the BLM submitted the South Santiam Water Quality Restoration Plan (WQRP), which details how the BLM will implement the TMDL on federal lands (U.S.D.I. BLM, 2007). The BLM will implement the WQRP on all public lands in the project area even when they lie upstream from the stream segments listed as water quality limited.

Stream Temperature

Field surveys, review of aerial photographs, and LiDAR data indicate that shading is near full potential on the only perennial channel in the project area (Criminal Creek), with canopy closure exceeding 80 percent and full potential shade. Based on this data, it is likely that stream temperature in the project area currently meets state standards on BLM lands.

LiDAR imagery for the project area was reviewed and field reviews for mass wasting potential were conducted in the winter of 2014. There are no unusual or highly unstable areas within the project and no mapped landslide features.

Surface erosion, stream bank, and channel erosion

Unusual levels of stream bank erosion were not observed in project streams. Streams in the project area on the BLM's land appeared to have moderate levels of wood in place with well-vegetated banks. Channel adjustments at culverts were within the range expected for these channel types and as described earlier in this report.

Turbidity and Sediment[22]

During winter field reviews of area streams, water clarity appeared typical for these stream types in Western Cascades and unusual turbidity levels were not noted.

[22] For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to *Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest* (Takashi et al. 2005)

3.2.2 Environmental Effects

3.2.2.1 The Proposed Action - Regeneration harvest

Channel and Wetland Morphology/Physical Integrity (ACS Objective 3)

Direct and Indirect Effects - Channel and Wetland Morphology

In general, there would be no direct alteration of the physical features of project area stream channels or wetlands under this proposal: stream banks, channel beds and wetlands are protected by full Riparian Reserves from direct physical alteration or disturbance by harvesting equipment. Direct disturbances by equipment or yarding would not occur in the Riparian Reserves.

In addition, the proposed action is unlikely to affect stream flow and therefore any indirect effects to stream channels as a result of flow alteration or timing is unlikely. Thus, the proposed action would not result in detectable effects to channel morphology, such as increases in bank erosion, channel incision, scouring of substrates or gravel deposits utilized by fish for spawning, loss of floodplain connectivity or alteration of local wetland hydrology that could result from augmented peak flows or altered watershed hydrology.

New road construction would not cross stream channels or wetlands.

Cumulative Effects - Channel and Wetland Morphology/Physical Integrity

With the exception of disturbance to the channels at culvert replacement sites, this proposal would not result in any direct effects to channel or wetland morphology and therefore would have no cumulative effect. At the locations of direct channel disturbance, adjustments would be limited to the site of disturbance and would not result in alterations to channels or floodplains downstream or elsewhere in the watershed. Channel adjustments at the site of disturbance, if they occur at all, would be of relatively low magnitude and short duration (within one year). Finally, since channels in the project area already have properly functioning dimensions and form there is no cumulative effect.

Project Area Hydrology (ACS Objective 6)

Mean Annual Water Yield

Increases in mean annual water yield (the total yield of water from a watershed in one year averaged across the period of record) following the removal of watershed vegetation have been documented in numerous studies around the world (Bosch et al. 1982). Forest vegetation intercepts precipitation and through the processes of sublimation (the direct conversion of snow from a solid to a gas without entering a liquid phase) and/or evapo-transpiration, the forest returns over 50 percent of the annual precipitation to the atmosphere that might otherwise become runoff. Therefore, this proposal would likely result in some incremental increase in annual water yield correlated to the removal of the conifer over-story (Troendle et al. 2006). However, other than the augmentation of peak and/or base flows (discussed below) the "increase in fall and winter discharge from forest activities is likely to have little biological or physical significance" (USEPA, 1991).

Base Flow and Fog Drip

No studies have been located for this analysis to indicate that fog drip is a large contributor to stream flow, in the project area. In addition, no studies have documented reductions in fog drip when forest removal is less than two percent of a watershed, as in this case. Based on these two factors, it is unlikely the proposed action would have a detectable effect on fog drip.

Peak flow

The proposed treatment unit is within the zone generally subject to transient snow accumulations (TSZ) in the winter. It can be assumed that the reduction in stand density would result in some increase in snow accumulation on the ground in these areas because there would be less canopy interception and sublimation. However, this proposal would not increase openings (areas less than 30 percent canopy closure) within the TSZ in project watersheds that are at risk for increasing peak flows (i.e. Criminal Creek). By leaving 15-17 trees per acre across the treatment unit in Criminal Creek, canopy closure (CC) will remain greater than 30 percent in this proposal, the increase in snow accumulation and melt-off during ROS events would remain below a level likely to result in measurable increases in peak flows according to the State of Oregon risk assessment methodology (EA Section 3.2.1 Affected Environment in this report).

For the Bear Creek watershed peak flow analysis area, CC may be reduced below the 30 percent minimum. Assuming the 48 treated acres in Bear Creek would be below 30 percent CC following treatment, this would add 48 acres to the existing estimated 448 acres with less than 30 percent CC, for a total of 498. The result is a 1 percent increase in the proportion of the TSZ that is less than 30 percent CC. However, this small of an increase does very little to alter the existing conditions in Bear Creek which would remain in the LOW risk zone for augmentation of peak flows due to canopy openings (see Figure 3-1 Graph for Determining Risk of Peak Flow Augmentation).

Peak Flow effects from Roads

Roads built as a result of this project would have no effect on sub-surface or groundwater flow and thus have no effect on the timing or volume of stream flow in the watershed (Wemple et al. 2003). Since no additional permanent stream crossings are proposed, there would be no additional routes for water intercepted by road surfaces to reach streams. Intercepted rainfall on these roads would be drained to the adjacent undisturbed forest floor where, because of the high permeability of forest soils, it would quickly infiltrate into the ground. Under these circumstances, road construction has a low risk of altering watershed hydrology or peak flows because intercepted water would not reach stream channels any faster than precipitation that falls on the forest floor.

Groundwater

The proposed action is unlikely to affect peak or base flow and so, by extension, it has little capacity to affect groundwater patterns which are intimately linked to the surface.

Watershed Hydrology: Cumulative Effects

The proposal is not likely to result in a direct effect to peak flow, thus the proposal would not contribute to any cumulative effects to peak flows in these watersheds. Since there would not be any direct or indirect effect to the watershed's ground water, the proposed action carries no risk

for contributing to any existing cumulative effects to this resource.

Water Quality (ACS Objective 4)

Direct and Indirect Effects - Water Quality

Summer Stream Temperature Maximums in Perennial Streams

Field reviews of the perennial stream channels in the project area found that they are well-shaded and functioning properly on the BLM land. This proposal would maintain effective shade within the range required under the Willamette TMDL which requires the recovery or maintenance of full potential shade along all perennial streams in the watershed.

Since Riparian Reserves would be left untreated in this proposal, no tree removal would occur within 200 feet of a perennial stream.

Dissolved Oxygen (DO), pH and Conductivity

Since the proposed action is unlikely to alter stream temperatures or sedimentation, would not place large amounts of fine organic material in the stream and would not alter re-aeration, it is unlikely that this proposal would have any measurable effect on DO levels in project area streams. Available data indicates that most forest management activities have little effect on pH or conductivity of water (U.S.E.P.A., 1991).

Turbidity

Road construction and maintenance

New roads would not be connected to the stream system and therefore no pathway would exist for delivery of fine sediment which could increase turbidity in streams. Since new road construction would occur on stable surfaces well away from streams and incorporate appropriate BMPs, there would be no opportunity for these roads to deliver sediment to the stream system.

Maintenance of existing roads would include rocking and blading of road surfaces. There may be increased turbidity (i.e. a visible reduction in water clarity) relative to background or upstream water clarity during the first winter following the project if storm events wash some of the fines off disturbed surfaces and deliver them to the stream.

Hauling

Timber hauling during periods when water is flowing on roads and into ditches could potentially increase stream turbidity and suspended sediment transport with indirect detrimental effects on the physical and biological attributes of the stream (Cederholm et al. 1980). Proposals to haul timber outside of the summer hauling season should require rocking of native surface roads to control erosion and sediment transport before approval. Turbidity levels would be unlikely to reach levels that would cause additional treatment expense or technical difficulties for the downstream water providers.

Broadcast Burn

A broadcast burn over this site would be unlikely to contribute sediment to local streams or alter

the current sediment regime in this watershed. The large, intact tree retention buffers together with low surface gradients at this site would prevent surface run-off with erosion and sediment delivery to streams.

Water Quality Cumulative Effects

Overall, this proposal is unlikely to have any measurable direct or indirect effect on stream temperatures, pH, or dissolved oxygen. Current conditions and trends in water quality would likely be maintained under all alternatives. Therefore, the proposal has little potential for contributing to any cumulative effects to these water quality attributes in these watersheds.

Sediment Regime (ACS Objectives 5)

Forest Management Practices

In most cases, management practices with the potential to accelerate erosion and sediment supply to stream channels include: road construction/maintenance, truck hauling of harvested material across unrocked or unpaved forest roads, yarding, and site preparation for reforestation, particularly prescribed burning. The BMPs are proposed to eliminate and/or limit the acceleration of erosion and sediment delivery to streams in the project area beyond background levels.

Tree harvest and yarding

Tree removal is not proposed on steep, unstable slopes where the potential for mass wasting adjacent to stream reaches is high as defined by the TPCC (pg.51). Therefore, increases in sediment delivery to streams due to mass wasting induced by loss of root strength and increases in soil pore pressure are unlikely to result.

Yarding corridors, if sufficiently compacted and disturbed, have the potential to route surface water and sediment into streams; however, field reviews (Hawe, 2012) of cable logged units on the BLM land during intense rainstorm events from 2007-2012 found no evidence of overland flow or sediment transport on cable yarding corridors where erosion models had predicted sediment transport under similar conditions.

Sediment Yield Cumulative Effects

Since there would be no detectable increase in sediment supply or transport as a result of the proposed action, there is no possibility to contribute to a cumulative effect.

3.2.2.2 Alternative A - Commercial thinning harvests

Tree retention under this alternative is estimated to be approximately 36 trees per acre (TPA) with a canopy closure of 52 percent. There is no existing research that can parse a difference between a 36 TPA retention compared to a 15 (up to 17) TPA retention alternative (as in the proposed action) relative to hydrologic or water quality effects. Therefore, since the same methods of logging and site treatment would be utilized, a commercial thinning treatment would result in effects to the hydrology and water quality that are indistinguishable from the proposed treatment.

3.2.2.3 No Action Alternative

Under this alternative the existing water quality conditions, stream flows, and channel conditions at the project site would continue their current trends (section 3.2.1).

3.3 FISHERIES AND AQUATIC HABITAT

3.3.1 Affected Environment

Fish and Aquatic Species

Distances (in miles) from the proposed project units downstream to resident cutthroat trout and ESA listed fish habitat are shown in Table 3-11. Distances estimated in feet are from the perimeter of tree harvest areas to stream banks.

Table 3-11. Distance of Harvest Units from Fish Species Habitat.

Unit Number	Distance to resident cutthroat trout habitat[1]	ESA Listed Fish Species	
		Distance to steelhead trout habitat	Distance to Chinook salmon habitat
5A	0.6 mi to Bear Creek	2.2	2.2
5A	1.2 mi to Criminal Creek	2.6	2.6

[1] The upstream limits of anadromous fish distribution were obtained from Streamnet (2006) or Oregon Department of Fish and Wildlife (ODFW) data, if ODFW data indicated fish were distributed further upstream than delineated by Streamnet. Stream distances were measured using ArcGIS software.

Coastal cutthroat trout (*Oncorhynchus clarki clarki*; Behnke 1992) are uncommon in the project area. They inhabit the lower portion of Bear Creek in section five near the harvest units (T.10S, R.2E). Cutthroat trout are absent from tributaries to Bear and Criminal creeks in and immediately adjacent to the timber sale unit. Fish are absent from the tributary to Criminal Creek located in the eastern portion of section five due to one or more barrier falls that prevent fish from accessing the stream from Criminal and Thomas creeks. The central tributary is too small to support fish populations.

Bear Creek is a tributary to Thomas Creek. Other resident fish known to inhabit the Thomas Creek watershed include mountain whitefish (*Prosopium williamsoni*), rainbow trout (*O. mykiss*), large scale sucker (*Catostomus macrocheilus*), dace (*Rhinicthys* spp.) and sculpin (*Cottus* spp.). These species are predominantly present in main stem reaches of Thomas Creek. The downstream-most reaches of Thomas creek also support redside shiner (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis*) and non-native smallmouth bass (*M. dolomieui*), brown bullhead (*Ameiurus nebulosus*) and yellow bullhead (A. natalis) (USBLM 1996).

Threatened and Endangered Species

Upper Willamette River (UWR) Winter run steelhead trout (*O. mykiss*), and UWR spring Chinook salmon (*O. tshawytscha*) are listed as threatened under the Endangered Species Act of 1973 (ESA). Salmon and steelhead populations in the Upper Willamette River evolutionary significant unit (ESU) are substantially reproductively isolated from other populations and are an important component in the evolutionary legacy of those species (NOAA 2005). Thomas Creek provides habitat for these species and is in the Upper Willamette River ESU.

Winter steelhead trout are distributed throughout much of the length of Thomas Creek to about eight miles upstream of the Bear Creek confluence. Spring Chinook salmon are also distributed to about eight miles upstream of the Bear Creek confluence. The timber sale unit is located 2.2 to 2.6 miles upstream of listed fish habitat (Table 3-11).

Aquatic Habitats

Stream channels in the project area are stable due to vegetated banks, well-shaded (greater than 90 percent effective shading), and stream banks are stable (greater than 90 percent of banks vegetated with riparian and streamside vegetation; BLM Fish Inventories 2013). Substrates are generally silt or gravel dominated; BLM Fish Inventories 2013). Larger tributary streams in or adjacent to the project unit, including Bear, Criminal, and Thomas creeks, have gradients of 4 to 10 percent (BLM 2001). In-stream habitats of Thomas Creek are rated in fair to desirable condition (BLM 1996). Pool frequency and area is generally desirable, but large woody debris (LWD) levels are severely lacking (USBLM 1996).

3.3.2 Environmental Effects

3.3.2.1 The Proposed Action - Regeneration Harvest

Aquatic Habitats

The overall effects of the proposed action to aquatic habitats are discussed below.

Stream Channels

The proposed tree harvest would not impact channel conditions and fish habitat due to minimum no-disturbance buffers (SPZs) of 200 feet on perennial and intermittent streams (Riparian Reserve LUAs would not be disturbed). These SPZs widths are adequate to intercept and infiltrate water carrying sediment preventing its delivery to streams and aquatic habitats (Olson and Rugger 2007, Rashin et al. 2006, CH2MHILL et al. 1999).

Stream Shading and Temperature

All streams would have minimum 200 foot no-disturbance buffers. Thus, with no disturbance to the primary shade zone (within 70 to 85 feet of channels) and secondary shade zone, no change in solar radiation input and stream temperature would occur (BLM TMDL Implementation

Strategy; Groom et al. 2011).

Large Wood

Large wood availability would be unchanged on tributaries to Bear and Criminal creeks, as no trees would be harvested within one standard potential tree height (220 feet) of perennial streams in the harvest unit.

Sediment and Roads

New and reconstructed roads are primarily located greater than 220 feet from stream channels and would be built as to not increase the size of the stream network (Wemple et al. 1996). New roads (a total of approx. 0.4 mile) would be located on gentle to moderate slopes. Road surfaces of new and reconstructed roads would be constructed to drain surface water to adjacent gentle slopes where it would infiltrate into the soil and groundwater. Thus, little if any sediment produced by road surfaces would reach stream channels and would not impact aquatic habitats or fish populations.

Peak flow effects

The proposed treatment unit is within the zone generally subject to transient snow accumulations (TSZ) in the winter (Hydrology Specialist Report 2014). By leaving 15 TPA across the treatment unit, canopy closure will remain greater than30 percent in the Criminal Creek watershed in this proposal, the increase in snow accumulation and melt-off during Rain on Snow (ROS) events would remain below a level likely to result in measurable increases in peak flows according to the State of Oregon risk assessment methodology EA section 3.2.1) The Bear Creek watershed is at low risk of peak flow effects due to relatively low area of openings (less than 30 percent canopy closure) in the watershed. The proposal to reduce canopy closure to 30 percent or slightly less in the unit in the Bear Creek watershed would not results in an increase in peak flows (Hydrology Specialist Report 2014). Thus, cutthroat trout, winter steelhead, and Chinook salmon habitat located in Bear, Criminal and Thomas creeks downstream of the project area would not be impacted by regeneration harvest.

Threatened and Endangered Species

The harvest units are greater than or equal to 2.2 miles from listed fish habitat (LFH) in Thomas Creek. Proposed tree harvest would not impact listed fish habitat due to minimum no-disturbance buffers of 200 feet on perennial and intermittent tributaries. These buffer widths are adequate to intercept and infiltrate water carrying sediment preventing its delivery to streams and aquatic habitats (Olson and Rugger 2007, Rashin et al. 2006, CH2MHILL et al. 1999). No disturbance to primary shade zones (within 70 to 85 feet of the channel), and retaining greater than 50 percent canopy closure in the secondary shade zone would result in no change in stream temperatures of perennial streams located upstream of LFH (BLM TMDL Implementation Strategy; Groom et al. 2011).

Large wood supplies in LFH in Thomas Creek would not be impacted because no trees would be harvested on tributary streams within one site potential tree height (220 feet).

There would be no peak flow effects to listed fish habitat due to maintaining canopy closures greater than or equal to 30 percent (see above discussion of peak flow effects).

There would be no peak flow effects to listed habitat due to maintaining canopy closures greater than or equal to 30 percent in the Criminal Creek watershed and due to the relatively small amount of openings with less than 30 percent canopy closure in Bear Creek watershed (see section 3.3.2.1)

Road construction would not increase the size of the stream network (Wemple et al. 1996). New roads are greater than 220 feet from stream channels, and constructed road surfaces would be designed to drain surface water to adjacent gentle slopes where it would infiltrate into the soil and groundwater. Thus, little sediment would be produced by the new roads and would not reach LFH, which is 2.2 miles downstream.

The haul route for section 5 (S. McCully Mtn. Road) is paved where it crosses Jordan Creek and a Jordan Creek tributary greater than or equal to 1.3 miles upstream of steelhead habitat in Jordan Creek, with no potential to deliver sediment to LFH. The upper portion of this haul route (roads 9-1E-36 and 10-2E-6) crosses Bear Creek and three 1st or 2nd order tributaries to Thomas Creek at 1.6 to 2 miles upstream of steelhead and chinook habitat. The road is well graveled with short ditch lines, and ditches are vegetated (thus limiting the capacity of the ditches to transport sediment (Luce and Black 1999), with no evidence of sediment moving to channels at the crossings. Increased turbidity as a result of hauling is unlikely to be visible or detectable beyond 800 meters below the site of the disturbance (Foltz and Yanosek 2005). Thus, steelhead and salmon habitat would not be impacted by log hauling from section 5.

Cumulative Effects

The proposed action would have no direct impacts to channel morphology (channel shape and form) of streams on the project areas and hence no cumulative effects to channel morphology. With no direct or cumulative impacts to channel morphology, instream fish habitat (pool habitat, instream cover, stream depth, etc.) would not be affected. No direct or cumulative impacts to peak flows are expected.

3.3.2.2 Alternative A - Commercial Thinning Harvests

Aquatic Habitats

Fewer trees would be harvested under this thinning alternative, but stream protection zones (no-disturbance buffers) would be identical to that of the proposed action. Thus, impacts of this alternative on aquatic habitats (impacts to stream channels, stream shading and temperature, large wood, sediment and roads, and peak flows) would be the same as that of the proposed action (see above).

Threatened and Endangered Species

Similar to that of the proposed action, thinning trees with the use of minimum no-disturbance buffers of 200 feet on perennial and intermittent tributary streams at distances equal to or greater than 2.2 miles from listed fish habitat would have no effect on listed fish and their habitats. Road construction and maintenance and log hauling would be similar to that of the proposed action. Therefore, road activities and log hauling associated with Alternative A would also have no effect on steelhead and salmon habitat (see analysis of proposed action).

Cumulative Effects

Alternative A would have no direct impacts to channel morphology (channel shape and form) of streams on the project areas and hence no cumulative effects to channel morphology. With no direct or cumulative impacts to channel morphology, instream fish habitat (pool habitat, instream cover, stream depth, etc.) would not be affected. No direct or cumulative impacts to peak flows are expected (see hydrology section).

3.3.2.3 No Action Alternative

Aquatic Habitats

Populations of aquatic species would undergo natural increases and declines related to changes in aquatic habitat condition (i.e. changes in stream temperature, sediment delivery events, and peak winter flows). Stream temperatures increase when shade from riparian canopy is lost (Johnson 2004). Substantial increases in stream temperatures can increase the metabolic costs of trout (Li et al. 2004), resulting in lower survival and recruitment, and consequently reduced population abundance (Hicks et al. 1991). During periods of accelerated sediment delivery (flooding), recruitment success is lower because of fine sediment reducing intragravel oxygen levels, resulting in higher embryo mortality and reduced population abundance (Bjornn and Reiser 1991). High winter flow likely reduces overwinter survival of cutthroat trout in western Oregon streams (House 1995).

Under the No Action alternative, canopy closure in primary and secondary shade zones along stream channels would remain similar to current levels, except for changes to tree canopy and consequently stream shade levels resulting from snow or ice break, wind storms, and wildfire. Stream temperatures would follow changes in stream shading (Johnson 2004). The large wood (LW) availability would increase over the long term as tree stands mature. Dense stands of riparian trees would self-thin over time, contributing small wood (trees less than 24 dbh) to stream channels. Windthrow from storms would contribute LW to streams over the long term. Natural sediment inputs to streams would vary as sediment contributing events (flooding) occur within Riparian Reserves.

Threatened and Endangered Species

This alternative would have no effect on UWR steelhead trout and UWR spring Chinook salmon

because no actions would be taken that would affect salmon and steelhead habitat. The project area is located more than 2.2 miles upstream of Chinook salmon and steelhead trout habitat in Thomas Creek.

3.4 SOILS

3.4.1 Affected Environment

Table 3-12. Primary Soils Series in Proposed Harvest Units.

Soil Series[1]	Limitations/Hazards	Slope[2]	Percent Clay	Erosion Factor (*Kw*)[3]	Coarse Fragments[4]
49F-Honeygrove silty clay loam	Compaction Slumping and scarring, rutting	25-50 percent South slopes	30-40 percent	0.17	0 percent
40G- Harrington-Klickitat Complex	Surface erosion shallow depth windfall	50-75 percent North slopes	20-27 percent	0.20	15-30 percent
41G- Harrington-Klickitat Complex	Surface erosion shallow depth windfall	50-75 percent South slopes	20-27 percent	0.20	15-30 percent

[1] Principal soil series in Soil Data Mart data for Linn County Area, Oregon (USDA Natural Resources Conservation Service, 2005).
[2] Slope values estimated.
[3] Soil erodibility factor, Revised Universal Soil Loss Equation (RUSLE); 0.0-0.2 = readily infiltrated, 0.2-0.3 = intermediate infiltration and moderate structural stability, greater than 0.3 = more easily eroded with low infiltration capacity (Brady 1996, Wischmeier and Smith 1978).
[4] Rock fragments greater than 3 inches in diameter in A and B horizons.

Timber Production Capability Classification (TPCC)

All of the proposed treatments are within areas classified as suitable or suitable but fragile. Areas that are suitable but fragile would utilize design features listed in the TPCC to reduce potential effects to soils.

Non-suitable lands in the project area are predominately areas with high water tables during portions of the year and thus unsuitable for conifer production. Proposed unit boundaries were developed to appropriately avoid areas that are non-suitable. Most of the wet areas are adjacent to streams and wetlands, all of which are within stream protection zones (SPZ) and would not be disturbed.

No areas with high slope gradient or areas prone to mass movement or land sliding are identified in the immediate project area.

During field investigation, very few continuous, linear compacted surfaces (indication of old skid road surfaces) were identified. The few sites that are evident are no longer deeply compacted and appear to have recovered to a disturbance Class 1 level (USFS Forest Soil Disturbance Monitoring Protocol).

Based on field review by the BLM's specialists, outside of the previous skid road network, soil surfaces generally appear to be in a non-compacted state and are covered with a moderately deep layer of surface duff (i.e. partially decomposed organic material, mostly needles, bark and wood, that protect the mineral soil surface). Some slight compaction (increase in bulk density of less than 10 percent relative to un-compacted soils) may persist in the area outside of the visible skid trails and roads as a result of previous logging that was accomplished with heavy ground-based equipment. However, it is difficult to assess how much if any of this disturbance remains because it is obscured by tree growth and the surface duff layer. Random small pits dug by the BLM's specialists did not reveal any compacted soil surfaces beneath the duff and thus it is reasonable to conclude that compaction outside of road and old skid trail surfaces, if it remains at all, is discontinuous and of little consequence to soil properties.

Estimated Compaction

Assuming an average 25 foot wide road footprint on the soil surface, approximately 2.4 percent of the surface area in Bear Creek Frontal, 2.2 percent of Criminal Creek and 2.9 percent of the area is road surface and therefore severely compacted. Only a small portion of the skid trails viewed during field visits to the project area have persisted. Review of LiDAR surface data also indicated few obvious persistent skid road surfaces in the project watersheds although some persistent road surfaces not currently mapped are visible. Based on these observations, a maximum of three percent of these watersheds have moderately compacted surfaces residual from logging.

Based on the preceding observations, a conservative estimate is that together with the estimate of road surfaces, a rough estimate of soil surfaces with discernible compaction is approximately five percent of the projects analyzed watershed. This assumes that conditions viewed on public lands are similar to those on adjacent private holdings.

3.4.2 Environmental Effects

3.4.2.1 The Proposed Action - Regeneration Harvest

Soil Disturbance: displacement and compaction

Following completion of the harvest, the majority of understory vegetation and root systems would remain, along with surface soil litter and slash from harvested trees. The proposed ground-based logging operations are consistent with 2008 FEIS Best Management Practices (BLM) standards and guidelines (pp. C-23, TH-9), less than 12 percent of surface soils would be subject to operations that could result in compaction or soil displacement, and operations would be limited to periods of low soil moisture. The estimated rate of surface erosion, under the worst case scenario, is discussed below.

Compaction, displacement and disturbance of surface soils from ground-based yarding varies greatly with soil moisture, the quantity and type of organic material on the surface (duff and slash layer), slope gradient, area topography, the type of equipment used and the operator of the equipment.

Typical ground based logging proceeds with tree felling and bucking to length (either by fellers with chain saws or, more common in recent years, harvesting machines). Cut trees are then yarded, typically accomplished by rubber tired grapple skidders dragging the trees along designated skid trails back to a landing to be loaded onto trucks for haul. If the ground-based units (58 acres) are treated in this manner, the percentage of total ground area impacted by surface disturbance and soil compaction would be between eight percent and nine percent on the area to be harvested (between 5-6 acres). The intensity of disturbance on skid trail surfaces would vary with the number of equipment passes, soil moisture levels, machinery type, the gradient of the soil surface and the operating habits of the machine operator. Typically, a moderate amount of top soil (duff layer and the top three to six inches of the soil) would be displaced by the equipment wheels.

Moderate to heavy soil compaction (10–20 percent increase in bulk density) in the first 6-12 inches of the top soil would be expected to occur, and wheel ruts up to approximately six inches would be visible corresponding to the tire width of the equipment. This disturbance would be distributed laterally to approximately 12 feet but would be concentrated in the soils beneath the wheel tracks. Duration of the changes to soil physical properties would vary with intensity, soil properties and local site conditions such as climate (precipitation, freeze-thaw) and biological activity (root growth, animal digging, etc.). Without restoration efforts, moderate to heavy soil compaction could take between one to several decades to recover to pre-disturbance levels. This level of disturbance would be expected in a typical ground-based harvesting operation assuming full implementation of BMPs: operation during conditions of low soil moisture, on slopes under 35 percent, and with a careful operator.

A mechanized harvesting system would impose soil disturbance in addition to that caused by tree yarding on designated skid trails. If utilized in place of hand falling, a tracked harvester moves through the area between skid trails, generally on top of a "slash mat" composed of limbs, branches, and organic materials derived from the tree processing. Trees are cut by the machine head, de-limbed and stacked adjacent to designated skid trails for removal. The magnitude of this effect (areal extent) would be approximately 50 percent of the harvest unit. The intensity of the disturbance would be highly variable depending on slash levels, equipment type, soil moisture levels, topography and operator experience level. Soil displacement would be minimal and soil compaction would not be likely to measurably affect bulk density of the soil on surfaces with a single pass by a harvesting machine (Allen et al. 1999). This assumes operation on top of a slash mat, low soil moisture conditions, slopes generally less than 35 percent, and an experienced operator. Pre-disturbance conditions would likely recover within one to two years.

Some of the potentially impacted acreage listed above for ground-based yarding systems includes existing skid trails from previous logging (estimated at 8 percent of the ground based units). Where practical, portions of these existing skid trails would be reutilized for this project. As a result, the amount of acreage for new or additional harvest impacts would be less than the totals listed above.

In skyline yarding areas (including "special yarding"), trees are typically hand felled and limbed before being pulled by suspended cable upslope (yarding) to the landing for loading. Typically one end of the trees being yarded will drag on the forest surface in the cable yarding corridor.

Impacts usually consist of light compaction and surface soil and duff displacement of a strip approximately four feet in width. If the treatment unit were cable harvested, the expected area of disturbance with skid trails would be 4–5 percent of the treatment unit or 2–3 acres.

The intensity of soil disturbance in skyline yarding corridors (from the bottom of the slope to the landing) would not be uniform; varying with topography, the size and number of logs and suspension characteristics. Typically, short stretches (less than 50 feet) of moderately compacted soils (10–20 percent increase in bulk density in the top six inches of the soil profile) with some mixing of the surface duff layer and displacement would be interspersed with longer stretches (greater than 250 feet) of fairly undisturbed soil (i.e. no measureable change to surface bulk density and no discernible soil displacement). Duration of the changes to soil physical properties would vary with intensity and with soil properties and local site conditions of climate (precipitation, freeze-thaw) and biological activity (root growth, animal digging, etc.). Without active restoration efforts, moderate soil compaction could take up to a decade to recover to pre-disturbance levels.

Total construction of new roads would displace topsoil and compact subsoil on 0.4 mile or 1.4 acres (average 30 feet wide). The intensity of this disturbance would be severe with the topsoil and duff removed and/or displaced and the subsoil compacted to a bulk density where it would no longer allow for water infiltration. The roads to be constructed would be predominately on low to moderate topography (grades less than 20 percent), so the total width of the clearing would be around 30 feet. Soil properties at these sites would not recover to pre-treatment conditions without intensive restoration efforts.

Other road work including road maintenance would result in no change in the amount of current non-forest land. Some encroaching vegetation along these roads would be removed, running surface graded, surface rock would be added where needed, and ditch and culvert inlets and outlets cleaned. The road maintenance work would be expected to result in some short term roadside erosion; this would be most likely to occur when the established vegetation in the ditch and culvert catchment areas would be removed while ditch cleaning and road reshaping operations occur. Litter-fall accumulations and vegetation growth generally re-establish within one to two seasons and erosion rates would be expected to return to very low levels thereafter.

Log landing construction and use would compact the soil and displace top soil at the site. However, about half of the surface area used for landings would be existing road surface, which is already compacted. The additional area adjacent to roads that would be needed for landing area is estimated to be approximately one percent of the treated area (0.6 acres). The intensity of soil disturbance and compaction in areas where logs are sorted or decked would be expected to be shallow and relatively quick to recover. However, where equipment turns or backs around multiple times, soil surfaces would experience heavy compaction and disturbance to the top soil layer which could persist for several years to decades following project completion.

Connected Actions

Fuels Treatments

Treatment options include a broadcast burn under spring conditions (high soil moisture, low temperatures), machine piling and burning of piles, and hand-piling and burning of piles.

Machine piling of slash for burning would require additional entry by mechanized equipment with potential for soil disturbance. This would take place under low soil moisture conditions. Extent of surface compaction/disturbance would be two percent of the piled area (1.1 acre). Piling completed under low soil moisture conditions and with operations on top of slash would lead to low to moderate levels of surface compaction and displacement.

Pile Burning

On harvest areas where machine or hand piles are constructed, covered and burned, localized areas of high-severity soil disturbance may occur. In these areas, surface organic material (O-horizon) would be removed, increasing localized potential for soil detachment. However, sediment delivery to streams is highly unlikely, since burn pile areas are outside riparian reserves, widely dispersed, and typically smaller than 20 feet in diameter. Pile burning and rain impact on burned areas can decrease infiltration capacity until natural re-vegetation occurs. Displaced soil would be filtered and retained by the intact vegetation immediately surrounding the burn pile area as well as the riparian reserve. Since burning would occur during wet soil conditions, heat damage to the upper soil layer (A-horizon) would be moderated and only occur in scattered localized sites.

Slashing and Broadcast Burning would create a uniform site preparation condition with low-to-moderate severity soil disturbance, effectively reducing the potential for wildfire, largely retaining the soil and duff layer, and would mimic the natural processes of the historical fire regime of this area (fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html). A broadcast burn executed under moist soil conditions (equal to or greater than 25 percent soil moisture) would maintain the productivity of the site and minimize the incidence of mineral soil exposure conducive to red alder and brush recruitment.

Summary of soil disturbance due to proposed action

There is an overall maximum increase of approximately seven acres (12 percent of the treatment area) in compaction/disturbance of soils under the proposed action. Approximately 33 percent of this disturbance (two acres) would be of low intensity, meaning soil physical properties would likely recover to pre-disturbance conditions, without active restoration, within several years. Approximately 33 percent of this disturbance (two acres) would be severe, meaning soil physical properties are unlikely to recover to pre-disturbance conditions without active restoration. The remaining two acres (33 percent) would be moderately disturbed, meaning soil physical properties would eventually recover to pre-disturbance conditions, without active restoration, following several decades without further disturbance. Active restoration would speed up recovery of soil properties at these locations.

Cumulative Effects

Soil Disturbance: displacement and compaction

The extent of compacted/disturbed soil surfaces in the projects analyzed watersheds as a whole, including road surfaces, was estimated at five percent (approximately 189 acres). Increasing compacted surfaces by seven acres would result in a 0.1 percent cumulative increase in the percentage of compacted surfaces. This magnitude of compaction on a watershed scale is

unlikely to result in any discernible cumulative effect since the compaction is dispersed across the landscape.

At the conclusion of the project the quantity of compacted/disturbed soils would begin to decrease over time from the maximum and would approach current levels, outside of new road surfaces, within a decade as moderately disturbed soil surfaces recover through natural processes (e.g. freeze- thaw, animal and insect burrowing, tree fall, root growth, etc.).

Soil erosion

Degradation of surface soils by erosion is of concern because soil formation is slow. Typical renewal rates for topsoil range from 0.12-0.8 t/ac/yr. (Pimentel 1987). Estimated background surface erosion rates in the project area are in the range of the assumed rate of soil formation, otherwise there would be no surface soil.

The proposal would not lead to any measurable increase in surface erosion, and soil erosion would remain within the range of background rates. Mass wasting is the primary cause of soil erosion in forested regions of the Pacific Northwest and this proposal would have no effect on mass wasting processes (see Hydrology report). Yarding corridors and trails, if sufficiently compacted and disturbed, have the potential to erode and route surface water and sediment into streams; however, field reviews (Hawe 2012) of cable and ground based logging units on the BLM's land during intense rainstorm events from 2007–2012 found no evidence of surface erosion or overland flow on units where erosion models had predicted surface erosion and sediment transport under similar conditions. As noted in these field reviews, several factors prevented surface erosion: 1) even when compacted, large quantities of residual slash on yarding corridors (both machine and cable) contributed to reducing the accumulation of runoff by deflecting and redistributing overland flow laterally to areas where it infiltrates into the soil; 2) gentle to moderate slopes in much of the project area provide little opportunity for surface water to flow; 3) the no-treatment zones in riparian areas have high surface roughness which functions to trap any overland flow and sediment before reaching streams; 4) the small size of trees being yarded limits surface disturbance to minimal levels; and 5) most skid road surfaces are too distant from stream channels to deliver any sediment.

3.4.2.2 Alternative A - Commercial Thinning Harvests

Since the same methods of logging and site treatment would be utilized, a commercial thinning treatment would result in similar effects to the soil as the proposed treatment. Ranges of soil compaction and disturbance levels would be the same as reported for the proposed treatment.

3.4.2.3 No Action Alternative

Under this alternative soil conditions on the project site would continue their current trends (See section 3.4.1 - Affected Environment).

3.5 WILDLIFE

3.5.1 Affected Environment

Variation in forest stand conditions within stands and at the landscape level is a key factor in providing habitat for a diversity of forest organisms (Hayes et al. 1997; Muir et al. 2002). Certain structural and compositional aspects that are important contributors to habitat diversity and species richness include dead wood in the form of snags and down logs, remnant large live trees, and vertical and horizontal variation in tree and understory canopies. Hardwood trees and shrubs are also important contributors to forest biodiversity. All of these elements provide habitat substrate, food sources, foraging substrate, and nesting opportunities for many wildlife species. Although this stand is over 80 years of age, large wood in the form of down logs and snags, remnant old-growth trees and snags, well developed understories, and ground cover are limited.

Snags, Down Logs (CWD), Old-Growth Remnants, and Special Habitats

There are no special habitats present in the project area. The presence or absence of special habitats and the amount of down logs present were based on stand exam data, aerial photos, and field review by specialists and are summarized in Table 3-13.

Table 3-13. Summary of Special Habitats, Old-Growth Remnants, and Down Logs.

Name/Unit	Location	Seral Stage[1]	Remnant trees	Special Habitats	Down Logs (feet)[2]
ThunderKat Timber Management Project Area					
5A, B	10S-2E-05	Early Mature	No	No	60/180

[1]Seral Stage Age Classes (years) based on Stand Exam data: Early Seral = 0-30; Early Mid Seral = 30-40; Mid Seral = 40-60; Late Mid Seral = 60-80; Early Mature Seral = 80-120; Mature = 120-200; Old Growth =200+

[2] Linear feet/acre greater than 19 inch diameter & greater than 20 feet long, hard (decay classes 1-2) and soft (decay classes 3-5) logs.

The BLM's management direction for down CWD in the Matrix is to leave a minimum of 240 linear feet of down logs per acre at the time of regeneration harvest. Logs should be at least 20 inches in diameter at the large end, 20 feet in length, and in hard decay classes 1 and 2 (RMP p. 21).

There is a shortage of large hard down logs in the stand. Most of the existing hard down logs in the project area are less than 20 inches in diameter. Hard logs in smaller size classes are the result of recent blow down and suppression mortality. These small logs are much less useful for forest floor-associated wildlife species because they have less volume, persist for shorter periods of time, and are less thermally stable than larger material.

Existing soft down logs (decay classes 3 to 5) are usually remnants of defective trees that were not removed after harvest or large CWD from the previous stand. There is some large soft material in the stand, but generally it is lacking. These logs provide valuable habitat for down CWD associated wildlife species, including various rodents, amphibians and reptiles (O'Niell et al. 2001), and they persist for many decades before passing through advanced decay classes to become unrecognizable as down logs.

Table 3-14 summarizes the snags currently present in the project area. A diameter of 15 inches and greater was used because most wildlife species that utilize snags are associated with snags greater than 14.2 inches (Rose et al. 2001). Smaller material has less volume, thus providing less habitat, and does not persist as long in the forested environment as larger snags. According to stand exam data, most of the existing snags are less than 20 inches dbh.

Table 3-14. Summary of existing snags (at least 15 feet tall) per acre by project unit

Unit #	Snags 15-25 inches dbh		Snags greater than 25 inches dbh		Total snags greater than 15 inches dbh	
	Hard	Soft	Hard	Soft	Hard	Soft
5A,B	1.6[1]	1.6*	0	0+[1]	1.6	1.6+

[1]The use of 0+ in the table denotes trace numbers of snags present that did not appear in the stand exam.

The snag habitat within the proposed unit consists mainly of smaller diameter snags less than 20 inches dbh. There are very few large snags over 25 inches dbh. There are no known old-growth remnants in the stand. There is a component of large (greater than 35 inches dbh) second growth. Stand exams indicate that there are four to five of these large trees per acre. Green tree retention would focus on leaving these large trees.

Special Status Species, Survey & Manage Species, and Species of Management Concern
The ThunderKat Timber Management Project EA Wildlife Report lists BLM Special Status/Species of Concern documented or suspected to occur in the Thunder Kat Project Area based on field inventories of the habitats present and a review of the existing literature. Stand exam data indicates that the stand proposed for thinning lacks habitat elements that support diverse populations of wildlife species, especially large old-growth trees, large snags, down logs, deciduous understory and ground cover vegetation.

Federally Listed Species

Northern Spotted Owl

The proposed units provide 58 acres of suitable habitat in the Thomas Creek Watershed. None of the units are located in 2012 Critical Habitat or unmapped Late Successional Reserves (LSRs). None of the units meet the stand level conditions characteristic of Recovery Action (RA) 32 habitat according to the Northern Spotted Owl Recovery Plan (NSO 2011 pp.III-67-68). The suitability of the habitat for spotted owls is marginal due to a lack of down CWD, large old-growth trees and snags for nesting and prey habitat.

There is one historical known spotted owl site within the provincial home range (PHR) radius (1.2 miles) of the ThunderKat Timber Management Project. The South McCully known owl site was last occupied by a resident single male in 1999. The last response was that of a male in 2003. There have been no spotted owl responses during surveys since 2003. Occupancy by a pair has never been confirmed at the site. The site is not viable due to a lack of suitable habitat and its location in the foothills of the Cascades close to rural resident areas adjacent to the Willamette Valley. Barred owls have occupied the site since 1999 and fledged three young in 2002.

Survey and Manage Species

Red Tree Vole

The red tree vole is a Category C (uncommon pre-disturbance surveys practical) Survey and Manage species under the Northwest Forest Plan. It is an arboreal vole associated with conifer forests west of the Cascades summit, below about 3,500 feet. The project area is within the elevation range of the Northern Mesic Zone of the geographic distribution of this species. Units 5AB meet the stand-level criteria as described in the Red Tree Vole Protocol (Huff et al. 2012). Surveys for red tree voles were conducted in all of the stands originally proposed for treatment 80 years of age and older (IM-OR-2011-063, "2006 Pechman Exemptions," 2011). Originally, 221 acres of 80 year old plus stands in four separate survey areas were surveyed for red tree voles. A total of 40 trees were climbed, confirming the presence of ten active red tree vole nests and seven inactive nests. As a result 93 acres of potential treatment area were dropped from the proposal. Red tree voles were found in units 10S-2E-13A and B, and three habitat areas were established. No red tree voles were found in the units proposed for harvest (10S-2E-5AB). Currently, 58 acres out of the 221 acres originally considered for treatment remain as part of the proposal.

Mollusks and Amphibians

Habitat, range data, and previous surveys for mollusks and amphibians conducted over 9,000 acres on the Cascades Resource Area since 1991 indicate that no Bureau Sensitive mollusks or amphibians are likely to be present in the proposed thinning unit. Surveys for Bureau Sensitive and Survey and Manage mollusks were conducted during the fall of 2013 and the spring of 2014. No Bureau Sensitive or Survey and Manage species were found. No impacts to Bureau Sensitive or Survey and Manage mollusk species are anticipated.

BLM Special Status Species and Survey and Manage Species

Migratory and Resident Bird Species

The project area is located in the Western Oregon Cascades Physiographic Province. About 125 bird species are documented or suspected to nest on the BLM lands in the Cascades Resource Area (Altman and Hagar 2007, Altman 2012, Marshall et al. 2003), of which 36 species are priority bird species of conservation concern (PIF 2012). There are no Bureau Sensitive birds documented or suspected to occur in the ThunderKat Timber Management project area. The Partners in Flight (PIF) conservation plan, which addresses the Western Oregon Cascades, is the Conservation Strategy for Landbirds in Coniferous Forest of Western Oregon and Washington (Altman 2012).

Some recent studies have correlated bird species richness at the stand level with habitat patchiness, densities of snags, and density by size-class of conifers (Hagar, McComb, and Emmingham 1996, Hansen et al. 1995). Even-aged conifer stands provide habitat for a relatively high abundance of a few bird species, many of which feed on insects gleaned from conifer foliage. The most common species include chestnut-backed chickadee, Pacific-slope flycatcher, hermit warbler, golden-crowned kinglet, varied thrush, winter wren, red-breasted nuthatch, and Swainson's thrush.

The project area is in an early mature stand which has been thinned and high graded in the past, removing the old-growth and much of the large tree component and leaving a stand characterized by a lack of snags and CWD and lack of well-developed understory and ground cover. The understory vegetation does not provide for a diverse community of shrub and ground cover plant species that are important in providing insect and plant food resources for bird species (Hagar 2004). Although lacking in the stand proposed for treatment, adjacent stands contain hardwoods and thinned areas which provide better-developed understories. Old-growth trees, CWD and snags are lacking throughout the area.

Bats

There are no Bureau Sensitive bat species suspected to occur in the project area; however, four bat species of concern are suspected to occur (silver-haired bat, long-eared myotis, long-legged myotis, and Yuma myotis). These species are associated with caves and mines, bridges, buildings, and cliff habitat. Decadent live trees and large snags with bark attached that extend above the tree canopy are used by bats associated with Douglas-fir forests as solitary roosts, maternity roosts, and hibernacula (Christy and West 1993, Weller and Zabel 2001, Waldien et al. 2000). None of these features are present in the project area.

Big Game

Big game species found in the vicinity include Roosevelt elk (Cervus elaphus roosevelti) and black-tailed deer (Odocoileus hemionus). The proposed unit is in early mature habitat located at low elevations mostly on southerly aspects, which provides hiding and high quality thermal cover, but lacks high quality forage due to poorly developed ground cover. The 1995 RMP identified no critical winter or summer range in the project areas (RMP p.26). There is big game use throughout the year due to the area's location at elevations below the seasonal snow zone.

Early seral stage stands are abundant in the Thomas Creek Watershed on private industrial timber lands, but they do not provide high quality early serial habitat. The objectives of intensive forestry practices utilized on private industrial timber lands are for maximum economic return from conifer timber. Harvest is usually done on large tracts based on ownership, timber volume, road systems and logging feasibility. Vegetation, which would otherwise provide browse, forage species diversity and understory development, is typically suppressed with herbicides and/or cutting on private lands. This is done because the vegetation competes with conifer growth and establishment. Conifer density is managed to fully utilize growing space which restricts light reaching the understory as the canopy closes. Species composition of private plantations is typically monoculture, or at least limited to very few conifer species. The young and mid-seral stage habitat provided by these practices is generally low quality, lacking in the species diversity, structural elements and spatial diversity associated with high quality young and mid-seral stage habitats.

3.5.2 Environmental Effects

3.5.2.1 The Proposed Action - Regeneration Harvest

There would be a removal of 58 acres of early mature forested habitat in the Middle Thomas Creek Watershed. This habitat would be converted to early successional habitat. As a result,

there would be effects to wildlife species associated with late successional habitat. The conversion of this habitat would have positive effects to early successional associated species, such as some Neotropical migratory birds that prefer early seral stages and foraging and big game species such as deer and elk. The adverse effects of regeneration harvest on wildlife habitat include removal of canopy cover and loss of standing snags.

Following harvest, pioneer species would regenerate and occupy the site providing habitat for early seral associated wildlife species. After planting, vegetative succession would move the site towards being predominately even-aged Douglas-fir and western red cedar. Some western hemlock and grand fir is expected to naturally regenerate.

In the long term, late-successional habitat conditions in the harvest units would not be achieved again until the stand develops in size (estimated to be 70 to 80 years).

Snags, Down Logs, Old-Growth Remnants, and Special Habitats

As wildlife design features, 10 to 12 large green trees per acre would be retained for the recruitment of standing dead/down CWD and development of a large green tree component in the future stands. Existing snags of any size would be retained where operationally practicable and where they do not pose a safety hazard. Snags that are felled for operational or safety purposed would be reserved on site as down logs. Existing CWD meeting 1995 RMP standards of at least 20 inches diameter (large end) and 20 feet long would be retained wherever feasible and would be protected from logging damage. Skid trails and operating techniques would be designed that require minimal movement of CWD to protect its physical integrity (RMP p. 21).

The additional green trees over and above the six to eight required in the Matrix LUA (RMP p. 21) would be left to compensate for snag deficit conditions and loss of up to 90 percent of snags in the harvest units and peak flows (EA section 3.2.2.1). In the long term, additional green tree retention could provide deadwood input into this stand till it slowly passes through decay classes and rots away or a stochastic event like fire removed the material. Snag densities and CWD levels, would meet NWFP standards, by the completion of the project.

Within regeneration harvest units, up to 90 percent of existing snags could be lost during falling, yarding, and site preparation. Snags which are small diameter, tall relative to their diameter, and/or in more advanced stages of decay are highly likely to be felled or knocked over during falling, yarding, and site preparation. These snags typically constitute a large proportion of the total number of snags in a stand. A snag's likelihood of remaining standing after operations increases with increasing diameter. Shorter snags with less decay also remain intact in higher percentages than tall, unstable, and/or decaying snags.

The loss of snags would result in a loss of existing habitat features for primary excavators (woodpeckers) and secondary cavity users, such as songbirds, bats and small mammals within the harvest units. There would be a loss of cover around the surviving standing material, leaving them more exposed in an open environment. Habitat for species such as the pileated woodpecker, which use snags in late successional habitat, would be adversely impacted.

Conversely, habitat would improve for species such as the western bluebird that utilize snags in more open environments. Any snag felled or that falls incidental to operations would be retained on site as CWD. This CWD would provide important habitat for a key group of dead-wood associated species (Aubry 2000, Bowman et al. 2000, Butts and McComb 2000).

Creation of up to two snags per acre, as provided for in both alternatives, would provide future snag habitats for snag dependent species greater than is currently available and consistent with the provisions of the NWFP. One additional tree may be felled for CWD creation, to meet NWFP requirements, following post-harvest monitoring.

Microhabitat drying and direct impacts to existing snags and CWD due to logging and site preparation activities are anticipated within and, to a lesser extent, around the perimeter of the harvest units. Microhabitat drying due to the loss of canopy cover would make existing CWD and snags less suitable for wildlife species that utilize this material. Large diameter CWD in advanced decay condition (decay class three to five) would persist as the canopy closes and contribute to forest-floor wildlife habitat conditions for many decades before becoming unrecognizable as down logs.

Broadcast burning could result in the loss of additional standing dead material and charring of down CWD, depending upon the timing and intensity of the burn. The BLM would implement project design features (Table 2-6 Project Design Features; Numbers 23 - 26), for fuel treatments to minimize impacts to residual green trees existing and CWD. However some damage to green trees and existing CWD may occur. Some trees may die as a result of broadcast burning, which would contribute to snags and CWD in the future life of the stand. .

Special Status Species, Survey and Manage Species, and species of management concern
Federally Listed Species

Northern Spotted Owl

Regeneration harvest may affect, and is likely to adversely affect the spotted owl due to the removal of 58 acres of suitable habitat. Suitable habitat would be converted to early seral stage capable habitat. Suitable spotted owl habitat conditions in the regeneration harvest units would not be achieved again for 70 to 80 years.

The proposed treatment units are not within the provincial home range radius of any known spotted owl sites. The ThunderKat Timber Management Project is in compliance with the Final Recovery Plan for the Northern Spotted Owl (USFWS, 2011). The habitat is not located in LSR or critical habitat and does not meet the criteria for RA 10 or RA 32. No incidental take of spotted owls is expected to occur as a result of regeneration harvest. Table 3-15 on the following page describes the anticipated spotted owl habitat medication.

Table 3-15. Spotted Owl Habitat Modification for the Proposed Action

TRSU	Proposed Treatment[1]	Acres	LUA[2]	Pre/Post Treatment Habitat Type[2]	Habitat Modification[3]	Effect[4]
10S-2E-5	Regeneration Harvest	60	Matrix GFMA	Suitable/Capable	Remove	LAA

Notes and definitions for Table (BA pp. 2-3, 4; BO pp. 9-10, 17-19).
[1] Treatment Type: Regeneration harvest is the removal of most or all of the overstory. The only remaining standing trees would be retained green trees, snags, or coarse woody debris recruitment trees. The habitat lost is canopy cover, roosting and nesting trees, foraging areas, and some large CWD.
[2] Habitat Types: **Capable Habitat** are capable of producing suitable northern spotted owl habitat in the future, regardless of current habitat. In the case of ThunderKat, suitable habitat would be removed, converting the suitable habitat to non-habitat that is capable of becoming suitable habitat again in 70 to 80 years. **Dispersal Habitat** consists 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). Generally, spotted owls use dispersal habitat to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal only habitat lacks the optimal structural characteristics needed for nesting. **Suitable habitat** consists of forested stands used by spotted owls for nesting, roosting and foraging (NRF). Generally, these stands are conifer-dominated, 80 years old or older, and multi-storied in structure, and have sufficient snags and down wood to provide opportunities for owl nesting, roosting and foraging. The canopy closure generally exceeds 60 percent. Suitable habitat also functions as dispersal habitat.
[3] Habitat Modifications: **Remove** refers to Silviculture activities that alter spotted owl suitable habitat such that the habitat no longer supports nesting, roosting, foraging, and dispersal. In the case of ThunderKat, removal of suitable habitat means to alter suitable habitat to capable non-habitat.
[4]Effect: LAA: May affect and likely to adversely affect.[i]

Survey and Manage Species

Red Tree Vole

There would be a loss of 58 acres of marginally suitable red tree vole habitat in the Thomas Creek Watershed as a result of regeneration harvest. The stand was surveyed for red tree voles and none were found. In the short term, undetected nest sites within suitable habitat could be damaged or destroyed during logging activities.

Mollusks and Amphibians

No impacts to Bureau Sensitive or Survey and Manage mollusk species are anticipated.

Other species of concern

Migratory and Resident Birds

Habitat modification activities that disturb vegetation may unintentionally take birds, eggs and nestlings during the nesting season. A seasonal restriction for nesting birds has been recommended from April 1 to July 15. If habitat modification activities are avoided during this window, unintentional take would be greatly reduced (Altman, Hagar 2007).

Broadcast burning could result in unintentional take of birds, eggs, and nestlings if it occurs during the nesting season. Burning would occur after habitat modification activities (felling and yarding) are complete. Impacts would be limited to birds that nest on the ground, in highly

disturbed slash and debris remaining after logging.

Regeneration harvest of mature conifer stands would immediately decrease habitat suitability for species which prefer late successional conditions for nesting, foraging, and/or roosting. Removing mature forests is expected to have negative long term effects on nesting for the black-throated gray warbler, brown creeper, chestnut-backed chickadee, Cooper's hawk, golden-crowned kinglet, Hammond's flycatcher, hermit warbler, northern goshawk, northern pygmy-owl, northern saw-whet owl, pileated woodpecker, red-breasted sapsucker, red crossbill, varied thrush, Vaux's swift, and winter wren. Individuals of these species may be displaced from regeneration treatment areas, but would find refugia in nearby untreated stands. Late successional habitat conditions in the regeneration harvest units would not be achieved again for 70 to 80 years.

Regeneration harvest would increase habitat suitability for species that prefer early seral conditions, edge habitat, and openings in the forest environment. Species of Conservation Concern that would benefit from regeneration harvest include the common nighthawk, MacGillivray's warbler, orange-crowned warbler, rufous hummingbird, spotted towhee, western bluebird and willow flycatcher.

Bird diversity in Pacific Northwest conifer forests is usually higher in regenerating stands that have early successional vegetation combined with some mature overstory trees than in intact mature forest or clearcuts without residual structure (Hansen and Hounihan, 1996). The olive-sided flycatcher would benefit from the development of a two-storied stand in the future. Overall bird species richness (a combination of species diversity and abundance) would increase due to greater foraging opportunity for a greater number of species.

Bats

There would be a loss of 58 acres of early-mature seral habitat, which would be converted to early seral habitat for foraging bats. There would be a loss of up to 90 percent of the existing snags within the proposed unit due to logging and site preparation activities. Microhabitat drying and direct impacts to existing snags are anticipated within and around the perimeter edge of the harvest units. However, the habitat quality for bats is currently poor due to the lack of suitable snags and other primary habitat features for bats. The four bat species of concern suspected to occur in the project area are associated with caves and mines, bridges, buildings and cliffs. These habitat features are not present in the stand proposed for treatment. Decadent live trees, and large snags with sloughing bark, especially those that extend above the stand canopy are also used by bats. There are few snags within the proposed unit and no large snags with sloughing bark. Late-successional forests with abundant large snags and decadent trees provide higher quality roost sites than younger forests, and many bat species prefer older forests (Thomas and West 1991, Perkins and Cross 1988).

Big Game

There would be a loss of 58 acres of thermal and hiding cover, which would be converted to early successional foraging habitat as a result of timber harvest. Vegetative forage such as saplings, shrubs, grasses, and forbs would increase as a result of regeneration harvest. Broadcast burning is expected to further increase the quantity and quality of the forage. An increased

vegetative response is anticipated as a result of burning, and this initial flush of vegetation would last up to three years. As a result of increased light and burning, forage quantity and quality would increase and attract foraging elk and deer to the treated areas. Analysis shows that early successional habitat is lacking on the BLM lands in the watershed.

In the short term, big game species would be disturbed during the implementation of the proposed action. Logging equipment noise and human presence may cause animals to avoid or disperse from the project areas temporarily. In the longer term, the road system into the project area is consistently gated, which greatly reduces the disturbance factors in the area.

In the long term (10+ years), thermal and hiding cover quality would gradually increase, and vegetative forage would gradually decrease as a result of canopy closure decreasing the amount of light reaching the forest floor with the development of a young vigorous conifer stand.

Cumulative Effects

Late-Successional Habitat

The amount and distribution of late-successional forest habitat affects many wildlife habitats including snags, CWD, and old-growth remnants. Most of the Special Status Species and species of concern addressed in this report are associated with late successional habitat. These include the spotted owl, red tree vole; many bat species, and some of the priority bird species.

The project area is located in the Thomas Creek 5th field watershed. The ThunderKat Timber Management Project, along with other planned projects in the foreseeable future, would retain over 15 percent of late successional habitat on federal lands in the Thomas Creek Watershed after implementation (NWFP p. C-44; RMP p. 25).

Table 3-16 on the following page shows the seral stage distribution of BLM lands in the project area watersheds.

Table 3-16. Summary of the BLM Acres in Different Seral Stages

Watershed	Seral Stage (acres)						
	Early	Mid-Seral			Late-Seral		
		Early-mid	Mid	Late-mid	Early-mature	Mature	OG
Thomas Creek 5th Field	1,533	1,236	3,882	1,814	1,087	1,419	1,659
Proposed					60		
Past projects		127	490	86	10		
Future projects		109	791	294	34		
Middle Thomas 6th Field	291	109	649	528	509	108	317
Proposed					60		
Past thinnings			88	44	10		
Future projects		109	224	159			
Bear Creek 7th Field	55	0	117	236	110	11	0
Proposed					29		
Past thinnings			54	44	10		
Future projects							
Criminal Creek 7th Field	31	0	184	143	95	64	14
Proposed					28		
Past thinnings							
Future projects			148	76			

The Thomas Creek Watershed is 75,066 acres and the BLM manages about 12,630 acres (17 percent) of the watershed. The remaining 83 percent of the watershed is managed primarily by private industry. These lands are managed for forestry purposes according to the Oregon Forest Practices Act (OFPA), and late successional habitat on non-federal lands are not expected to persist in the long term (20+ years). In the future, the average rotation ages when final harvest occurs would be less than the stand ages necessary to attain late successional conditions. For these reasons, private lands would not contribute to late successional conditions in the future. Currently, late successional forests comprise 33 percent of the federal ownership in the watershed. About 70 acres of regeneration harvest have been implemented in the Thomas Creek Watershed on the BLM's land since the inception of the NWFP in 1995. The ThunderKat Timber Management Project proposes to perform regeneration harvest on 58 acres (less than two percent) of late successional forests on the BLM lands.

The project area is located in the Middle Thomas Creek 6th field watershed, which is 20,826 acres in size and contains 2,511 acres (12 percent) of the BLM lands. Currently, late successional forests comprise 37 percent of the BLM ownership in the watershed. The ThunderKat Timber Management Project proposes to regeneration harvest about six percent of these late successional forests on the BLM lands in the Middle Thomas 6th field watershed.

The ThunderKat Timber Management Project is located in the Bear and Criminal Creek 7th field watersheds. Together they are 3,777 acres, of which 1,060 acres (28 percent) are managed by the BLM. Currently, late-successional forests comprise 28 percent of the BLM ownership in these watersheds. The ThunderKat Timber Management Project proposes to regeneration harvest about 19 percent of the remaining late successional forest on the BLM lands in the Criminal and Bear Creek 7th field watersheds.

At the local scale of the BLM parcel in which the project would occur, 58 acres (54 percent) of the total 108 acres of late seral forest is proposed for regeneration harvest.

There would not be any additional increases in open road densities due to the regeneration harvest proposal.

Snags, Down Logs (CWD), Remnants, and Special Habitats

Since these components are most abundant and closely associated with late successional habitat, cumulative effects to these components follow closely the cumulative effects to late successional habitat. Snags and CWD on over 98 percent of the late successional habitat on federal lands in the Thomas Creek Watershed would remain. However, more negative cumulative effects to snags, CWD and associated species are expected at the local level. At the site-specific scale, 47 percent of the snags and CWD would remain undisturbed in section five where the ThunderKat Timber Management Project would occur.

Special Status Species, Survey and Manage Species, and species of management concern

Federally Listed Species – Northern Spotted Owl

Cumulative effects to spotted owls and their habitat were analyzed at the watershed level and are contained in the pertinent watershed analysis (TCWA pp. 42-45, 84-85, p. 96).

The proposed project would have minimal cumulative effects on northern spotted owl dispersal because the area offers limited value dispersal habitat due to scattered federal ownership and its location in the foothills of the Cascades. The North Santiam Corridor and the Willamette Valley act as effective barriers to dispersal (TCWA p. 85). The Thomas Creek Watershed was found not to be critical for the dispersal of spotted owls within the Oregon Cascades Physiographic province (TCWA p. 96). No harvest would occur within the provincial home range of any known spotted owl sites and dispersal habitat would be maintained between known spotted owl sites and LSRs. Therefore, the proposed action would not contribute to cumulative effects to spotted owls.

Survey and Manage Species

Red Tree Vole

Due to the harvest of mature forest habitat in the Thomas Creek Watershed, there could be local effects to the red tree vole. The cumulative effect on late successional forest habitat for these species was analyzed at various scales. The proposed regeneration harvest would result in the loss of less than two percent of the late successional forest on federal lands in the Thomas Creek Watershed. After harvest, the watershed would remain above the late successional habitat guideline of 15 percent on federal lands after implementation (NWFP p. C-44; RMP p. 25).

Other Species of Concern

Migratory and Resident Birds

As a result of the harvest of 58 acres of mature forested habitat, habitat fragmentation would occur and priority species which prefer closed canopy forested habitat would be affected at the local level. Other priority species which prefer early successional habitat and open areas and edges would benefit from regeneration harvest of mature forest. At the various watershed levels analyzed and at the regional scale, this alternative would not reduce the persistence of any priority bird species. Analysis shows that early successional habitat is lacking on the BLM lands in the watershed.

Bats

Cumulative effects to bats would be low and follow closely the cumulative effects to snag and late successional habitat. Habitat quality for bats is poor due to the lack of suitable snags and other primary habitat features for bats.

Big Game

As a result of the harvest of 58 acres of mature forested habitat, cover would be converted to open forage areas at the local level. Thermal and hiding cover would become early successional habitat which would provide forage and edge habitat for big game. Broadcast burning would improve the quality of the forage habitat. At the local level 47 percent of the mature forest cover would remain intact. At the various watershed levels analyzed, this alternative would result in minimal cumulative effects. Analysis shows that early successional habitat is lacking on the BLM lands in the watershed, particularly early seral habitat less than ten years of age. Typically, privately held timberlands are not broadcast burned following a regeneration harvest. Broadcast burning, as proposed under this alternative would provide a release of nutrients for post-burn vegetation growth and diversity.

In conclusion, this project would not contribute to the need to list any Bureau Sensitive Species or species of concern under the Endangered Species Act (BLM 6840) because late successional habitat would remain at the site-specific scale, sub watershed basin (SWB) scale, the watershed level, the provincial scale, and the regional scale.

3.5.2.2 Alternative A - Commercial Thinning Harvests

The proposed treatment would have both short (less than five years) and long term (more than five years) effects. In the short term, thinning would result in a reduction of suppression mortality and canopy cover. In the longer term, there are trade-offs in terms of a loss of smaller diameter suppression mortality that would occur without thinning versus an increase in stand complexity as a result of thinning. While thinning these stands would reduce the number of small diameter (less than 15 inches dbh) snags that would otherwise die from suppression mortality, there would be an increase in understory development, crown structure and growth of the residual conifers. The long-term effect of thinning would be increased canopy structure, tree diameters, spacing of the leave trees, understory and ground cover development. Stand conditions and structural complexity would improve as canopies close and thus improve habitat quality for mid to late successional wildlife species.

Research that has occurred since the 1980s has determined that it is possible to develop desired structural and compositional diversity in young managed stands through specific actions (Bailey and Tappeiner 1997, Chan et al. 2006). Thinning forest stands reduces competition between the remaining overstory trees and increases the availability of solar radiation to the forest floor (Hayes, Weikel and Huso 2003). Growth, size, branch diameter, and crown ratio of the remaining trees increases and development of understory and ground cover vegetation is stimulated. These changes effectively increase structural complexity and alter habitat quality. The increase in structural diversity would improve habitat for many species by providing more opportunities for foraging, nesting/breeding, resting, hiding and escape cover/habitat for a variety of species in the forest environment, including invertebrates, songbirds, and small mammal species.

Proposed road construction, skid trails, and skyline corridors under Alternative A would create narrow linear openings through the vegetation, disturbing, reducing or removing ground vegetation and creating breaks in the canopy, which would allow more light to reach the forest floor. The effects on wildlife habitat would be a short-term disturbance and reduction in ground vegetation and canopy closure that would increase access to the stand by certain wildlife species, specifically larger mammals such as big game, coyotes, and avian predators. In the long term, ground vegetation would become re-established due to increased light to the forest floor, and the breaks in the canopy would close.

This alternative includes up to four one-acre low retention areas. These openings would increase understory layering, structural diversity and ground cover, adding complexity at both the forest stand and landscape levels. Species expected to benefit from low retention areas are ruffed grouse, Wilson's warbler, warbling vireo, song sparrow and big game species.

Snags, Down Logs (CWD), Remnants and Special Habitats
Thinning these stands would reduce the number of small diameter (less than 15 inches dbh) snags over the next 10 to 30 years because thinning from below removes the smaller suppressed and intermediate trees that would otherwise die from suppression mortality and become snags within that time period. Also, some of the existing smaller diameter/taller snags (between 9 and 15 inches dbh and greater than 25 feet tall) would be felled for safety reasons or fall incidental to

thinning operations. These smaller snags have less value for wildlife species than the larger material over 15 inches (Rose et al. 2001). Within thinning units, approximately 90 percent or more of existing snags over 15 inches diameter would remain standing after treatment, retaining the best available habitat. Ten percent or less of these large snags may need to be felled to maintain safe project operations.

In unmanaged forests, the presence of cavity nesting birds has been linked to the presence of snags, particularly greater than 50 cm (19.26 inches) (Carey et al. 1991, Huff and Raley 1991). Snag associated species such as chestnut backed chickadees, red breasted nuthatches, brown creepers and hairy woodpeckers have shown selectivity to foraging habitats based on deciduous trees, large diameter conifers, and large diameter heavy decayed snags and logs (Weikel and Hayes 1999).

Up to two trees per acre would become snags or down logs through logging where leave tree damage occurs and reserve trees are felled and left to facilitate logging. All felled snags and reserve trees would remain on-site as down CWD, providing important habitat for dead wood associated species.

Small dead wood created through suppression mortality would be abundant in adjacent untreated areas. There would be an abundance of untreated areas to provide small dead wood from suppression mortality.

Throughout the project area, approximately 35 to 40 green trees per acre would be retained for green trees and recruitment of snags and down logs in the future stands (RMP p. 25). As a result of thinning, growth of residual live trees would accelerate, so that larger trees would be available sooner for recruitment as snags and down logs than without thinning.

Existing large diameter down logs in more advanced decay conditions would persist and contribute to forest floor wildlife habitat conditions for many decades before passing through decay class five to become unrecognizable as down logs. It is anticipated that less than ten percent of existing down CWD would be directly impacted by logging. Less than ten percent of the thinning area would be directly impacted by skidding/yarding, which is the operation with the highest potential impact to existing CWD. The BLM oversight of skyline corridor and skid trail locations would avoid impact to high value CWD wherever feasible.

There would be no effects to old-growth remnants since the proposed unit lacks these structures.

As a result of increased growth rates of retained trees and snag/CWD creation, the 1995 RMP guidelines for snags (40 percent maximum population densities) and down logs (240 plus linear feet per acre of material in decay classes 1 or 2, at least 20 inches in diameter at the large end, and 20 feet in length) in the Matrix could be met in one to three decades.

Special Status Species, Survey and Manage Species, and other species of management concern

Federally Listed Species

Northern Spotted Owl

Alternative A may affect, and is likely to adversely affect the spotted owl due to down grading of suitable habitat to dispersal habitat as a result of thinning. The proposal is to thin 58 acres of suitable habitat in the Thomas Creek Watershed. The unit is not located in 2012 Critical Habitat or unmapped Late Successional Reserves.

Alternative A is consistent with the Revised Northern Spotted Owl Recovery Plan (NSO 2011) and conforms with Recovery Actions 10 and 32. Recovery Action (RA) 10 recommends conserving existing known spotted owl sites with high value habitat (NSO 2011 p. III-43). No harvest would occur within the provincial home range radius (1.2 miles) of any known active spotted owl site. RA 32 recommends land managers maintain high quality suitable habitat. Since the proposed unit does not meet the stand level conditions characteristic of RA 32 habitat (NSO p. III-67) there would be no alteration of RA 32 habitat.

The short term effect of thinning would be downgrading 58 acres of suitable habitat to dispersal habitat. Downgrading refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat. Suitable habitat would be downgraded, but dispersal habitat would be maintained after treatment. Maintaining habitat means thinning in which forest stand characteristics are altered but the components of spotted owl habitat are maintained such that spotted owl life history requirements are supported. For spotted owl dispersal habitat, a canopy cover of over 40 percent along with other habitat elements (including snags, down wood, tree-height class-diversity, and older hardwoods) would be maintained post treatment to adequately provide for spotted owl dispersal.

As the thinned stand grows, habitat conditions would improve. Canopy closures would increase and the downgraded stand could attain suitable habitat conditions again within 10 to 30 years. Subsequent treatments to create snags and down logs would help move these stands toward suitable habitat conditions.

Survey and Manage Species

Red Tree Vole

The stand was surveyed for red tree voles, and none were found. The habitat is considered to be marginal; however it is suitable for red tree voles. In the short-term, undetected nests could be destroyed or disturbed during thinning. Thinning can temporarily inhibit dispersal and make habitat less suitable because of wider spacing between crowns (Hayes et al. 1997). After thinning, stand conditions would improve over time as canopies close.

Mollusks and Amphibians

No impacts to Bureau Sensitive or Survey and Manage mollusk species are anticipated.

Other species of concern

Migratory and Resident Birds

With the recommended seasonal restriction from April 1 to July 15, the effects to breeding migratory and resident birds would be greatly reduced. The effects of thinning would be short term, and would not reduce the persistence of any bird species in the watershed or populations at the regional scale.

Some individual birds may be displaced during harvest operations in the project area due to disturbance. Adjacent untreated areas and areas where active operations are not occurring would provide refuge, which would minimize short-term disturbance.

Changes in habitat structure would have immediate effects on bird communities in thinned stands. Thinning would immediately enhance habitat suitability for species which prefer a less dense conifer canopy, and reduce habitat suitability for species that prefer more continuous conifer canopies. Reducing the canopy closure and opening up stands is expected to have short term negative effects on the brown creeper, golden-crowned kinglet, hermit warbler, Pacific-slope flycatcher and varied thrush. Thinning would have positive long term effects on this same set of species as understories develop and habitat quality improves.

Overall bird species richness (a combination of species diversity and abundance) would gradually increase as hardwood components develop, plant species composition becomes more complex, and hardwood shrub layers, epiphyte cover, and snag density become more prominent within the stands. The future development of hardwood/deciduous tree/bush components and canopy layers would favor species such as the band-tailed pigeon, ruffed grouse, red-breasted sapsucker, Wilson's warbler, Hutton's Vireo and black-throated gray warbler. The low retention areas would encourage the development of hardwood/deciduous tree/shrub components and canopy layers more rapidly and would further benefit this same set of species.

Bats

Adverse impacts to bat species would be low. Old-growth forests provide higher quality roost sites than younger forests, and many species prefer older forests (Thomas and West 1991, Perkins and Cross 1988). There are few snags within the unit proposed for thinning. Bat activity appears to be higher in thinned versus unthinned stands. Structural changes in stands caused by thinning may benefit bats by creating habitat structure in young stands that bats are able to use more effectively (Humes, Hayes, Collopy 1999). Bat species are also associated with buildings, bridges, mines, cliff crevices and caves. None of these features are present in the project area.

Big Game

Big game species would be temporarily disturbed during the implementation of the proposed thinning. Logging equipment noise and human presence may cause animals to avoid or disperse from the project area during times of operation. Thermal and hiding cover quality would decrease in the short term as a result of thinning, new roads, and road improvements (Cole et al. 1997, Trombulak and Frissell 1999). Saplings and vegetative forage such as shrubs, grasses and forbs would increase because of thinning and road closures after thinning. As a result of increased light, forage quantity would increase and attract early successional species such as elk

and deer to the thinned areas. This response of early seral plant species would be especially evident in the low retention areas.

In the long term (five plus years), thermal and hiding cover quality would increase and vegetative forage would gradually decrease as a result of canopy closure. Vegetative forage would persist longer in low retention areas.

Cumulative Effects

The ThunderKat Timber Management Project area is located in the Thomas Creek 5th field watershed. Refer to Table 3–16 for seral stage acreages of the BLM lands in the Thomas Creek Watershed and various SWB which contain the ThunderKat proposal, that show past, present and planned future commercial thinning projects on the BLM lands. Most of the thinning that has occurred or is planned for the foreseeable future is targeted for mid seral stands 35 to 74 years of age.

Snags, Down Logs (CWD), Remnants and Special Habitats

Thinning these stands would reduce the number of small diameter (less than 15 inches dbh) snags over the next 10 to 30 years that would otherwise die from suppression mortality and become snags. Analysis shows that 69 percent of the mid to late successional stands in the Middle Thomas SWB would remain untreated. Smaller scale analysis shows that on the BLM ownership in the immediate vicinity of the treated areas, 45 to 50 percent of these stands would remain untreated. Small dead wood would still be present and available in adjacent untreated areas. Design features would retain existing down logs greater than 20 inches dbh and snags greater than 15 inches dbh. Any snag that falls for any reason as a result of thinning operations would remain on-site to become down CWD, providing important habitat for a different, but also key group of dead-wood associated species (Aubry 2000, Bowman et al. 2000, Butts and McComb 2000).

Up to two trees per acre would become snags or down logs through logging where leave tree damage occurs and reserve trees are felled and left to facilitate logging.

Beneficial long term cumulative effects to larger CWD and associated wildlife species would occur as a result of implementing the project, since larger trees would be available sooner than without thinning to contribute additional large snags and CWD recruitment in future stands. As larger trees develop in the residual stands, they would provide source material for girdling and topping.

Special Status Species, Survey and Manage Species, and Species of Management Concern

Federally Listed Species

Northern Spotted Owl

The scale for cumulative effects for the northern spotted owl is the home range of known spotted owl sites (BA, p. 7-8; LOC, p. 13-14) and the location of the project in relationship to adjacent known spotted owl sites and Late Successional Reserves (LSRs). The scale was chosen because

the Northwest Forest Plan (NWFP) prescribes maintaining suitable owl habitat within LSRs and the provincial home range of known owl sites and dispersal habitat between LSRs and known owl sites. This alternative would maintain dispersal habitat within and between known owl sites, and no harvest would occur in LSRs, RA 10 or RA 32 habitat.

The Thomas Creek Watershed offers limited value habitat for spotted owls due to scattered federal ownership and its location in the foothills of the Cascades adjacent to the Willamette Valley (TCWA Ch. 6 p. 85). No harvest would occur within the provincial home range of any known spotted owl sites and dispersal habitat would be maintained between known spotted owl sites and LSRs. Therefore, Alternative A would not contribute to cumulative effects to spotted owls.

Survey and Manage Species

Red Tree Vole

This alternative would not contribute to cumulative effects to any Special Status or Survey and Manage Wildlife species such as the red tree vole because none of these species have been found during surveys of the area. Habitat within the project area is low quality due to a lack of important habitat elements required for the red tree vole. A high percentage of similar habitat in the watershed would remain untreated and high quality suitable habitat for Special Status/Survey and Manage species would remain intact. Implementation of the project would not eliminate connectivity between adjacent untreated stands under the BLM's management.

Other Species of Concern

Migratory and Resident Birds

No cumulative effects to birds are expected. This alternative would not reduce the persistence of any bird species in the watershed or populations at the regional scale. Habitat changes resulting from this alternative would not change seral stage habitat or change any patch size, and therefore would not contribute to fragmentation of bird habitat. Thinning would not contribute to a fundamental change in the species composition of existing bird communities within the watershed. In the long term, the thinning could have the potential to improve habitat for bird species as this stand continues to mature, resulting in greater bird species diversity.

Bats

Cumulative effects to bats would be low and follow closely the cumulative effects to snag and late successional habitat. Habitat quality for bats is poor due to the lack of suitable snags and other primary habitat features for bats.

Big Game

No adverse cumulative effects to big game species populations are expected. This alternative would not change any forest cover type or change any habitat patch size. Therefore, thermal and hiding cover present before treatment would be maintained after harvest. The Variable density thinning, including low retention areas, are expected to improve the quality of forage and cover both in the short and long term.

In conclusion, thinning in the project areas would not be expected to contribute to the need to list any Bureau Sensitive species, Survey and Manage species, or species of concern under the Endangered Species Act (BLM 6840). Habitat for the species that are known to occur in the watershed would be maintained, habitat connectivity would not be changed, any habitat alteration would have only short-term negative effects, and long-term effects could be beneficial.

3.5.2.3 No Action Alternative

Snags, Down Logs (CWD), Remnants and Special Habitats
Self-thinning would occur, but snags and down logs created by suppression mortality would not be large enough to meet 1995 RMP standards until later in the life of the stand (approximately 20 to 60 years) when suppressed co-dominates achieve these diameters before dying. No snag or CWD creation would occur, and CWD development would occur over a long period through self-thinning. Understory and ground cover development would establish slowly as self-thinning occurs, or until a disturbance such as fire or wind throw removes overstory trees, allowing light to reach the forest floor. Late successional habitat conditions would continue to develop slowly; these stands would maintain low species and vertical diversity for 20-40 years.

Special Status Species, Survey and Manage Species, and species of management concern

Federally Listed Species

Northern Spotted Owl
There would be no immediate change in spotted owl habitat and no effect to spotted owls from management action. Habitat conditions would remain as described in the Affected Environment and would develop slowly for the reasons stated above. Currently, the stand is marginally suitable and would not be downgraded or removed and slowly improve under the no action alternative.

Survey and Manage Species

Red Tree Vole
In the short term, there would be no immediate change in current habitat conditions for Survey and Manage and the BLM's Special Status Species. In the long term, trees would grow slowly, and material available for CWD recruitment would average smaller in diameter than if thinning were to occur. Since no new disturbance to the conifer canopy would occur, no undetected red tree vole nests would be affected. Optimal habitat for the red tree vole would develop more slowly without thinning.

Other Species of Concern

Migratory and Resident Birds
Habitat conditions would remain as described in Affected Environment and would continue to develop slowly. Species richness of bird communities would continue to reflect mid to early mature for a longer period of time, and overall bird species richness would be less than if these

stands were thinned. Bird species richness may not noticeably increase, and legacy features in the future stand would likely be smaller and less persistent, especially those that provide habitat for cavity-nesting species.

Bats

Poor habitat conditions would remain as described in Affected Environment and would continue to develop slowly. Stand mortality would allow for some large snags over 20 to 40 years.

Big Game

In the short term, there would be no disturbance effects due to this alternative. Thermal and hiding cover quality would remain the same as current conditions. There would be no increase in vegetative forage due to increased light to the forest floor. In the long term, thermal and hiding cover quality would remain about the same as this overstocked stand matures. Forage quantity would continue to decrease as less light reaches the forest floor.

3.6 AIR QUALITY / FIRE HAZARD RISK

3.6.1 Affected Environment

Air Quality

Particulate air emissions within the ThunderKat Timber Management Project analysis area could be produced from smoke from a wildfire, resource management activities including: smoke from prescribed burning, dust from logging equipment and/or the improvement and use of natural-surfaced haul roads associated with the proposed project.

The Willamette Valley experiences periods of air stagnation. This historically occurs during winter months when cold air becomes trapped under slightly warmer air aloft, creating temperature inversion conditions. The restricted ventilation causes air pollutants to become trapped near the ground. Wintertime temperature inversions contribute to high air particulate levels. Stagnant periods in the summertime contribute to increases in ozone levels, causing the local air quality to deteriorate. The Willamette Valley has been designated by the State of Oregon as a Smoke Sensitive Receptor Area.[23]

Fire Risk

The climate in Northwest Oregon is generally mild and wet in the winter. In the northern Cascade mountain range, snowfall historically occurs at higher elevations; creating snow accumulation which usually remains well into the early summer months. Summers are warm with periods of dry weather usually during the months of July, August, and September. Summer temperatures during this period average approximately 60° F with higher temperatures reaching the mid to upper 90s, and occasionally topping 100° F for short periods of time. During average weather years the conditions under the forest canopy remain relatively moist.

[23] http://www.oregon.gov/odf/fire/smp/smokemgtmap.pdf, Accessed 7/15/2015

The two main causes of wildfire starts across the state are human activity and lightning. Dry lightning (lightning that that has little or no accompanying moisture) that occurs during the summer months is rare in Northwest Oregon. Within the Oregon Department of Forestry's Western Oregon Area - North Cascades District - Santiam Unit over the last ten years one fire start was attributed to lightning. (http://oregon.gov/ODF/FIRE/HLCause.pdf).

Fire effects on forested areas are influenced by fire frequency, fire duration, and fire intensity (Van Wagner 1965). These factors vary depending on fuel type and structure, topography and atmospheric variables. Effects from high-severity wildfire may include total tree mortality; formation of snags; loss or reduction in the quality of plant, fish and wildlife habitat; loss of resources on adjacent private land; elimination of the duff and litter layers; reduction of the downed woody component (especially logs in later stages of decay); loss of soil productivity; increased soil erosion; increased sediment loading to streams; decreased infiltration rates; and in the short term, high levels of smoke pollution.

Previous wildfires, fuels treatments, and timber harvests, as well as proposed treatments and suppression priorities placed on the BLM land by the Oregon Department of Forestry would result in a continued low risk of a major stand replacement wildfire. Without effective fuel treatments, all proposed harvest units would see a short term (one to five year) increase in fire ignition and burn intensity potential because of the increase of surface fuel loading. Over time, the elevated risk of fire associated with the post-harvest slash would diminish as the slash decomposes and the vertical arrangement of the fuel load becomes closer to the ground.
The highest risk ignition source within the proposed project area is anthropogenic (human caused), with ODF reporting 20 starts related to human activities over the last 10 years: (http://www.oregon.gov/ODF/FIRE/HLCause.pdf).

The proposed project area is located behind a locked private gate which is signed with a "No Motorized Public Access" sign. These areas are only accessible to the public by foot throughout the year; they receive increased use during hunting season, generally after the close of fire season when fires can still happen.

Fire Regime and Condition Class (FRCC)

The Fire Regime classifies the role fire would play across the landscape in the absence of modern human intervention. The Condition Class classifies the amount of departure from the natural fire regime. The modeling predictions for fire regime and condition class come from the LANDFIRE Rapid Assessment Vegetation Models.[24]

The model identifies the analysis area as falling within the Pacific Northwest Forested landscape. The analysis area's potential natural vegetation group is listed as Douglas-fir Hemlock-Dry Mesic and falls within Fire Regime III with a mean fire return interval of 300 years for stand replacement fire and 100 years for mixed severity fire. Historical data shows that 75 percent of fires are characterized as mixed severity while 25 percent are categorized as stand replacement fires (USFS). The timber stands in the analysis area generally fall within Condition Class 3 with species composition and structure functioning outside their natural (historical) range of variation

[24] http://www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html. Accessed 7/15/2015.

due to overstocking and past harvest treatments. Commercially thinning these stands will not change the Condition Class in the short term, but will move the stands toward Condition Class 2 over the long term. Management of the surrounding private land affects the Condition Class to such an extent that actions on the BLM land alone are unlikely to change the Condition Class rating on a landscape scale.

Timber Stand and Fire History

The fire history of the proposed ThunderKat Timber Management project analysis area is not well documented, although it is known that Native Americans actively burned within the Willamette Valley and foothill area. To what extent this burning extended into the valley foothills is not specifically known. Fire and human activity play a major role as disturbance agents. The analysis area has experienced numerous management activities over the past 100 years. The majority of timber stands in the analysis area were established following clearcut harvesting during the mid to late 1930s to the late 1960s. Many of these harvest units had broadcast burning associated with them, both for fuels reduction and for site preparation.

It has been several decades since the most recent human-caused disturbance (logging) occurred, and although fire has been excluded from the landscape, the proposed project analysis area remains within a normal fire return interval.

3.6.2 Environmental Effects

Comparison of Alternatives

Table 3-17 lists the estimated tons per acre and total tons of post-harvest fuels, the estimated tons per acre and total tons of post prescribed burning fuels, and the estimated tons per acre and total tons that would be consumed by the various prescribed burn treatment prescriptions.

Table 3-17. Comparison of Dead Fuel Loading by Alternative.

Alternative	Harvest Type	Post-Harvest		Post Burn			
		Tons Acre[1]	Total Tons[1]	Tons Acre[2]	Total Tons[2]	Tons /ac. consumed[3]	Total Tons Consumed[4]
Proposed Action (regeneration harvest)	Regeneration	≈236 - 284	≈14,160 - 17,040	≈94 - 114	≈5,640 - 6,840	≈142 - 170	≈8,520 - 10,200
Alternative A (commercial thinning)	Thinning	≈166 - 214	≈9,960 - 12,840	≈151 - 195	≈9,060 - 11,700	≈15 - 19	≈900 - 1,140
No Action (Existing Condition)	No treatment	≈95 - 103	N/M	N/M	N/M	N/M	N/M

[1] Total of all CWD and post-harvest logging debris.
[2] Total of all CWD and post-harvest logging debris left on site following prescribed burning.
[3] Tons of post-harvest logging debris consumed per acre following prescribed burning.
[4] Total Tons of fuel consumed

3.6.2.1 The Proposed Action - Regeneration Harvest

Air Quality

Hauling associated with the proposed project would occur across the BLM and private roads. Dust created from proposed project activities across gravel or natural-surface roads would contribute to short-term (during harvest and hauling) effects (dust) to air quality. None of these activities would create dust above critical threshold (the intensity level that is just barely perceptible) levels (set forth by the Clean Air Act) and would be localized to the immediate vicinity of the operations.

Increased fuel loading resulting from the proposed activities could likely pose a fire hazard and/or reduce the ability to effectively reforest the treatment area, as measured by post-harvest surveys through the use of on-site photo points and the Stereo Photo Series for Quantifying Forest Residues in Douglas-Fir-Hemlock Type of the Willamette National Forest (PNW-GTR-258). To minimize the increase of post-harvest surface fuel loading and to optimize replanting operations, prescribed burning would be conducted and smoke would be generated.

Burning would be conducted when the prevailing winds are blowing away from SSRAs (Smoke Sensitive Receptor Areas) in order to minimize or eliminate the potential for smoke intrusions. The potential for smoke intrusion would be further reduced by burning under atmospheric conditions that favor good vertical mixing so that smoke and other particulate matter is borne aloft and dispersed by upper elevation winds.

Prescribed burning would cause short term impacts to air quality that could persist for up to a week within one-quarter to one mile of units. The overall effects of smoke on air quality are subject to fuel moisture and atmospheric conditions at the time of the burn. Smoke impacts related to a prescribed burn implemented under favorable conditions are predicted to be localized and of short duration. The proposed project units are not located in close proximity to any major highways that could affect motorist safety. Activities associated with the proposed action would comply with the provisions of the Oregon State Implementation Plan and Oregon Smoke Management Plan and the Clean Air Act.

Fire Risk

The proposed action would remove ladder fuels and decrease crown closure from 80 percent to 32 percent, effectively increasing tree crown spacing. The proposed action reduces relative density of the harvest units from 66 to 16. A relative density of 35–45 percent or lower has been identified as the point where crown bulk density is unlikely to sustain a high intensity crown fire (Agee, 1996).

Post-harvest surface fuel loading is estimated to be elevated, increasing the risk of a fire start and reducing the ability to accomplish effective control measures in the event of a fire start. These effects would be greatest during the first season following harvest when needles dry but remain attached to tree limbs. The additional surface fuel loading created by post-harvest slash and the addition of coarse woody debris left for wildlife habitat within the proposed harvest units is

estimated to be approximately 21 tons per acre or approximately 1,260 total tons of post-harvest slash throughout the proposed harvest units (PNW-GTR-258).

Public access to the proposed project area is limited. The proposed project area is behind a locked private gate which is signed with a "No Motorized Public Access" sign. These areas are accessible to the public by foot throughout the year with the highest use during hunting season; immediately after the close of fire season when fuels are often still combustible. Skid roads within the proposed project area will be removed or blocked following harvest.

Fuels Management

Units would be harvested using ground-based equipment. If cut-to-length logging systems are used (harvester and skid/swing), moderate to heavy accumulations of logging slash (limbs and tops) will be produced throughout the treatment area. If whole-tree logging systems are employed (feller-buncher and skid), light accumulation of logging slash will be produced throughout the treatment units with large slash piles at roadside landings.

Broadcast burning is the preferred fuels treatment under this treatment alternative in order to minimize associated fire hazard and to reduce or eliminate surface fuel accumulations, effectively preparing the site for replanting efforts.

Post-harvest logging slash will be widely scattered throughout the harvest unit and the overall fuel tonnage is estimated between 236–284 tons per acre. Under the preferred atmospheric conditions, fuel loading levels would yield low to moderate fire behavior except under extremely dry and windy conditions that would allow the live understory to act as a fuel rather than as a heat-sink. Reduction in crown bulk density and a significant increase in tree spacing will make the occurrence of a crown fire under even severe weather conditions highly unlikely. Individual and/or group tree torching is possible. Skid trails and yarding corridors will have areas of bare soil creating fire breaks within the unit.

Approximately 9,800 total feet of containment line would be constructed; 7,400 feet in unit 5A and 2,400 feet in unit 5B. If whole tree loggings systems are employed, landing piles would also be constructed and covered with 4 millimeter plastic. The piles will then be burned at the same time of the broadcast burn.

Pile burning would normally occur in the late fall when favorable smoke dispersion conditions are most common and risk of fire spread is low. If operational or atmospheric conditions do not allow for an effective or safe broadcast burning, then machine and/or hand piling will be implemented throughout the harvest units within 2 seasons post-harvest.

3.6.2.2 Alternative A - Commercial Thinning

Air Quality

Hauling associated with the proposed project would occur across the BLM and private roads. Dust created from proposed project activities across gravel or natural-surface roads would contribute to short-term (during harvest and hauling) effects to air quality. None of these activities would create dust above critical threshold (the intensity level that is just barely perceptible) levels and would be localized to the immediate vicinity of the operations.

It is anticipated that increased fuel load resulting from Alternative A could pose a fire hazard, as measured by conducting post-harvest surveys, through the use of on-site photo points and the Stereo Photo Series for Quantifying Forest Residues in Douglas-Fir-Hemlock Type of the Willamette National Forest (PNW-GTR-258). To reduce the increase of post-harvest surface fuel loading prescribed pile burning would be conducted and smoke would be generated.

Prescribed pile burning would cause short term impacts to air quality that could persist for up to a week within one-quarter to one mile of units. The overall effects of smoke on air quality are influenced by fuel moisture and atmospheric conditions at the time of the burn. Smoke impacts are predicted to be localized and of short duration (two to four days). None of the proposed project units are located in close proximity to any major highways that could affect motorist safety. Activities associated with the proposed action would comply with the provisions of the Oregon State Implementation Plan, the Oregon Smoke Management Plan and the Clean Air Act.

Fire Risk

The Alternative A silvicultural prescription would remove ladder fuels and decrease crown closure from 80 percent to 52 percent; effectively increasing tree crown spacing. The Alternative A silvicultural prescription would reduce the relative density of the harvest units from 66 to 30. A relative density of 35-45 percent or lower has been identified as the point where crown bulk density is unlikely to sustain a high intensity crown fire (Agee 1996). Thus the potential of a sustained crown fire post-harvest would remain with the implementation of Alternative A.

Post-harvest surface fuel loading is estimated to be elevated, increasing the risk of a fire start and fire intensity while reducing the ability to accomplish effective control measures in the event of a start. These effects would be greatest during the first season following harvest when needles dry but remain attached to tree limbs. The additional surface fuel loading created by post-harvest slash and the addition of coarse woody debris left for wildlife habitat within the proposed harvest units is estimated to be up to 18 tons per acre or approximately 1,015 total tons of post-harvest slash in the project area.

Public access to the proposed project area is limited. The area is behind a locked private gate which is signed with a “No Motorized Public Access” sign. These areas are accessible to the public by foot throughout the year with the highest use during hunting season; immediately after the close of fire season when fuels are often still combustible. Skid roads within the proposed project area would be removed or blocked following harvest.

Fuels Management

Units would be harvested using ground-based equipment. If cut-to-length logging systems are used (harvester and skid/swing), light to moderate accumulations of logging slash (limbs and tops) would be produced throughout the treatment area. If whole-tree logging systems are employed (feller-buncher and skid), light accumulation of logging slash would be produced throughout the treatment units. Pile and burn treatments would only be implemented at log landings, 50 feet in from roads and project unit area adjacent to private property. Landing piles would be constructed by machine and/or hand and covered with 4 millimeter plastic.

Post-harvest logging slash would be widely scattered throughout the harvest unit with the overall fuel tonnage is estimated between 166 – 214 tons per acre. This fuel loading level would yield low to moderate fire behavior except under extremely dry and windy conditions that would allow the live understory to act as a fuel rather than as a heat-sink. Reduction in crown bulk density would make the occurrence of a crown fire under even severe weather conditions unlikely. Individual and/or group tree torching is possible. Skid trails and yarding corridors would have areas of bare soil creating fire breaks within the unit.

Pile burning would generally occur in the late fall when favorable smoke dispersion conditions are most common and risk of fire spread is low.

3.6.2.3 No Action Alternative

Air Quality

In the short term (0–1 year) there would be no timber harvest, road construction, log hauling, or any need for prescribed burning and no localized effects to air quality. In the long term (1-100 years) as the bottom and middle layers of the timber stands continue to grow, the increase in understory trees and associated ladder fuels would cause the stands to gradually become more susceptible to a stand replacement fire event that would burn an area larger than the proposed project area and subsequently a potentially larger input of smoke would be created than if prescribed burning had been implemented to reduce the hazardous fuels accumulations within the project area.

Fire Risk and Fuels Management

The analysis area would continue on its current trend. The current risk of a fire start would remain moderate. There would be a slow increase in the coarse woody fuel load (1,000 hour fuels) as well as the fine fuel load (1, 10, and 100 hour fuels) in these timber stands as stress-induced mortality within the stands increases. Areas infected with the root disease *Phellinus weirii* would see larger increases in fuel loading than non-root disease areas as infected Douglas-fir tree roots are weakened and the trees fall in small one to two acre pockets. Ladder fuel densities would increase as understory trees grow larger and new understory trees begin to grow. The potential for these stands to eventually succumb to a wildfire would continue to increase as they near the maximum fire return interval and the condition class departs further from the

natural fire regime. No action would eventually result in moving from a Fuel Model 5 to a heavy timber litter Fuel Model 10 with higher potential for stand replacing fire behavior in the event of a fire start.

3.7 RECREATION, RURAL INTERFACE, VISUAL, WILDERNESS, AND WILD AND SCENIC RIVERS

3.7.1 Affected Environment

Recreation

The proposed harvest area is within a forested setting. While no developed recreational areas exist within the project area dispersed recreation can occur to the extent the public can access the area. Roads accessing the area are gated on private land and block motorized access for the general public. Roads have been developed in the area primarily to provide access for timber management activities including timber harvests.

There is a 14 day camping limit on the BLM lands and within development recreation areas. There are numerous recreation sites within the vicinity of the project area. The Oregon Department of Forestry's Santiam Horse Camp and Monument Peak Trail Systems, Silver Falls State Park, and BLM-administered Fishermen's Bend, Elkhorn Valley, and Canyon Creek Recreation Sites. There is a 14 day camping limit on the BLM lands and within development recreation areas.

The Oregon Department of Transportation website lists the average annual daily traffic for the North Santiam Highway No. 162 (Highway 22) as being 8,500 vehicles per day at mile point 22.4. Multiplying the 8,500 vehicles per day, by 365 days per year a total of 3,102,500 vehicles drove past mile post 22.4 in 2012.

The 1995 RMP provides for Off-Highway Vehicles (OHV) to be allowed on existing roads and designated trails. There are no designated OHV trails in the vicinity, any trails that do exist are unauthorized and will not be protected within the proposed unit during any project operations.

Rural Interface Zones

Rural interface zones are BLM-administered lands where a half-mile buffer around county zoning for 1 to 20 acre lots intersect each other (RMP p. 39). Haul routes from the ThunderKat Timber Management project would pass through RIA along Highway 22 near Lyons, Oregon.

Visual Resource Management

Visual resources consist of the land, water, vegetation, animals, structures, and other features that make up the scenery and physical features visible on the landscape. All Salem District BLM-administered lands have been classified under a Visual Resource Management (VRM) class system that was established by the BLM during the last planning effort in the early 1990s. In

2014 the BLM Salem District re-inventoried for current scenic values and categorized BLM lands into Visual Resource Inventory (VRI) classes derived from individual visual resource components. A VRI class is determined by overlaying the ratings of scenic quality (A, B, or C), public sensitivity to changes in visual character (H, M, or L), and distance zones as seen from major viewing platforms or travel routes (foreground-middle ground, background, or seldom seen). The foreground-middle ground zone includes areas seen from less than three miles away. Visible areas beyond 3 miles but usually less than 15 miles away are in the background zone. Areas either hidden from view or beyond 15 miles are in the seldom-seen zone (BLM Handbook H-8410).

Visual resource values and opportunities to maintain scenic quality are greatest on BLM-administered lands seen from state and county scenic highways and roads, parks, rural residential areas, scenic ACECs, special recreation management areas, and recreation sites and trails. The intermixed land ownership pattern between public and private lands greatly limits the BLM's ability to manage the project areas as a contiguous viewshed. Timber management operations near or adjacent to the project areas are observable from private and public lands and major roads. The view from major roads and highways of the surrounding terrain is one of timber management, various age classes of trees are visible.

BLM's responsibility to manage the scenic resources of the public lands is established by law:

- **The Federal Land Policy and Management Act of 1976 (FLPMA)** states, "...public lands will be managed in a manner which will protect the quality of the scenic (visual) values of these lands."
- **The National Environmental Policy Act of 1969 (NEPA)** requires that measures be taken to "...assure for all Americans...aesthetically pleasing surroundings...."

This responsibility is reinforced by BLM's mission statement:

- "It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations."

BLM Salem District Resource Management Plan Guidance for Visual Resource Management provides the following specific guidance:

Lands within the project area fall under VRM Class IV, as assigned in the existing RMP. As visual contrasts in line, form, color and texture under this class may be strong; no specific visual management constraints would apply to management actions. However, mitigation of visual impacts would be incorporated where consistent with efficient timber harvest and other management activities (RMP pp. 36–37).

VRM Class IV objectives provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer

attention (RMP p. 37). Regeneration harvest is an example of an allowable management activity in VRM Class IV that may dominate the landscape.

The RMP states that every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements of line, form, color, and texture (RMP p. 37). These objectives do not apply on private residential lands or commercial timber land. The environmental effects section of this report describes how the Rainbow Ridge timber sale meets RMP direction for VRM class IV and how it would affect the visual quality of the landscape as seen from locations frequently visited and traveled by the public. Project Design Features that help minimize the visual impacts of the harvest are also discussed.

VRM class criteria include scenery quality ratings, public sensitivity ratings, and area mapping criteria, for distance zone-seen. Lands within the project area fall under VRM IV. There are no major travel routes that provide views of the project area.

ThunderKat Timber Management Project Area

The project area, characterized as rural surrounded by managed agriculture and forest land, is located approximately three miles south of Lyons, Oregon, in Linn County. The landscape exhibits extensive forest management on the rolling northern hills of the Cascade Mountains within the Santiam Canyon Corridor. The Santiam Canyon is located along the North Fork Santiam River and Highway 22. The project area is in the background to seldom-seen distance zone from major travel routes used to identify key observation points (KOPs).

Views of the project area are rare while traveling east on Highway 22 from Lyons to Mill City, including Fishermen's Bend Recreation Site. No visible area exists from KOPs used in the viewshed analysis. The foreground-middle ground zone has views of deciduous and coniferous trees along the North Santiam River with few views of the northern Linn County mountains. The background view of the mountains from the travel routes show multiple age classes of timber management across the landscape, if visible at all. The background view exhibits a patchwork of forested lands managed for timber harvest. The different age classes and species mixes provide various textures and colors to the landscape from browns of newly harvested units to a wide range of green hues as planted parcels and standing timber age. During autumn, glorious oranges, reds, and brown hues of deciduous plants intermix with coniferous plants.

Key Observation Points

The BLM identified seven key observation points (KOPs), where the project area may be visible to the casual observer, to analyze the potential effect of the project on the characteristic landscape (Section 7.0 Maps, Table 3-18). The BLM determined that no KOP provided a direct view of the project area. All of the KOPs were located outside of the traveler's field of view and not substantially visible. The BLM did not complete visual contrast rating worksheets for any KOP due to their location from the project and no view of the project area.

Table 3-18. Key Observation Point Summary

KOP Name	Distance between KOP and Project in Miles	Remarks
Lyons Bridge	4.04	Bridge in Lyons on Highway 226. Highly modified area with power lines, signs, commercial business buildings, and residential buildings in view. No view of units due to standing trees, vegetation, and topography.
226 and Fir	3.49	Highway 226 and Fir Street. Highly modified same again highly modified. No view of units due to standing trees, vegetation, and topography.
Main Street East	2.56	Main street east of town near Apple Loop intersection. Again highly modified. Commercial businesses dominate view. No view of units due to standing trees, vegetation, and topography.
North Santiam Park	2.45	Location along river within the North Santiam Park. No highly modified views to the south towards the ThunderKat area.
Fish ADA Platform	3.25	Fishermen's Bend accessible fishing platform on southwest boundary of park. Residences in foreground. No view of units due to standing trees, vegetation, and topography.
FB Boat Launch	3.46	Fishermen's Bend boat launch in day use area near River Loop. Visible modifications across the North Santiam River. No view of units due to standing trees, vegetation, and topography.
FB Rriver Trail Grp Loop	3.61	Fishermen's Bend trail along the southern boundary of the park near Group Loop. No view of units due to standing trees, vegetation, and topography.

Other Resources

There is no Wilderness or Lands with Wilderness Character in the vicinity. There are lands with wilderness characteristics northeast of the project area near the Opal Creek Wilderness (over 14 miles away).

There are no designated Wild and Scenic Rivers (WSR) in the project area. Elkhorn Creek WSR is over 10 miles north east. Little North Santiam River, an Eligible Wild and Scenic River, is over three miles to the north in a separate watershed.

3.7.2 Environmental Effects

3.7.2.1 Proposed Action - Regeneration Harvest

Recreation

Because access by the public is effectively prohibited in the project area (being land locked by private land owners), the proposed action would have no effect on recreational opportunities in

the general area.

Rural Interface Areas (RIA)

Based on current harvest amounts this could result in about 500 log truck loads of logs on Highway 22 over a three year contract period. This would be a negligible increase in traffic on the highway.

Visual Resources

The proposed project would comply with VRM objectives. Visual disturbance of the project area would be associated with modifications to vegetation and other ground disturbing activities from timber sale operations. Evidence of harvest activities would not be observable within five years as understory vegetation returns to a more natural appearance and the remaining stand continues to mature. A forest setting and the 15 (up to 17) trees per acre green tree retention prescription would provide some canopy cover. Views of the area from a distance, foreground-middle ground, would lessen the attention of a thinner canopy. Harvest activities would remove the majority of trees from the proposed units leaving undergrowth vegetation crushed. Logging debris and crushed undergrowth vegetation would continue turning brown to red as it dies leaving the view of the units undesirable. Fuel treatment of logging debris if burned would result in short-term decline in visual quality from smoke leaving the units blackened and gray. Fuel treatments would comply with state smoke management regulations thus reducing the duration of affect to visual quality to a few days. Planted seedlings, understory vegetation, and the remaining trees would rebound, grow, and continue to green up covering logging debris and burn pile scars.

The BLM completed a visual analysis to assess the visibility of the project from major roads. According to this analysis, no portion of the two units is visible from roads that are not gated. As a result, the effects of the proposed action are consistent with the provisions and decisions in the Salem RMP. Project design features, time in view, and unit locations minimize any adverse effect to scenic resources according to VRM class IV objectives.

Wilderness Characteristics

Implementing the proposed action would have no effect on wilderness or potential wilderness (lands with wilderness characteristics), because none are present in the project area. The closet lands with wilderness characteristics are northeast of the project area near the Opal Creek Wilderness (over 14 miles away).

3.7.2.2 Alternative A - Commercial Thinning

Recreation, Wilderness, and Wild and Scenic River Characteristics Resources

There would be no difference in environmental effects between the proposed action and Alternative A for the resources described in this section.

Rural Interface Areas

Based on current harvest amounts this could result in about 450 log truck loads of logs on Highway 22 over a three year contract period. This would increase traffic on the highway by .0048 percent compared to 2012 traffic levels.

Visual Resources

Visual effects from commercial thinning would be less than that of the proposed action as a result of leaving more trees per acre. The canopy would be mostly intact. The view of this area from the KOPs would be indistinguishable from the foreground-middleground.

3.7.2.3 No Action Alternative

Recreation, Visual Resources, Wilderness, and Wild and Scenic River Characteristics Resources

Selection of this alternative would result in no effects to the above mentioned resources.

Rural Interface Areas

If this alternative is selected there would be no increase in log truck trips on Highway 22 over the course of three years compared to the action alternatives.

3.8 REVIEW OF ELEMENTS OF THE ENVIRONMENT BASED ON AUTHORITIES AND MANAGEMENT DIRECTION

Table 3-19. Authorities and Management Direction

Element of the Environment /Authority	Remarks/Effects
Aquatic Conservation Strategy	EA sections 3.2-3.6 show how the ThunderKat project meets the Aquatic Conservation Strategy. See also section 3.9 of this EA.
Air Quality (Clean Air Act as amended (42 USC 7401 et seq.)	This project is in compliance with this direction because air quality impacts would be of short duration and would follow the ODF smoke management plan. Addressed in EA Section 3.6.
Cultural Resources (National Historic Preservation Act, as amended (16 USC 470) [40 CFR 1508.27(b)(3)], [40 CFR 1508.27(b)(8)]	This project is in compliance with this direction and the project would have no effect (Section 1.7.5) on this element because cultural resource inventories found no cultural resources.
Ecologically critical areas [40 CFR 1508.27(b)(3)]	This project would have no effect on this element because there are no ecologically critical areas present within the project area.

Element of the Environment /Authority	Remarks/Effects
Energy Policy (Executive Order 13212)	This project is in compliance with this direction because this project would not interfere with the Energy Policy (Executive Order 13212).
Environmental Justice (E.O. 12898, "Environmental Justice" February 11, 1994)	This project is in compliance with this direction because it would have no effect on low income populations.
Fish Habitat, Essential (Magnuson-Stevens Act) Provision: Essential Fish Habitat (EFH): Final Rule (50 CFR Part 600; 67 FR 2376, January 17, 2002)	This project is in compliance with this direction because the project would have no effect on listed fish species or on essential fish habitat (EA Section 3.3).
Farm Lands, Prime [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because no prime farm lands are present on the BLM land within the Cascades Resource Area.
Floodplains (E.O. 11988, as amended, Floodplain Management, 5/24/77)	This project is in compliance with this direction because the proposed treatments would not change or affect floodplain functions.
Hazardous or Solid Wastes (Resource Conservation and Recovery Act of 1976 (43 USC 6901 et seq.) Comprehensive Environmental Repose Compensation, and Liability Act of 1980, as amended (43 USC 9615)	This project would have no effect on this element because no hazardous or solid waste would be stored or disposed of on the BLM lands as a result of this project.
Healthy Forests Restoration Act of 2003 (P.L. 108-148)	This project is in compliance with this direction because treatments would help maintain forests in a healthy functioning condition with low risk of wildfire (EA Section 3.1, 3.6).
Migratory Bird Act of 1918, as amended (16 USC 703 et seq.)	This project is in compliance with this direction because treatments would immediately increase the overall habitat diversity for migratory birds and increase overall bird species richness in the long term (20 years). (EA Section 3.5).
Native American Religious Concerns: American Indian Religious Freedom Act of 1978 (42 USC 1996)	This project is in compliance with this direction because no Native American religious concerns were identified during the scoping period.
Noxious Weed or Invasive Species (Federal Noxious Weed Control Act and Executive Order 13112)	This project is in compliance with this direction because project design features would prevent establishment of new populations of invasive plant species and because vegetation development would result in a decline in both number and vigor of invasive plant populations in the project area. (EA Section 3.1).
Park lands [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because there are no parks within or immediately adjacent to the project area.

Element of the Environment /Authority	Remarks/Effects
Public Health and Safety [40 CFR 1508.27(b)(2)]	The project would have no effect on this element because the public would be restricted from the project area during operations, the project would not create hazards lasting beyond project operations, and traffic control would be implemented to provide for safe public passage through the project area during active operations.
Threatened or Endangered Species: Endangered Species Act of 1983, as amended (16 USC 1531)	This project is in compliance with this direction because there would be no adverse effects on Threatened or Endangered Species (EA Sections 3.1, 3.3, 3.5).
Water Quality: Safe Drinking Water Act, as amended (43 USC 300f et seq.); Clean Water Act of 1977 (33 USC 1251 et seq.)	This project is in compliance with this direction because Oregon State water quality standards would be adhered to and the area hydrology would not be changed measurably (EA Section 3.2).
Wetlands: E.O. 11990 Protection of Wetlands 5/24/77 [40 CFR 1508.27(b)(3)]	This project is in compliance with this direction because wetland areas have been removed from all activity (EA Section 3.2, 3.4.1)
Wild and Scenic Rivers: Wild and Scenic Rivers Act, as amended (16 USC 1271)) [40 CFR 1508.27(b)(3)]	This project is in compliance with this direction because there are no project units within or adjacent to any wild and scenic corridors.
Wilderness: Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.); Wilderness Act of 1964 (16 USC 1131 et seq.)	This project is in compliance with this direction because the proposed action is not within designated wilderness or lands containing wilderness characteristics.

3.9 COMPLIANCE WITH THE AQUATIC CONSERVATION STRATEGY

Based on the environmental analysis described in the previous sections of the EA, Cascades Resource Area Staff have determined that the project complies with the Aquatic Conservation Strategy (ACS) on the project (site specific) scale. The project complies with the four components of the Aquatic Conservation Strategy, as follows:

ACS Component 1 – Riparian Reserves

No harvest would occur within the Riparian Reserves. Direct disturbance by equipment or yarding would not occur. The proposed action would not result in detectable effects to channel morphology, such as increases in bank erosion, channel incision, scouring of substrates or gravel deposits utilized by fish for spawning, loss of floodplain connectivity or alteration of local wetland hydrology that could result from augmented peak flows or altered watershed hydrology.

ACS Component 2 – Key Watershed

The Middle Thomas Creek Watershed is not a key watershed under the provisions of the 1995

RMP.

ACS Component 3 – Watershed Analysis

The IDT incorporated information from the Middle Thomas Creek Watershed Analysis (1996) into the development of the proposed action, into the description of the affected environment, and into the environmental effects analysis, and is hereby incorporated by reference. In Appendix I, p. I-66 the watershed analysis identifies this stand (FOI 950752) as recommended for a regeneration harvest.

ACS Component 4 – Watershed Restoration

The project would comply with provisions for watershed restoration found in the NWFP (p. 10) by the control and restoration of road related runoff and sediment production as proposed for either alternative in the Connected Actions portions of this document (Section 2.3).

Aquatic Conservation Strategy Objectives (ACSO)

1. **ACSO 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.**

Proposed Action: Overstory trees that were removed decades ago through logging were primarily Douglas-fir. As detailed in the text (EA section 3.1), immediately following regeneration harvest the residual trees should appear healthy with minimal damage from harvest activities. The site should have minimal soil disturbance from yarding. There should be approximately 15 green trees per acre. These trees should be in a combination of clumps and scattered individual trees. The retained trees should be among the largest in the stand and should be 20 inches dbh and larger. They should consist of primarily Douglas fir with a few grand fir and western hemlock.

Following harvest, pioneer species will regenerate and occupy the site providing habitat for early seral associated wildlife species. After planting, vegetative succession would move the site towards being predominately even aged Douglas-fir and western red cedar.

The proposed action would restore and maintain the distribution, diversity and complexity of vegetation adjacent to riparian areas within the harvest units. No alteration or modification of vegetation within the riparian zones would occur outside of roadside activities proposed for road maintenance.

Alternative A: The EA states in section 3.1 that the units are now dominated by western hemlock with components of Douglas-fir grand fir, red alder and big leaf maple. The shrub understory consists mainly of vine maple and sword fern. There are no old growth remnants in any of the units.

Thinning activities would seek to retain large Douglas-fir and other less common conifers species. The reduction in trees per acre would not enhance the diversity and complexity of tree

species as well as the proposed action. Section 3.1.2.2 of the EA states in part that Conifer species composition will remain the same, leaving western hemlock as the dominant species.

No Action Alternative: The No Action alternative would maintain the development of the existing vegetation and associated stand structure at its present rate and composition. The current distribution, diversity, and complexity of watershed and landscape-scale features would be maintained. The provisions of ACSO 1 would be maintained.

2. **ACSO 2: Maintain and restore spatial and temporal connectivity within and between watersheds.** Addressed in Text (EA sections 3.1, 3.2, 3.5,) In summary:

Proposed Action: With the limited scale of the 58 acre harvest proposal, there would be little effect to connectivity at the watershed scale. Long-term connectivity of terrestrial watershed features would continue to develop as the harvest area is reforested and a more diverse mixture of tree and shrub species become established. The Riparian Reserves, which are reserved from harvest, would continue to improve in function as refugia for late successional, aquatic and riparian associated and dependent species. Both terrestrial and aquatic connectivity would be maintained, and over the long-term, as the Riparian Reserves develops late-successional characteristics, lateral, longitudinal and drainage connectivity would be restored.

Alternative A: Implementation of the alternative would also have little to no effect to spatial connectivity at the watershed scale. Both terrestrial and aquatic connectivity would be maintained, and over the long-term, as the Riparian Reserves develop late-successional characteristics connectivity would be restored.

No Action Alternative: The No Action alternative would have little effect on connectivity within the affected watershed except in the long term.

3. **ACSO 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations**. Addressed in Text (EA sections 3.2, and 3.3). In summary:

Proposed Action: The current condition of physical integrity would be maintained.

Alternative A: The current condition of physical integrity would be maintained.

No Action Alternative: The current condition of physical integrity would be maintained.

4. **ACSO 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.** Addressed in Text (EA sections 3.2). In summary:

Proposed Action: The proposed new road locations will have no hydrologic connections to streams. Overall, this alternative would have no measurable effect on stream temperatures, pH, or dissolved oxygen (section 3.2). Sediment transport and turbidity in the affected watersheds is likely to increase over the short term as a direct result of road renovation/culverts at stream crossings. Turbidity increases would not be visible beyond 800 meters (0.5 mile) downstream from road/stream intersections and would not be expected to affect beneficial uses (p. 49).

Alternative A: The effects to ACSO 4 would be the same as the Proposed Action.

No Action Alternative: It is assumed that the current condition of the water quality would be maintained. Deteriorating culverts and other road features will require periodic maintenance and replacement.

5. **ACSO 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved.** Addressed in Text (EA sections 3.2 and 3.3). In summary:

Proposed Action: Other than replacement activities for depleted culverts no in stream disturbance will occur under this alternative. The effects of culvert replacement activities are discussed in section 3.2.2.1 of this EA. Hauling restrictions and project design features would maintain the sediment delivery within its natural range.

Alternative A: The effects to ACSO 5 would be the same as the Proposed Action.

No Action Alternative: It is assumed that the current sediment regime would be maintained. There are several depleted culverts within the road system that provide a future probability that one or more culvert failures could cause short term increase in sediment at some time in the future.

6. **ACSO 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.** Addressed in Text (EA section 3.2). In summary:

Proposed Action: this proposal would likely result in some incremental increase in annual water yield correlated to the removal of the conifer over-story (EA section 3.2.2.1). However, this is likely to have little biological or physical effect (EA section 3.2.2.1).

Alternative A: The effects to ACSO 6 would be the same as the Proposed Action.

No Action Alternative: No change in in-streams flows would be anticipated.

7. **ACSO 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.** Addressed in Text (EA sections 3.2). In summary:

Proposed Action: The proposed action would maintain the current condition of floodplain inundation and water tables.

Alternative A: The effects to ACSO 7 would be the same as the Proposed Action.

No Action Alternative: The current condition of flood plains and their ability to sustain inundation and the water table elevations in meadows and wetlands is expected to be maintained.

8. **ACSO 8: Maintain and restore the species composition 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 distributions of coarse woody debris sufficient to sustain physical complexity and stability.** Addressed in Text (EA sections 3.1, 3.2; and 3.3). In summary:

Proposed Action: No disturbance within riparian areas or area wetlands would occur under this alternative. The current species composition and structural diversity of plant communities would continue along the current trajectory. Diversification would occur over time.

Alternative A: The effects of Alternative A on ACSO 8 will be the same as the Proposed Action.

No Action Alternative: The current species composition and structural diversity of plant communities would continue along the current trajectory. Diversification would occur over time.

9. **ACSO 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.** Addressed in Text (EA sections 3.2; and 3.3). In summary:

Proposed Action: The Proposed Action would have no effect on riparian dependent species. No harvest activities would occur in riparian zones. Riparian habitats would be maintained over the short-term and continue to develop over the long term with no impacts on species currently present.

Alternative A: The effects to ACSO 9 would be the same as the Proposed Action.

No Action Alternative: Habitats would be maintained over the short-term and continue to develop over the long-term with no known impacts on species currently present.

4.0 LIST OF PREPARERS

Resource	Name	Initials	Date
Botany	Terry Fennell		
Cultural Resources	Heather Ulrich/ Fred Greatorex		
Engineering	Steve Ditterick		
Fire/Fuels	Seth Macalady		
Fisheries	Bruce Zoellick		
Hydrology/ Water Quality	Patrick Hawe		
Logging Systems	Jason Bernards		
Recreation, Visual Resources Management and Rural Interface	Traci Meredith		
Silviculture	Alisa Tanner/ Dugan Bonney		
Soils	Patrick Hawe		
Wildlife	Corbin Murphy/ Jim England		
Writer/Editor / NEPA Review	Rodrigo Arellano/ David Simons		

Reviewed and released for public comment by Cascades Resource Area Field Manager.

_____ _____

John Huston
Field Manager, Cascades Resource Area

Date

5.0 CONTACTS AND CONSULTATION

5.1 CONSULTATION

U.S. Fish and Wildlife Service

The ThunderKat Timber Management Project proposal was submitted for formal consultation with U.S. Fish and Wildlife Service (USFWS) as provided in Section 7 of the Endangered Species Act (ESA) of 1973 (16U.S.C. 1536 (a)(2) and (a)(4) as amended) during the FY 2015 consultation process.

The Biological Assessment of Likely to Adversely Affect Projects with the Potential to Modify the Habitat of Northern Spotted Owls, Willamette Planning Province – FY2015 (BA) was submitted in July 2014. Using effect determination guidelines, the BA concluded that the ThunderKat proposal may affect and is likely to adversely affect the northern spotted owl due to modification of suitable habitat (BA pp. 31, 33) but would have no effect on spotted owl Critical Habitat.

The Biological Opinion (BO) Regarding the Effects of Habitat Modification Activities on the Northern Spotted Owl and its Critical Habitat within the Willamette Province, FY2015 associated with the ThunderKat Project was issued in October 2014 (FWS reference

#01EOFW00-2014-F-0221). The BO concurred that the habitat modification activities described in the BA, including the ThunderKat Project, are not likely to jeopardize the continued existence of the spotted owl and are not likely to adversely modify spotted owl critical habitat (BO p. 132).

Furthermore, the proposed action is not likely to diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat on federal lands within its range (BO p. 132).

The timber harvests and connected actions described in this EA have incorporated the applicable General Standards that were described in the BA (pp. 9-10) and BO (pp. 22–24); and comply with all reasonable and prudent measures outlined in the BO (pp. 134–135). This includes delaying proposed activities to avoid disrupting owls at known owl sites until after the critical nesting season, and monitoring/reporting on the implementation of this project to the U.S. Fish and Wildlife Service.

National Marine Fisheries Service

Consultation with the National Marine Fisheries Service (NMFS) on effects of the ThunderKat Timber Management Project on Upper Willamette River (UWR) Chinook salmon and UWR winter steelhead trout is not required because the project would have no effect on these species or on essential fish habitat. The harvest units are greater than 2.2 miles from listed fish habitat (LFH) in Thomas Creek, and no streams are within the harvest units. The boundaries of the harvest units have been set back 200 feet to buffer effects to streams. These buffers would maintain large wood supplies, and stream shading and thus stream temperature, and intercept and infiltrate water carrying sediment preventing its delivery to listed fish habitats (LFH). There would be no peak flow effects to listed fish habitat due to maintaining canopy closures equal or greater than 30 percent in the Criminal Creek watershed and due to the relatively small amount of openings less than 30 percent canopy closure in the Bear Creek watershed (see hydrology section 3.2.2). The haul route is paved where it crosses listed fish habitat in Jordan Creek, with no mechanism to deliver sediment to LFH. The upper portion of the route crosses several tributaries to Thomas Creek at 1.6 to 2 miles upstream of steelhead and chinook habitat. Potential increased turbidity from sediment movement from the gravel road surface during hauling is unlikely to be visible or detectable beyond 800 meters downstream of the stream crossing (Foltz and Yanosek 2005). Thus, log hauling of the upper portion of haul route also would not impact listed fish habitat.

6.0 LIST OF REPORTS INCORPORATED BY REFERENCE

Cascades Resource Area Interdisciplinary Team Reports

Fennel, Terry. 2015. ThunderKat Botanical Report
Greatorex, Fred. 2015. ThunderKat Cultural Report
Stammers, Amy. 2015. ThunderKat Engineering Report
Zoellick, Bruce. 2015.ThunderKat Fisheries Report
Hawe, Patrick. 2015 ThunderKat Hydrology and Soils Report
Mortensen, Kent. 2015. ThunderKat Fuels Report
Bonney, Dugan. 2015. ThunderKat Silviculture Report
Meredith, Traci. 2015. ThunderKat Recreation Report
England, Jim. 2015. ThunderKat Wildlife Report

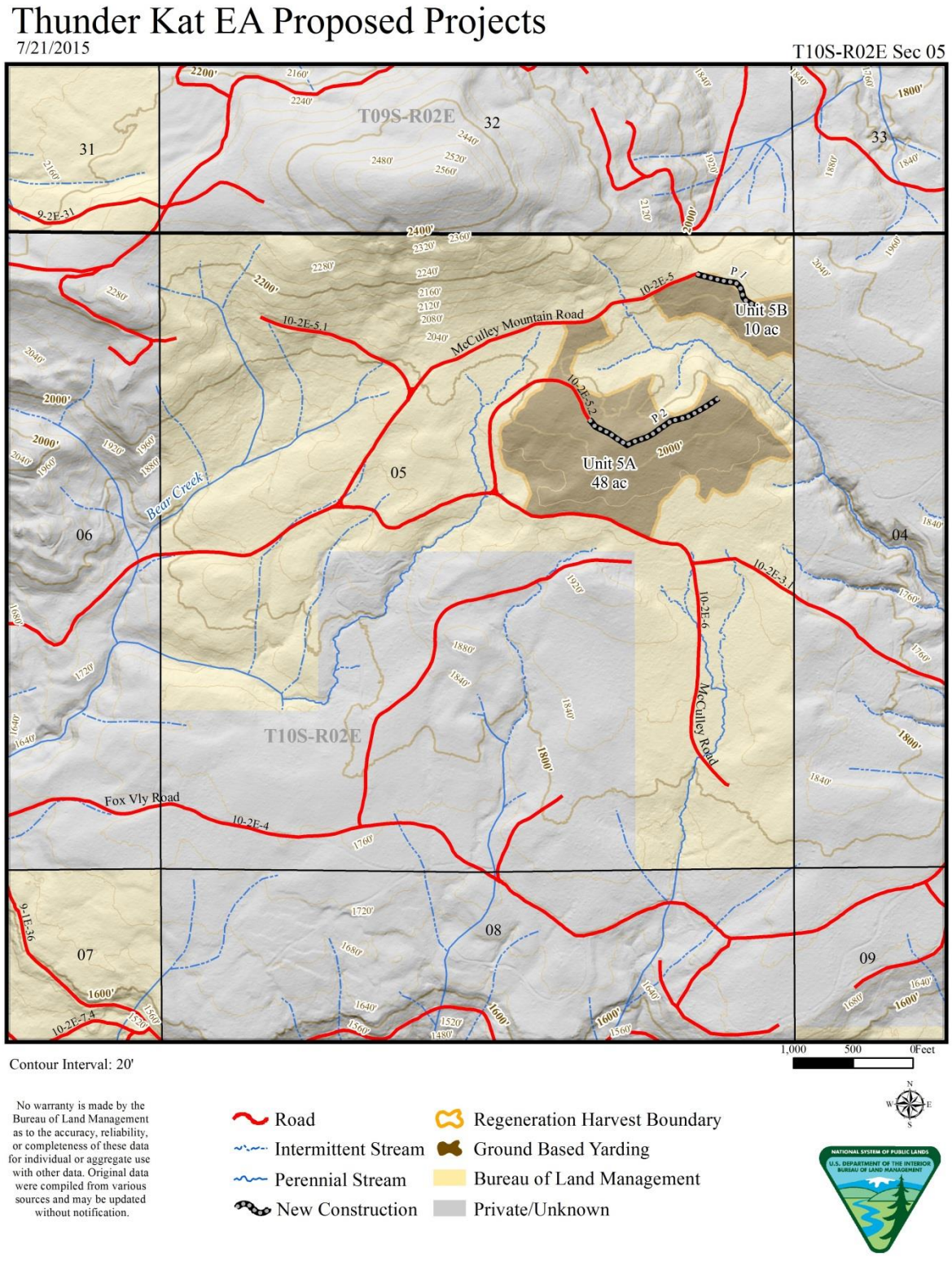
Other Planning and Supporting Documents

Thomas Creek Watershed Analysis, 1996

Willamette Planning Province – FY2015 Biological Assessment of Likely to Adversely Affect Projects with the Potential to Modify the Habitat and/or Disrupt Northern Spotted Owls (BA), USDI, Bureau of Land Management; Fish and Wildlife Service; USDA Forest Service. July 2014.

Biological Opinion Regarding the Effects of Habitat Modification Activities on the Northern Spotted Owl and its' Critical Habitat within the Willamette Province, FY2015; FWS Reference #01EOFW00-2014-F-0221 (BO), USDI Fish and Wildlife Service. October 2014.

7.0 MAPS


Thunder Kat EA Proposed Projects
7/21/2015
T10S-R02E Sec 05
T09S-R02E
T10S-R02E
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Unit 5B
10 ac
Unit 5A
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P 2
10-2E-5
10-2E-5.1
10-2E-5.2
10-2E-6
10-2E-3.1
10-2E-4
10-2E-7.4
9-2E-31
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McCulley Mountain Road
McCulley Road
Bear Creek
Fox Vly Road
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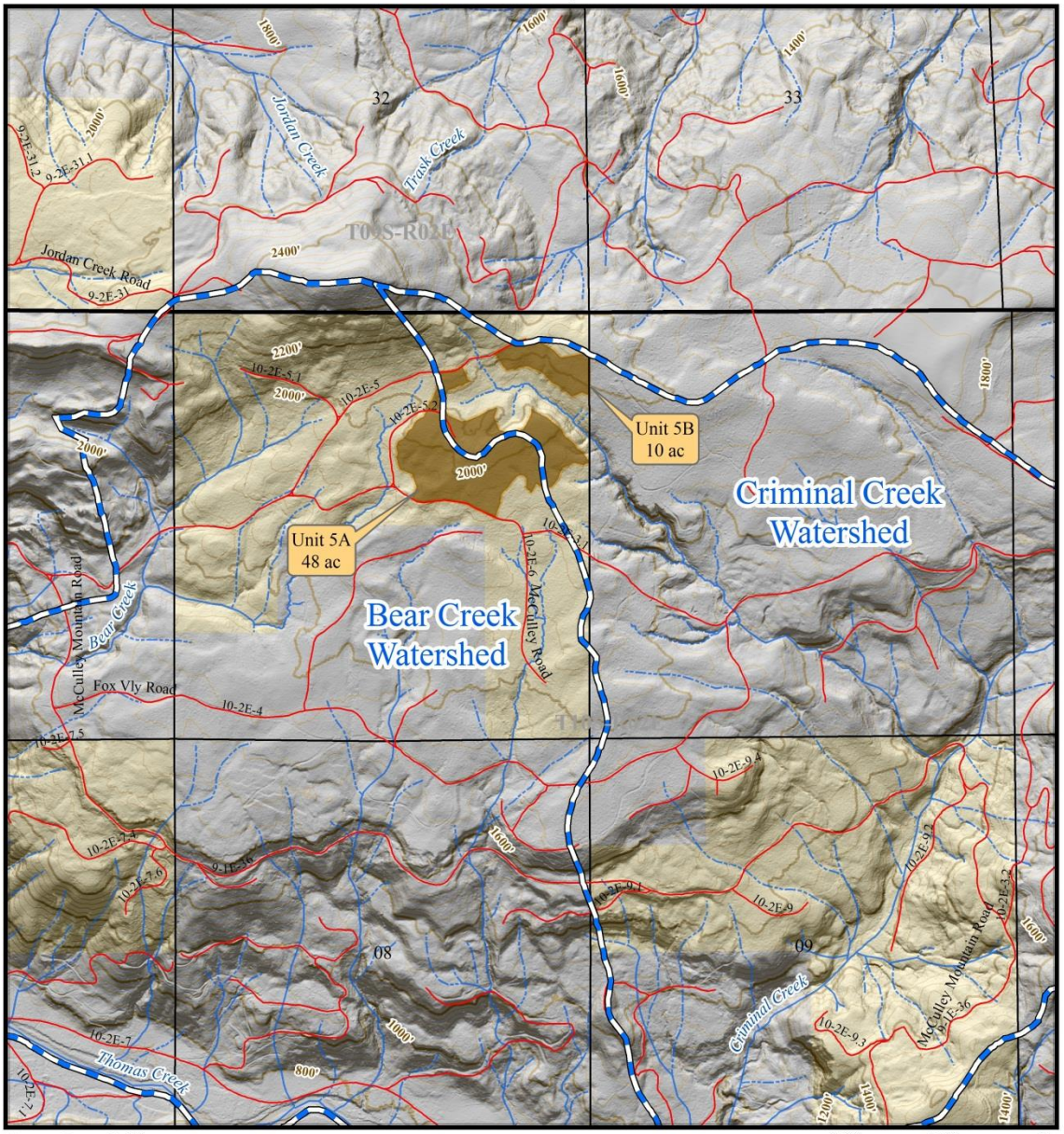
Contour Interval: 20'
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
Road
Intermittent Stream
Perennial Stream
New Construction
Regeneration Harvest Boundary
Ground Based Yarding
Bureau of Land Management
Private/Unknown
NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Thunder Kat EA Peak Flow Analysis Watersheds

9/1/2015



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No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.

- Watershed Boundary
- Road
- Intermittent Stream
- Perennial Stream
- Regeneration Harvest Boundary
- Ground Based Yarding
- Bureau of Land Management
- Private/Unknown

8.0 BIBLIOGRAPHY AND LITERATURE CITED

Agee, J. K. 1996. *The influence of forest structure on fire behavior.* In: Proceedings of the 17th annual forest vegetation management conference; 1996 January 16-18; Redding, CA: 52-68. (Agee, 1996)

Allen M., M. Taratoot and P. Adams. 1999. *Soil Compaction and Disturbance From Skyline and Mechanized Partial Cuttings for Multiple Resource Objectives in Western and Northeastern Oregon, USA.* Proceedings of the International Mountain Logging and 10th pacific Northwest Skyline Symposium. Corvallis, Oregon.

Altman, B., and J. Hagar. 2007. *Rainforest Birds: A Land Manager's Guide to Breeding Bird Habitat in Young Conifer Forests in the Pacific Northwest*. U.S. Geological Survey, Scientific Investigations Report, 2006-5304. 60 p.

Altman, Bob. 2012. *Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington*, Version 2. American Bird Conservancy, Oregon-Washington Partners In Flight.

Anderson, Hal E., April 1982. *Aids to Determining Fuel Models For Estimating Fire Behavior* General Technical Report INT-122 National Wildfire Coordinating Group U.S. Department of Agriculture, U.S. Department of the Interior, National Association of State Foresters. National Interagency Fire Center, the BLM Warehouse, Boise, Idaho (Anderson, 1982)

Bailey, J., and Tappeiner, J. 1997. Effects of Thinning on Structural Development in 40 to 100 Year-old Douglas-fir Stands in Western Oregon. Forest Ecology and Management, 108 (1998) 99-113. (Bailey and Tappeiner 1997)

Beese, W.J., and Bryant, A.A., 1999, *Effect of alternative silvicultural systems on vegetation and bird communities in coastal montane forests of British Columbia, Canada*: Forest Ecology and Management, v. 115, p. 231-242.

Behnke, R.J. 1992. *Native trout of Western North America.* American Fisheries Society Monograph 6. 275 pp.

Benda, Lee, R.D., M.A. Hassan, M. Church, and C.L. May. 2005. *Geomorphology of Steep land Headwaters: The Transition From Hillslopes to Channels.* Journal of the American Water Resources Association. August, 2005. pp. 835-851.

Beschta, R. L.. 1978. *Long-term patterns of sediment production following road construction and logging in the Oregon Coast Range.* Water Resources Research 14(6):1011-1016.

Binkley, D., and T.C. Brown. 1993. *Forest practices as nonpoint sources of pollution in North America*. Journal of the American Water Resources Association 29(5):729-740.

Bjornn, T.C. and D.W. Reiser. 1991. *Habitat requirements of salmonids in streams. pp. 83-138 in Influences of forest and rangeland management on salmonid fishes and their habitats,* Meehan, W.R., editor. American Fisheries Society Special Publication 19.

Bonney, D. 2014. ThunderKat Silvicultural Prescriptions (Silviculture Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Borg, H., Hordace, A., and Batini, F., 1988. *Effects of logging in stream and river buffers on water courses and water quality in southern forests of Western Australia*. Australian Forestry **51**(2), 98-105.

Bosch, J.M., and J.D. Hewlett. 1982. *A Review of Catchment Experiments to Determine the Effect of Vegetation Changes on Water Yield and Evaporation.* Journal of Hydrology, 55:3-23.

Brady, N. C and Weil, R. R. 1996. *The Nature and Properties of Soil* – 11th Edition. Prentice-Hall, Inc.

Bureau of Land Management – Manual 8400 – Visual Resource Management: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.34032.File.dat/8400.pdf

Bureau of Land Management – Manual H-8410-1 – Visual Resource Inventory: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.31679.File.dat/H-8410.pdf

Bureau of Land Management – Manual 8431 – Visual Resource Contrast Rating: http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.79462.File.dat/8431.pdf

Chan, S., Larson, D., Maas-Hebner, K., Emmingham, W., Johnston, S., and Mikowski, D. 2006. *Overstory and Understory Development in Thinned and Underplanted Oregon Coast Range Douglas-fir Stands.* Canadian Journal of Forest Research. 36: 2696-2711 (Chan et.al. 2006)

Christy, R.E., and S.D. West. 1993. *Biology of bats in Douglas-fir forests*. PNW-GTR-308. U.S.D.A. Forest Service, Pacific Northwest Research Station.

Cederholm, C.J., L.M., Reid, and E.O. Salo. 1980. *Cumulative Effects of Logging Road Sediment on Salmonid Populations in the Clearwater River, Jefferson County, Washington.* In Proceedings of a conference on Salmon-spawning Gravel: a renewable resource in the Pacific Northwest, Seattle, WA. October 6-7, 1980.

CH2MHILL and Western Watershed Analysts. 1999. *FEMAT riparian process effectiveness curves: what is science-based and what is subjective judgment?* Oregon Forest Industries Council. Salem, Oregon.

Chambers, C.L., McComb, W.C., and Tappeiner, J.C., 1999, *Breeding bird responses to three silvicultural treatments in the Oregon Coast Range: Ecological Applications*, v. 9, no. 1, p. 171-185.

Curtis, R.O. 1982. *A simple index of stand density for Douglas-fir*. Forest Science. 28(1): 92-94 (Curtis RD)

D. Pimental, et al. 1987. *World Agriculture and Soil Erosion. BioScience,* Vol. 37 No.4, pgs.277-283.

Dissmeyer, George E.[Editor]. 2000. *Gen. Tech. Rep. SRS-039*. Asheville, NC: U.S.D.A., Forest Service, Southern Research Station. 246 p. (http://www.srs.fs.usda.gov/pubs/viewpub.jsp?index=1866).

Elliot, W. J., and D. E. Hall. 1997. *Water Erosion Prediction Project (WEPP) forest*

applications. General Technical Report INT-GTR-365. Ogden, UT: U.S.D.A., Forest Service, Rocky Mountain Research Station.

Fleming, J., Dimas, S. 2005. *Vehicle Cleaning Technology for Controlling the Spread of Noxious Weeds and Invasive Species*. U.S.D.A., Forest Service Technology & Development Program, San Dimas, California. Available at: http://gacc.nifc.gov/rmcc/administrative/docs/weed_wash_unit.pdf

Foltz, R.B. and K.A. Yanosek. 2005. *Effects of Road Obliteration on Stream Water Quality. from Managing Watersheds for Human and Natural Impacts Engineering, Ecological, and Economic Challenges Watershed 2005* Glenn E. Moglen - Editor, July 19–22, 2005, Williamsburg, Virginia, USA.

Forsman, E.D., E.C. Meslow and H.M. Wight. 1984. *Distribution and biology of the spotted owl in Oregon.* Wildlife Monographs 87:1–64.

Forsman, E.D., R.G. Anthony, E.C. Meslow and C.J. Zabel. 2004. *Diets and foraging behavior of northern spotted owls in Oregon*. Journal of Raptor Research 38:214–230.

Grant, Gordon E.; Lewis, Sarah L.; Swanson, Frederick J.; Cissel, John H.; McDonnell, Jeffrey J. 2008. *Effects of forest practices on peak flows and consequent channel response: a state-of-science report for western Oregon and Washington.* Gen. Tech. Rep. PNW-GTR-760. Portland, OR: U.S.D.A., Forest Service, Pacific Northwest Research Station. 76 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr760.pdf

Groom, J.D., L. Dent, L.J. Madsen and J. Fleuret. 2011. *Response of western Oregon (USA) stream temperatures to contemporary forest management.* Forest Ecology and Management 262:1618-1629.

Hall, J.D., and R.L. Lantz. 1969. *Effects of logging on the habitat of coho salmon and cutthroat trout in coastal streams.* Pages 355-375 in T.G. Northcote (ed.), Symposium on Salmon and Trout in Streams. H.R. MacMillian Lectures in fisheries, Univ. British Columbia.

Hamer, T.E., D.L. Hays, C.M. Senger and E.D. Forsman. 2001. *Diets of northern barred owls and northern spotted owls in an area of sympatry*. Journal of Raptor Research 35:221–227.

Hann, Ritchie, Wang, Zumrawi. 2006. *Oregon Growth Analysis and Projection System, Growth and Yield Project for Northwest Oregon Forests (ORGANON),* NW Oregon Version Edition 8.2, College of Forestry, Oregon State University. (Hann, et. al.,2006)

Hansen and Hounihan, 1996. *Canopy Tree Retention and Avian Diversity in the Oregon Cascades. IN: Biodiversity in Managed Landscapes: Theory and Practice*, edited by Robert C. Szaro and David W. Johnston, pp. 401-420; Oxford University Press, N.Y.

Harr, R.D., R.L. Fredriksen, and J. Rothacher, 1979. *Changes in stream flow following timber harvest in Southwestern Oregon.* USDA For. Ser. Pap. PNW-249. 22p.

Hassan, M.A., M. Church, T.E. Lisle, F. Brardinoni, L. Benda and G.E. Grant. 2005. *Sediment Transport and Channel Morphology of Small Forested Streams.* Journal of the American Water Resources Association. August, 2005. Pps. 853-876.

Hawe, W.P., 2012. *Round Mountain Sale Monitoring,* Cascades Resource Area Salem District.

Hicks, B.J., J. D. Hall, P.A. Bisson, and J.R. Sedell. 1991. *Responses of salmonids to habitat changes. pp. 483-518 in Influences of forest and rangeland management on salmonid fishes and their habitats,* Meehan, W.R., editor. American Fisheries Society Special Publication 19.

House, R. 1995. *Temporal variation in abundance of an isolated population of cutthroat trout in western Oregon,* 1981-1991. North American Journal of Fisheries Management 15:33-41.

Hudiburg, T., Law, B., Turner, D. Campbel, J. Danato, D. and Duane, M. 2009. Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. Ecological Applications, 2009: 163-180. (Hudiburg, et al. 2009)

Johnson, M.G., and R.L. Beschta. 1980. *Logging, Infiltration Capacity, and Surface Erodibility in Western Oregon.* Journal of Forestry. June, 1980, 334-337.

Johnson, S.L. 2004. *Factors influencing stream temperatures in small streams: substrate effects and a shading experiment.* Canadian J. Fisheries and Aquatic Science 61:913-923.

Jones, J.A., and G.E. Grant. 1996. *Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon.* Water Resources Research, Vol 32, No.4, 959-974.

Lane, E. W. 1955. *Design of stable alluvial channels.* Transactions, American society of Civil Engineers. 120(2776):1234-1260.

Larsen, Eric M.; Rodrick, Elizabeth; Milner, Ruth. December, 1995, *Management Recommendations for Washington's Priority Species Volume I: Invertebrates*. Washington Department of Fish and Wildlife, Olympia, Washington. 7:1-5.

Leopold, L.B. 1997. *Water, rivers and creeks.* University Science Books. Sausalito, CA. Page 40-41.

Luce, C.H., and T.A. Black. 1999. *Sediment production from forest roads in western Oregon.* Water Resources Research. Vol. 35. No. 8:2561-2570.

MacDonald, Lee H. 1991**.** *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska*. Page 95. EPA/910/9-91-001

McCune, B., Geiser, L., 1997. *Macrolichens of the Pacific Northwest.* Oregon State University Press, Corvallis, Or. Available at: Most book stores.

Montgomery, David R., and John M. Buffington. 1997. *Channel-reach morphology in mountain drainage basins.* Geologic Society of America Bulletin, May 1997. Pp. 596-611.

Moore, D. R. and S.M. Wondzel. 2005. *Physical Hydrology and the Effects of Forest Harvesting in the Pacific Northwest: A Review.* Journal of the American Water Resources Association. August, 2005. pp. 763-784.

NOAA. 2005. *Endangered and threatened species; designation of critical habitat for 12 evolutionarily significant units of west coast salmon and steelhead in Washington, Oregon, and Idaho; Final Rule.* Federal Register 70(170):52630-52858.

Norris, Vol. 1993. *The Use of Buffer Zones to Protect Water Quality: A Review.* Water Resources Management 7: 257-272.

Olson, D.H. and C. Rugger. 2007. *Preliminary study of the effects of headwater riparian reserves with upslope thinning on stream habitats and amphibians in western Oregon.* Forest Science 53:331-342.

Oregon Department of Agriculture. Weed Mapper Information Center. Available at: http://www.weedmapper.org/index.html

Oregon Department of Forestry (ODF). June, 2003. *Wet Season Road Use Monitoring Report. Final Report.* Forest Practices Monitoring Program Technical Report #17.

Oregon Natural Heritage Information Center. 2007. *Rare, Threatened and Endangered Species of Oregon*. Oregon Natural Heritage Information Center, Oregon State University, Portland, Oregon. Available at: http://oregonstate.edu/ornhic/2007_t&e_book.pdf

Oregon Watershed Enhancement Board (OWEB). *Oregon Watershed Assessment Manual.* Page IV-11. Salem, Oregon. (http://www.oweb.state.or.us/publications/wa_manual99.shtml).

Ottmar, Roger D., and Hardy, Colin C., 1989. Stereo Photo Series for Quantifying Forest Residues in Coastal Oregon Forests: Second-Growth Douglas-Fir---Western Hemlock Type, Western Hemlock---Sitka Spruce Type, and Red Alder Type. General Technical Report PNW-GTR-231 U.S. Department of Agriculture - Forest Service, Pacific Northwest Research Station. Siuslaw National Forest. (Ottmar, Hardy, 1989)

Patric, J.H., James, O. Evans, and J. David Helvey. 1984. *Summary of Sediment Yield Data From Forested Land in the United States*. Journal of Forestry. Pages 101-105.

Pojar, J., MacKinnon, A., 1994. *Plants of the Pacific Northwest Coast, Washington, Oregon, British Columbia & Alaska*. Lone. Pine Publishing, Alberta, Canada. Available at: Most book stores.

Power, W.E., Tausch, W.A.. 1987. Timber Production Capability Classification. TPCC Technical Guide. U.S.D.I. BLM, Salem District. OR.

Rashin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. *Effectiveness of timber harvest practices for controlling sediment related water quality impacts.* J. American Water Resources Association 42(5): 1307-1327.

Robert Feldt. 2010. *Sediment Trapping by Streamside Management Zones of Various Widths after Forest Harvest and Site Preparation.* Forest Science 56(6).

Rosgen, D.L. 1994. *A classification of natural rivers.* Catena 22:169-199.

Rosgen, David, L.. 1996. *j*. Wildland Hydrology, Pagosa Springs, Colorado.

Schofield, W.B. 1992. *Some Common Mosses of British Columbia*. Royal British Columbia Museum Press, Victoria, British Columbia, Canada.

Sisco, C.L. 1990. *Seasonal home range and habitat ecology of spotted owls in northwestern California.* Thesis, Humboldt State University, Arcata, California.

Streamnet. 2006. On-line map. Welcome to StreamNet On-line! http://map.streamnet.org, Gladstone, Oregon.

Takashi, Gomi, R.D. Moore and M.A. Hassan. 2005. *Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest.* Journal of the American Water Resources Association. August, 2005. Pps. 877-898.

Toman, E. T. 2004. *Forest road hydrology: the influence of forest roads on stream flow at stream crossings*. M.S. thesis. Forest Engineering Department, Oregon State University. Corvallis, Oregon. 78 pp.

Tonina D., Luce, C., Clayton, S.R., Alì, S. Md., Barry, J.J., Rieman, B., Goodwin, P., Buffington, J.M., Berenbrock, C., 2008. *Hydrological response to timber harvest in northern Idaho: Implications for channel scour and persistence of salmonids*, Journal of Hydrological Processes, 22.

Troendle, C.A., L.H. MacDonald, and C.H. Luce. May, 2006. Chapter 7 Fuels Management and Water Yield. from *Cumulative Watershed Effects of Fuels Management: A Western Synthesis.* Available at http://www.wy.blm.gov/fireuse/pubs/FuelsMgmt_WaterYield.pdf

U.S. Environmental Protection Agency, Region 10. EPA 910/9-91-001. *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska*. Pgs.52-53. Seattle, Washington.

U.S.D.A., Forest Service and U.S.D.I., Bureau of Land Management. *Interagency Special Status / Sensitive Species Program.* Available at: http://www.fs.fed.us/r6/sfpnw/issssp/

U.S.D.A., Forest Service and U.S.D.I., Bureau of Land Management. 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.* Available at: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/

U.S.D.A., Forest Service and U.S.D.I., Bureau of Land Management. *Oregon & Washington Special Status Policy* – Instruction Memorandum - OR-91-57, Available at: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/

U.S.D.A., Forest Service and U.S.D.I., Bureau of Land Management. 2004. *Northwest Forest Plan Temperature TMDL Implementation Strategies.* Draft. Portland, Oregon. http://www.blm.gov/nhp/efoia/or/fy2006/ib/p/ib-or-2006-014Att2.pdf (Final)

U.S.D.A., Forest Service; U.S.D.I., Bureau of Land Management. 1994. *Record of Decision for Amendments to Forest Service and Bureau of Land Management Documents Within the Range of the Northern Spotted Owl. Portland, Oregon.*

U.S.D.A., Forest Service; U.S.D.I., Bureau of Land Management. 1993. *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, Oregon.

U.S.D.A., Natural Resources Conservation Service. 2005. *Soil Data Mart.* Accessed at http://soildatamart.nrcs.usda.gov/ December 2005-June 2006.

USDI, Bureau of Land Management; Fish and Wildlife Service; USDA Forest Service. July 2014. Willamette Planning Province – *FY2015 Biological Assessment of Likely to Adversely Affect Projects with the Potential to Modify the Habitat and/or Disrupt Northern Spotted Owls (BA).*

U.S.D.I, Bureau of Land Management. 1987. *Timber Production Capability Classification*. Salem District.

U.S.D.I. Bureau of Land Management. 1998. *Riparian Area Management. A User Guide to Assessing Proper Functional Condition and the Supporting Science for Lotic Areas*. TR1737-15. National Applied Resource Science Center. Denver, CO.

U.S.D.I., Bureau of Land Management, 1995. *Salem District Record of Decision and Resource Management Plan*, Available at: http: www.blm.gov/or/plans/files/salem_rmp.pdf

USDI, Bureau of Land Management, Salem District, Cascades Resource Area. 1996. Thomas Creek Watershed Analysis.

U.S.D.I., Bureau of Land Management, Fish and Wildlife Service; U.S.D.A., Forest Service. August 2013. *Biological Assessment of Not Likely to Adversely Affect Projects with the Potential to Modify the Habitat of Northern Spotted Owls, Willamette Planning Province* – FY2014 (BA 2014);

U.S.D.I., Bureau of Land Management. 1996. *Thomas Creek watershed analysis*. Cascades Resource Area. Salem, Oregon.

U.S.D.I., Bureau of Land Management. *Known Site Data Base*. Cascade Resource Area, Salem District BLM

U.S.D.I., Bureau of Land Management. *Manual 6840 – Special Status Species Management.* Available at: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/

U.S.D.I., Bureau of Land Management. 2007. *The Salem and Eugene District Water Quality Restoration Plan for the Willamette Basin.* Internal document, Salem and Eugene district files

U.S.D.I., Bureau of Land Management. Manual 9015 – *Integrated Weed Management.* Available at: http://www.blm.gov/ca/st/en/prog/weeds/9015.html

U.S.D.I., Bureau of Land Management.. 1986. *Timber Production Capability Classification Handbook*. Manual Supplement Oregon State Office Handbook 5251-1 with Salem District Supplement. Portland, Oregon.

U.S.D.I., Bureau of Land Management.. 2013, *Stand Exam Reports and Organon Yield Tables*; Cascades Resource Area, Salem District.

U.S.D.I., Bureau of Land Management.. 3. 2013. Huston, John. *Project Initiation Letter, 2014 Timber Sale EA's*. Salem District, Cascades Resource Area, Salem, OR.

USDI Fish and Wildlife Service. October 2014. Biological Opinion Regarding the Effects of Habitat Modification Activities on the Northern Spotted Owl and its Critical Habitat within the Willamette Province, *FY2015; FWS Reference #01EOFW00-2014-F-0221 (BO).*

U.S.D.I., Fish and Wildlife Service. September 2013. *Letter of Concurrence Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY2014,* Proposed by the Eugene District, Bureau of Land Management; Salem District, Bureau of Land Management; Mt. Hood National Forest; Willamette National Forest; Columbia River Gorge National Scenic Area on the Northern Spotted Owl and its Critical Habitat; FWS Reference #01EOFW00-2013-I-0187 (LOC 2014).

U.S.D.I., U.S. Fish and Wildlife Service. January 2013. *Revised Critical Habitat for the Northern Spotted Owl.* Portland, OR.

U.S.D.I., U.S. Fish and Wildlife Service. June 2011. *Revised Recovery Plan for the Northern Spotted Owl.* Region One U.S. Fish and Wildlife Service, Portland, OR (NSO 2011).

U.S.D.I., *Weed Control Program - DOI Department Manual – Part 609* Available at: http: http://elips.doi.gov/elips/release/3042.htm

USA. Executive Order13112- *Invasive Species.* Available at: http: http://www.invasivespeciesinfo.gov/laws/execorder.shtml

Van Wagner, C.E. 1965. *Describing Forest Fires - old ways and new.* Forestry Chronicle 41:301-305

Waldien, D., Hayes, J., and Arnett, E. 2000. *Day Roosts of Female Long-eared Myotis in Western Oregon.* Journal of Wildlife Management 64(3):785-796.

Walker, G.W., N.S. Macleod. 1991**.** *Geologic Map of Oregon.* U.S.D.I. U.S. Geologic Survey.

Ward, J.W. Jr., R.J. Gutiérrez and B.R. Noon. 1998. *Habitat selection by northern spotted owls: the consequences of prey selection and distribution.* Condor 100:79–92.

Weller, T., and Zabel, C. 2001. *Characteristics of Fringed Myotis Day Roosts in Northern California*. Journal of Wildlife Management 65(3):489-497.

Wemple, B.C., J.A .Jones, and G.E. Grant. 1996. *Channel Network Extension by Logging Roads in Two Basins, Western Cascades, Oregon.* WATER RESOURCES BULLETIN, VOL. 32, NO. 6, 1195.

Wemple, B.C., J.A. Jones. 2003. *Runoff production on forest roads in a steep, mountain catchment.* WATER RESOURCES RESEARCH, VOL. 39, NO. 8, 1220.

Wilkerson, Ethel, J.M.Hagan, D.Siegel, and A.A. Whitman. 2006. *The Effectiveness of Different Buffer Widths for Protecting Headwater Stream Temperature in Maine.* Forest Science 52(3) 2006.

William A. Lakel III, Wallace M. Aust, M. Chad Bolding, C. Andrew Dolloff, Patrick Keyser,

Wischmeier, W. H. and Smith, D. D. 1978. *Predicting Rainfall Erosion Losses – A Guide to Conservation Planning.* U.S. Department of Agriculture Handbook 537. Washington, D. C.: USDA.

Witt, D., Marsh, J., Bovey, R., 1998. *Mosses, Lichens & Ferns of North America*. University of Washington, Seattle, Washington. Lone Pine Publishing, Alberta, Canada. Available at: Most book stores.

Zabel, C.J., K.M. McKelvey and J.P. Ward, Jr. 1995. *Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls* (*Strix occidentalis caurina*). Canadian Journal of Zoology 73:433–439.