Sunday Morning Belly Twister Timber Management Project

Environmental Assessment and Finding of No Significant Impact

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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. 1 E., section 35;
T. 11 S., R. 1 E., sections 1, 3, 15, 16, 17 and 27;
T. 11 S., R. 2 E., sections 5, 6, 7 and 8, W.M.

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BLM
Salem District

As the Nation's principal conservation agency, the Department of Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering economic use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

BLM/OR/WA/AE-15/008+1632

FINDING OF NO SIGNIFICANT IMPACT

Introduction

The Bureau of Land Management (BLM) has conducted an environmental analysis for a proposal to commercially thin 1,500 acres of 40-102 year old forest stands and an alternative to commercially thin 1,435 acres of 40-102 year old forest stands and regeneration harvest 65 acres of a 102 year old stand. The project is located on BLM lands in T. 10 S., R. 1 E., section 35; T. 11 S., R. 1 E., sections 1, 3, 15, 16, 17 and 27; and T. 11 S., R. 2 E., sections 5, 6, 7 and 8; W.M. in Linn County, Oregon. The Sunday Morning Belly Twister (SMBT) Environmental Assessment (EA) (#DOI-BLM-OR-S040-2014-0001-EA) documents the environmental analysis of the proposed timber management alternatives. The EA is attached to and incorporated by reference in this Finding of No Significant Impact determination. The EA and unsigned FONSI will be made available for public review and comment from December 17, 2014 to January 16, 2015 (*EA section 5.3*).

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 proposed timber management activities have been designed 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 BLM lands within the Salem District (*EA Section 1.3*).

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 Sunday Morning Belly Twister Timber Management Project (SMBT).

Based upon review of the SMBT EA and supporting documents, the proposed action is not 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 the proposed action have been analyzed within the context of the project area boundaries, and the following 6th field watersheds: Middle Crabtree Creek, Beaver Creek and Neal Creek. The 1,500 acre project would affect approximately 2.2 percent of the combined 67,587 acres in these three 6th field watersheds.

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 BLMs consideration of the severity of the impacts as assessed in the SMBT EA.

Impacts that may be both beneficial and adverse [40 CFR 1508.27(b) (1)]: The effects of commercial thinning are unlikely to have significant (beneficial and/or adverse) impacts *(EA Chapter 3)* for the following reasons:

Project Design (EA section 2.3): The proposed treatments described in EA section 2.3.1.1 (proposed action, including the project design features described in Table 5) and EA section 2.3.1.2 (alternative action, including additional project design features described in Table 8) were developed by the Interdisciplinary Team of Resource Specialists (IDT) so that the risk of effects to affected resources would conform to RMP Management Direction and be within the effects described in the RMP/FEIS.

Vegetation and Forest Stand Characteristics (EA section 3.4): Effects to these resources would not have significant impacts because:

A forest environment would be maintained in the project area by retaining green trees within project units (EA Table 13).

There would be no identifiable effects on 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 habitat for Special Status Species (SSS) or any known or undiscovered SSS populations from this project because the nature of thinning the forest would not change these habitats in a way that would preclude those species. Potential undiscovered populations include seasonal fungi species.

Live BRNO fruiting bodies would be adequately protected by minimum 50 feet radius untreated buffers as determined in the 2007 Management Plan for the Snow Peak BRNO population. BLM anticipates that thinning overstocked timber stands to promote growth of larger diameter true fir would help ensure the survival of this species in managed stands.

Therefore, the project would not contribute to the need to list any BLM Special Status Species.

BLM examined past timber harvest areas near to the proposed project area and found no evidence to indicate that adverse impacts from invasive/non-native species would occur as a result of the proposed project.

Hydrology, Fisheries and Aquatic Habitat (EA sections 3.5; 3.6): Effects to these resources would not have significant impacts because the project effects on water quality would comply with Oregon Department of Environmental Quality (ODEQ) water quality standards because:

In general, there would be no direct alteration of the physical features of project area stream channels or wetlands from timber harvest or logging operations. (The exception is for culvert replacements on the haul routes.)

The proposed action is unlikely to affect stream flow and the potential increases in stream flow from the alternative action are unlikely to exceed the threshold for peak flow augmentation, so the project is unlikely to cause indirect effects to stream channels as a result of flow alteration or timing.

The project would maintain current stream temperatures by retaining the current vegetation and shading in the primary shade zone (stream protection zones, or SPZ) and most of the current levels of shading provided by the secondary shade zone.

It is unlikely that the proposed action would result in a discernible effect to the levels of turbidity or water clarity in project watersheds or that turbidity levels would reach levels that would impact aquatic organisms or cause additional treatment expense or technical difficulties for the downstream water providers. Water quality would be maintained because logging, road

construction/renovation, culvert replacement, road maintenance and timber haul project design features (EA Table 4) and SPZ are expected to prevent sediment from reaching streams and causing sediment/turbidity that would exceed ODEQ water quality standards.

Water quality would also be maintained because road construction would occur on gentle, stable slopes so no mass movement would be expected which could increase sediment. Runoff from new roads would drain to stable, vegetated slopes where it would infiltrate into the soil rather than connect to stream channels to transport sediment or augment peak flows. Redesigning and improving 0.3 mile of the Church Creek Spur road in section 15 would ultimately improve channel processes.

No changes in project area hydrology due to project actions are likely to be detectable, including mean annual water yield, fog drip, base flow and peak flows.

The project would not impact stream channels, aquatic habitat or fish populations because it would not cause water quality impacts that exceed ODEQ water quality standards and would not detectably change project area hydrology.

Soils (EA section 3.7): Effects to this resource would not have significant impacts because:

Project design features (EA Table 5) limit machinery operations so that there would be an overall maximum increase of 12 percent of the project area in moderate to heavy compaction/disturbance of soils from all sources, which is within RMP standards (C-2, 10 percent from logging; and C-9, 2 percent from site preparation) which were analyzed in the RMP/FEIS.

No loss of growth and yield would be expected at the stand level because thinning treatments typically lead to acceleration of average tree growth and compacted soils affect less than half of the rooting area of individual trees.

Following completion of thinning (all acres in proposed action, 1435 out of 1500 acres in alternative action), the majority of organic matter, understory vegetation and root systems would remain.

Following completion of regeneration harvest (65 of 1500 acres in the alternative action) the majority of root systems would remain to provide soil stability and vegetation would provide ground cover within 1-3 years as vegetation resprouts and conifer trees are planted and established.

The project would not lead to any measurable increase in surface erosion and overall erosion would remain within the natural range of background erosion rates.

The project would maintain sufficient mycorrhizae populations because the root systems of most vegetation would remain undisturbed and past disturbance of the area has not apparently affected mycorrhizae populations.

Wildlife (EA section 3.8): Effects to this resource would not have significant impacts because:

Proposed treatments (and non-treatment) would have trade-offs of effects in both the short and long term which would be beneficial to some species and detrimental to other species. The variation within proposed treatments 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 thinning are not presently functioning as late-successional or old growth habitat and no remnant legacy trees older than 200 years would be affected.

Existing snags and coarse woody debris (CWD) would be retained on site. Fewer than 10 percent of existing large (≥15 inches and ≥15 feet tall) that would be felled for safety or knocked over by logging operations would be retained as CWD. Fewer than 10 percent of CWD would be impacted by logging and would remain on site.

No suitable habitat for BLM Special Status species (SSS) which are known or likely to be present in the project area would be lost. Therefore the project would not contribute to the need to list any SSS.

Proposed treatments would not significantly change species richness (a combination of species diversity and abundance) of the Migratory and Resident Bird community. No species would be extirpated in stands as a result of thinning.

See Intensity Point # 9 for effects to northern spotted owl.

Air Quality and Fire Hazard/Risk (EA section 3.9): Effects to this resource would not have significant impacts because:

After 3 to 5 years the fine fuels generated by thinning would be decayed in the units and the risk of surface fire would decrease to near current levels. Under the alternative action, fuels treatment for site preparation would immediately reduce the risk of surface fire to at or below current levels.

The thinning itself would decrease the risk of a canopy fire.

The proposed action would comply with State of Oregon Air Quality Standards by strict adherence to smoke management regulations.

Carbon Storage, Carbon Emissions and Climate Change (EA section 1.8.3): Effects to this resource would not have significant impacts because the incremental increase in carbon emissions as greenhouse gasses that could be attributable to the proposed action is of such small magnitude that it is unlikely to be detectable at global, continental or regional scales or to affect the results of any models now being used to predict climate change.

Recreation, Visual Resources, and Rural Interface (EA section 3.10): Effects to this resource would not have significant impacts because:

Recreation visitation would be moderately restricted for short periods (weeks) in specific locations (units) during a 3 – 5 year period for safety, then should return to prior usage.

There are no authorized recreation trails to be impacted. Access to one social hiking trail to Snow Peak would be restricted for a few weeks during a 3-5 year period for safety then be available again for use.

No long term changes (more than weeks within a 3-5 year period) to public access would result from the project.

Changes to the landscape character would comply with Visual Resource Management (VRM) class 3 and 4 objectives since thinning would not significantly alter the visual character of the project area. Regeneration harvest under the alternative action would comply with VRM class 4 management objectives which allow major modifications of the visual landscape.

Proposed timber harvest operations would not increase OHV access to units and would obliterate any existing unauthorized OHV trails and stabilize soils.

[40 CFR 1508.27(b) (2)] - The degree to which the proposed action affects public health or safety (*EA sections 1.6, 1.7.2, 2.3, 2.3.1 Table 4, 3.4, 3.8, 3.9*)*:* The proposed project would not adversely affect public health or safety because:

Public access to much of the proposed project areas is restricted by private gates. Public access to hazardous work areas where there are accessible roads would be restricted by warning signs and temporary traffic control barriers or devices.

OSHA mandated health and safety regulations are applied to all project operations related to the proposed project implementation.

All actions of the proposed project must meet national and State of Oregon air and water quality standards, as provided for by the EIS.

[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: Effects to these resources would not have significant impacts because:

The proposed project would not affect historical or cultural resources because there are no known cultural resources within project units or other locations where they could potentially be impacted by project operations. On site cultural and historic surveys have been completed and have not produced evidence to support the previous or present existence of artifacts of significant cultural or historical value. (*EA section 3.11*)

There are no park lands, prime farmlands or wild and scenic rivers to be impacted.

[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 actions similar to both the proposed action and the alternative action and in similar areas so the effects are well known, not highly controversial.

[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 effects of the project do not have not uncertain, unique or unknown risks because the BLM has experience implementing similar actions in similar areas without these risks, no potential unique or unknown risks were identified by the BLM or by comments submitted in response to scoping, and project design features would minimize the risks associated with the project (*EA sections 2.2.1, 2.3.1.1, 2.3.1.2*). See # 4, above.

[40 CFR 1508.27(b) (6)] - The degree to which the action may establish a precedent for future actions with signific5nt effects or represents a decision in principle about a future consideration: The proposed actions would not establish a precedent for future actions beyond the time frames analyzed nor would they represent a decision in principle about a further consideration for the following reasons:

The project is in the scope of proposed activities documented in the RMP FEIS.

The BLM has experience implementing similar actions in similar areas without setting a precedent for future actions or representing a decision about a further consideration. See #s 4 and 5, above.

[40 CFR 1508.27(b) (7)] - Whether the action is related to other actions with individually insignificant but cumulatively significant impacts: The Interdisciplinary Team (IDT) evaluated the project area in context of past, present and reasonably foreseeable actions and determined that there is a potential for cumulative effects on water quality and fisheries, peak flows and fisheries, and carbon storage and emissions. These effects are not expected to be significant for the following reasons:

Water Quality/Fisheries: The proposed action would be expected to temporarily increase stream sediment and turbidity as a result of culvert replacement, road maintenance, and road use (*EA Sections 3.5, 3.6*). These effects are not expected to be significant for the following reasons:

Any sediment increase resulting from thinning would be too small to be discernable relative to background sediment yields, would not be expected to exceed ODEQ water quality standards and would decrease quickly over time, returning to current levels within three to five years as vegetation increases (Dissmeyer, 2000).

The limited magnitude of sediment inputs (non-detectable on 7th field watershed scale, not visible more than 800 meters downstream of crossings) and duration (primarily major storm events during the first year following disturbance at culvert replacement sites) of this effect would likely be insignificant for water quality on the watershed scale. Cumulatively, the proposed action and connected actions would be unlikely to result in any detectable change for water quality on a 7th field watershed scale (even less effect on the larger 6th field watershed scale) and would be unlikely to have any effect on any designated beneficial uses, including fisheries. (*EA Section 3.5.1, 3.6.1*)

Road use restrictions, road design and maintenance, protection measures and monitoring of road conditions would prevent increases in turbidity that exceed ODEQ standards which were established to maintain water quality (*EA section 2.3.1., and Table 5*). When water quality is maintained within ODEQ standards, changes to sediment levels would not significantly impact fisheries, including listed fish habitat (LFH). (*EA sections 3.6.2.1, 3.6.2.2*)

Peak Flows and Fisheries: Neither the proposed action nor the alternative action, combined with the effects of BLM's estimate of potential harvest on private lands over the next 10 years would augment peak flows to exceed the threshold for peak flow effects. (*EA sections 3.5.2.1, 3.5.2.2, 3.6.2.1, 3.6.2.2*)

The project alternatives carry no risk for contributing to any existing cumulative effect to watershed hydrology because the watersheds are currently at a low risk for impacts and there would not be any detectable direct or indirect effects to surface flows or ground water. (*EA sections 3.5.2.1, 3.5.2.2*)

Based on BLM analysis of recent, ongoing and potential future harvest on private industrial forest lands in the project watersheds, it is likely that much less than 60 percent of the closed forest stands on private land has been harvested within the last decade or would be harvested within the next decade. This analysis is based on field observations, general knowledge of private harvest cycles, BLM GIS data and analysis of BLM's 2012 aerial photography. (*EA section 3.5.2.2, Figure 28*)

One decade after harvest, open stands would grow to at least 30 percent closure and not contribute to augmenting peak flows. (*EA section 3.5.2.2*)

Since the project is at low risk for potential increases in peak flows so it would not affect stream channels, large wood or sediment levels in project area streams and therefore would not significantly affect fisheries. (*EA sections 3.6.2.1, 3.6.2.2*)

Carbon storage and carbon emissions (*EA section 1.8.3*): The proposed thinning would contribute to cumulative effects to carbon storage and carbon emissions. The effects are not significant for the following reasons:

The incremental increase in carbon emissions as greenhouse gasses that could be attributable to the proposed action is of such small magnitude, as determined by analysis of similar projects,

that it is unlikely to be detectable at global, continental or regional scales or to affect the results of any models now being used to predict climate change.

The net carbon emissions would be of short duration, as determined by analysis of similar projects.

[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 no districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places exist within or near the proposed project vicinity. (*EA section 3.11*)

[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: 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 3.8): Effects to the species are not significant because: The project maintains dispersal and suitable habitat, and does not affect suitable owl habitat within and between known owl sites; habitat conditions are expected to improve as thinned stands mature (>20 years); residual trees would increase in size and be available for recruitment or creation of snags, culls and CWD for prey species and nesting opportunities, particularly in Riparian Reserves. ESA Consultation is described in EA section 5.1.1.

ESA Fish – UWR Chinook salmon, UWR steelhead trout (EA Section 3.6): Effects to ESA fish are not significant because thinning is not expected to affect these species for the reasons stated in the Hydrology section (*EA section 3.5*).

Effects of road maintenance and log hauling are not significant because project design features would prevent sediment from entering streams in quantities sufficient to exceed ODEQ water quality standards. The haul routes are designed and maintained to support year around use and direct most water and sediment onto stable slopes where it infiltrates rather than delivering it to streams. Condition related restrictions and monitoring would prevent generating and delivering sediment to streams.

New road construction would be located in stable locations and would not contribute to degradation of aquatic habitat or extend the stream network through ditches on new roads draining into streams.

ESA Consultation is described in EA section 5.1.

[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 section 1.7*)

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

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Chapter 1: Introduction

This Environmental Assessment (EA) analyzes the effects on the human environment of a proposed timber management and harvest project with two 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 Action Alternatives[1]

1.1.1 Proposed Action: Commercial Thinning

The Cascades Resource Area, Salem District Bureau of Land Management (BLM), proposes to thin approximately 1,500 acres of 40-102 year old[2] forest stands. Connected actions include: habitat improvement such as low density thinning patches; creating coarse woody debris (CWD); tree topping and snag creation; road maintenance, construction, renovation, culvert replacement, and/or improvement; road stabilization and closure; and fuels treatment.

1.1.2 Alternative Action: Commercial Thinning and Regeneration Harvest

The Cascades Resource Area proposes an alternative action to thin approximately 1,435 acres of 40-102 year old forest stands and to regeneration harvest approximately 65 acres of 102 year old forest stands. In addition to the connected actions for the proposed action, connected actions include site preparation and reforestation.

1.2 Project Area[3] Location and Vicinity

The proposed Sunday Morning Belly Twister (SMBT) project is located within Linn County, Oregon within;

The Sunday Morning Block: Township 11 South, Range 1 East, Sections 15, 16, 17 and 27, Willamette Meridian.

The Belly Twister Block: Township 10 South, Range 1 East, Section 35; Township 11 South, Range 1 East, Sections 1 and 3; Township 11 South, Range 2 East, Sections 6 and 7, Willamette Meridian. Except the unit identified as 8A.

The Bent Beekman Block: Township 11 South, Range 2 East, Sections 5, 6, 7 and 8, Willamette Meridian. Units identified as 8A and 8C.

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[1] Thinning is a generic term used for cutting a portion of the trees in a forest stand to manage tree densities to achieve defined objectives. Commercial thinning accomplishes this by selling designated standing trees to a purchaser who cuts those trees, removes the logs and performs connected actions (EA chapter 2) under the terms of a BLM contract. Related terms that may be used interchangeably in this EA and supporting documents in the project file include: commercial thinning, CT, thinning, density management, partial cut, and treatment as well as other verb tenses of thin and treat.

[2] Total stand age calculated as of January 2013.

[3] "Project area" is the area proposed for treatment such as thinning, or other operations such as road construction and road renovation. "Project vicinity" is the contiguous block(s) of BLM managed lands within the sections that contain the project area. The "Vicinity Map" shows the project vicinity and additional area.

The proposed project area is within the Crabtree Creek and Thomas Creek fifth field watersheds, tributary to the South Santiam River. Sixth field watersheds containing the project area include: Middle Crabtree Creek, Beaver Creek and Neal Creek. BLM lands are intermixed with privately-owned industrial timberland, creating a mosaic of ownership patterns.

See EA Sections 3.5.1 - Hydrology, and 7.1 - Vicinity Map and Section Maps.

1.3 Need for Action

1.3.1 General Need for a Timber Sale and Connected Actions

The proposed Sunday Morning Belly Twister project responds to the need to manage revested Oregon and California Railroad (O&C) lands under the principles of sustained yield management for permanent forest production of timber to: contribute to the economic stability of local communities and industries, provide for forest habitat and provide for water quality and aquatic habitat.

The land within the SMBT project area is revested Oregon and California Railroad (O&C) land within the Salem District BLM. The statutory requirements of the O&C Act (43 U.S.C. §1181a et seq.), which governs BLM-administered O&C lands in western Oregon, include, but are not limited to, managing the O&C lands for permanent forest production by selling, cutting, and removing timber in conformance with the principles of sustained yield; determining the annual productive capacity of the lands managed under the O&C Act; and offering that determined capacity annually under normal market conditions. The statute states that the purpose of sustained yield management of these lands is to provide a permanent source of timber, contribute to the economic stability of local communities and industries, as well as benefit watersheds, regulate stream flows, and provide recreational use. (RMP p. 2; 2008 FEIS Ch.1 pp. 8 – 9 and A6 – 7.)

Forest management by BLM must be implemented in full compliance with a number of subsequent laws that direct how BLM accomplishes that statutory direction. For further discussion of legal authorities which direct the proposed action and alternatives, see EA section 1.7, Conformance with Land Use Plan, Statutes, Regulations and Other Plans.

The Federal Land Policy and Management Act of 1976 (FLPMA, 43 U.S.C. §1701 et seq.) requires that public lands be managed for multiple uses and establishes a planning process. The FLPMA does not require that every parcel be managed for every value and timber is included in these uses. The FLPMA further specifically provides that if there is any conflict between its provisions and the O&C Act related to management of timber resources, the O&C Act prevails (43 U.S.C. §1701).

The Salem District Record of Decision and Resource Management Plan (RMP, May 1995) responds to both the need for a healthy forest ecosystem and the need for a sustainable supply of timber. "The Oregon and California Lands Act requires the Secretary of the Interior to manage Oregon and California lands for permanent forest production; however, such management must also be in accord with sustained-yield principles. Further, that Act requires that management of Oregon and California lands protect watersheds, …" (RMP: Record of Decision, Introduction and pp. 1-2).

BLM has identified specific forest stands that can be managed at this time to provide a portion of the Salem District's sustainable supply of timber resources within the context of providing for a healthy forest ecosystem.

1.3.2 Site Specific Need for the Project

1.3.2.1 General RMP Strategy and Objectives

The Salem RMP strategy is to manage BLM lands to maintain healthy, functioning ecosystems from which a sustainable production of natural resources can be provided (RMP pp. 4, 5) to implement the O&C Act and Northwest Forest Plan (NWFP). The RMP designates land use allocations (LUA) and provides objectives and management actions/directions for managing land in each of these LUAs on the Salem District. Active forest management is needed to implement elements of this strategy and these objectives. These are the general RMP Objectives for each LUA which indicate the need for action:

Matrix: Lands within the Matrix LUA are designated to (RMP p. 20):

- Produce a sustainable supply of timber to provide jobs and contribute to community stability;
- Provide connectivity between Late-Successional Reserves;
- Provide habitat for a variety of organisms associated with both late-successional and younger forests;
- Provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags and large trees;
- Provide early successional habitat.

Declining growth rates result in reduced volume yield and value over the planned timber rotation and simple stand structure contributes little to meeting the ecological objectives for this LUA. Active forest management is needed to reverse these trends in the project area stands so the stands will thrive and contribute to future timber production and habitat improvement goals of the NWFP. Matrix LUA in the SMBT project area includes both General Forest Management Area (GFMA) and Connectivity/Diversity Block (CONN).

Riparian Reserve: Lands within the Riparian Reserve (RR) LUA are designated to restore and maintain the ecological health of watersheds and aquatic ecosystems (RMP p. 5, Aquatic Conservation Strategy (ACS)), and to provide habitat for terrestrial species (RMP p. 9). The RR designation overlays Matrix, which is the primary LUA throughout the SMBT. When RR overlays the Matrix LUA, RR objectives and management action/direction supersede those of the Matrix LUA.

1.3.2.2 Site Specific Needs for Action

BLM resource specialists have identified specific forest stands in the Sunday Morning Belly Twister project area that meet criteria in the RMP for management actions/direction. Most of these stands are stocked densely enough with conifer trees to benefit from thinning to reduce tree density and allow the remaining trees sufficient water, nutrients and space for vigorous growth to meet RMP objectives described above. Some of the stands are reaching culmination of mean annual increment (CMAI) which is a criteria for scheduling regeneration harvest (RMP p. 48), or have species compositions or diseases which detract from timber production and/or ecosystem health.

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 model.

Using professional judgment and data from modeling, they analyzed expected stand growth rates, timber products yield, species composition and elements of stand structure to compare stand development with and without treatment. Stands which they determined would benefit from treatment to meet RMP objectives for each LUA are analyzed in this EA and compared to expected results if no treatment were done.

Stocking levels which are high enough to create competition for site resources including light, water and nutrients over the next 20 years detract from meeting RMP objectives for both Matrix and RR LUAs in the project area. As trees become crowded and compete for site resources several trends develop: growth rates decline, the lower limbs of the crowns die as they are shaded (a process called "self-pruning"), understories tend to be sparse, and the vigor of these slow growing forest stands declines and the trees become more susceptible to insects, diseases and wind damage. Suppressed trees die (a process called suppression mortality or self-thinning), creating large quantities of small diameter dead wood. This small diameter dead wood (snags and down woody debris) has little or no identified commercial forest product value and relatively limited habitat value, but is very common across the landscape. Dead wood may also build up dead fuel levels in the forest and increase the chances of severe wildfire. How these principles apply to the SMBT project is discussed in chapter 3 of this EA.

BLM has identified the need to manage specific conifer stands in Matrix lands as part of the general need to produce timber consistent with the principles of sustained yield management and ecosystem health as described in the RMP and in this EA. These stands need to be managed to reduce stand density because stand growth and development trends described in this EA reduce the overall value of timber products over the life cycle of an unmanaged stand compared to a managed timber stand. These stands also need to be managed to increase habitat complexity across the landscape, compared to retaining large blocks of these stands with the current levels of uniform stand structure – especially in the CONN portion of the Matrix LUA.

BLM has also identified that openings interspersed through the interior of forest stands are a desirable component of landscape level habitat diversity and are scarce in the project vicinity. Large scale clearcuts when the project vicinity was originally logged in the 1930s -1960s resulted in the present large scale, relatively uniform, early-mid seral stands. There are few small gaps/openings to provide forage species and dense brush patches which are valuable habitat for a variety of species. The large scale clearcuts and intensive management practices common on intermixed private industrial forest lands do not provide comparable habitat.

BLM has identified the need to change some of the trends described above in selected RR stands to immediately introduce habitat variation and complexity in RR and to develop some habitat characteristics associated with structurally complex forests faster than they would be expected to develop in unmanaged stands. Desired characteristics include large diameter green trees, large diameter dead trees (both standing snags and down coarse woody debris), full crowns with large limbs, and understory diversity and complexity.

The following photos show some of the stands proposed for thinning in the SMBT project:

Figure 1: Unit 8A, 11S-2E-6, SE¼SE¼, Elev. 3400 ft. This part of unit 8A is analyzed only for thinning.

Figure 2: Unit 8C, 11S-2E-8 NE¼NE¼, Elev. 3400 ft. Unit 8C is analyzed for both thinning and regeneration alternatives.

Figure 3: Unit 8A, 11S-2E-8 NW¼NW¼, Elev. 3400 ft., Above Road. This part of unit 8A is analyzed only for thinning.

Figure 4: Unit 8A, 11S-2E-8 NW¼NW¼, Elev. 3400 ft., Below road, viewpoint from road edge. This part of unit 8A is analyzed for both thinning and regeneration alternatives.

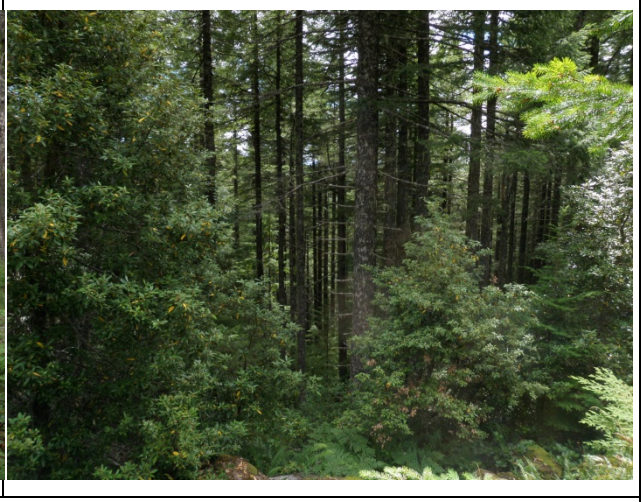


Figure 5: Unit 17A, 11S-1E-17 NE¼SE¼, Elev. 900 ft.

Figure 6: Unit 15C, 11S-1E-15 NW¼NW¼, El. 1400 ft.

Figure 8: Unit 27A, 11S-1E-27 NE¼NW¼, Elev. 1200 ft., View from private land west of BLM.

Figure 7: Unit 16A, 11S-1E-16 NE¼SW¼, Elev. 1200 ft.

Figures 1-8: K. Walton, August 2013. Photos digitally brightened for printing.

1.4 Purposes (Objectives) of the Project

In this EA we describe specific objectives for each LUA and each resource is analyzed separately as a way to organize information, but the specific objectives and resources are all interrelated and each contributes collectively and cumulatively to meeting overall RMP objectives and management strategy. They work together and must be considered together to accurately reflect the place of this project in the concept of ecosystem management described in the RMP (RMP p. 7) and fulfilling the objectives of the O&C Act.

BLM proposes commercial thinning timber harvest in these forest stands[4] to implement the resource management objectives described in the RMP, the Northwest Forest Plan (NWFP) and the O&C Act. The RMP, NWFP and related documents direct and provide the legal framework for management of BLM lands within the Salem District (EA Section 1.7).

[4] A "forest stand" is a contiguous group of trees which is similar enough and growing on a site that is uniform enough to be identifiable. "Forest stand" - or simply "stand" – is used in this document as a generic term that does not indicate management objectives. "Timber stand" – or simply "timber" – is used for forest stands (all in Matrix) where commercial wood production is a major objective. Other terms such as "habitat" are used to provide context for other objectives.

The proposed project area is within the Matrix (both General Forest Management Area [GFMA] and Connectivity/Diversity Block [CONN]) and Riparian Reserve (RR)[5] Land Use Allocations (LUA).

Objectives are numbered 1-20 across headings for easier reference later in this EA.

The overall objectives relevant to the Sunday Morning Belly Twister project which are defined by the O&C Act, the Salem District RMP, and the IDT include:

1.4.1 Overall O&C Act Objectives (*43 U.S.C. §1181a*)

Manage O&C lands classified as timberlands for permanent forest production and sell, cut and remove timber in conformity with the principle of sustained yield for the purpose of:

1. Providing a permanent source of timber supply,
2. Protecting watersheds,
3. Regulating stream flow,
4. Contributing to the economic stability of local communities and industries, and
5. Providing recreational facilities.

1.4.2 Overall RMP Objectives (RMP pp. 1, 41)

6. Contribute to a healthy forest ecosystem with habitat that will support populations of native species and provide protection for riparian areas[6] and waters.
7. Contribute to providing a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies and contribute valuable resources to the national economy on a predictable and long-term basis.
8. Contribute to local, state, national and international economies through sustainable use of BLM-managed lands and resources and use of innovative contracting and other implementation strategies.

The specific objectives that this project is designed to implement include:

1.4.3 Timber Resources Objectives (RMP pp. 46-48)

9. Provide a sustainable supply of timber and other forest products.

[5] The Riparian Reserve (RR) Land Use Allocation (LUA) is a defined management allocation intended to protect riparian ecosystems; provide for the aquatic, hydrologic and terrestrial functions embodied in the Aquatic Conservation Strategy Objectives (ACSO); and to provide connectivity between upland habitat blocks. Riparian Reserves include both riparian area and upland area. (RMP pp. 2, 5-6, 7-8, 9-15)

[6] "Riparian area", as used in this EA, refers to the aquatic habitat and the terrestrial zone where biotic and hydrologic elements interact with and affect each other directly. It is basically the area where plants grow rooted in the water table of streams, springs, wet meadows, etc. Related terms include aquatic zone/habitat, riparian zone/habitat and riparian buffer zone. These related terms are sometimes used in other documents as synonyms, and sometimes to indicate specific parts or functions of the overall riparian area, especially the terrestrial part of the riparian area. (RMP/FEIS 1994, Chp. 6 p. 12; Helms (Editor), 1998, *The Dictionary of Forestry*.)

Another related term used in this EA is Stream Protection Zone (SPZ) which is designated on the ground to include the riparian area and enough additional upland area to protect habitat in the riparian area, water quality and aquatic habitat. Related terms used in other documents include: stream buffer, riparian buffer, protection buffer, no-entry buffer or no-harvest buffer.

10. Manage developing stands on available lands to promote tree survival and growth and to achieve a balance between weed volume production, quality of wood, and timber value at harvest.

11. Manage timber stands to reduce the risk of loss from fires, animals, insects and diseases.

1.4.4 Objectives Common to All Land Use Allocations (RMP p. 1. See additional references specific to each LUA, below)

12. Implement an environmentally sound and economically viable timber sale that contributes to meeting the overall RMP Objectives described above and accomplishes specific objectives described below for each Land Use Allocation.

13. Protect, manage, and conserve federal listed and proposed species and their habitats to achieve their recovery in compliance with the Endangered Species Act and Bureau special status species policies (RMP p. 28).

14. Maintain and develop habitat and forage for wildlife species in addition to special status species (IDT defined objective).

15. Maintain and develop a safe, efficient and environmentally sound road system (RMP p. 62) and reduce environmental effects associated with identified existing roads within the project area (RMP p. 11) by:

    - Providing appropriate access for timber harvest, silvicultural practices, and fire protection needed to meet these objectives;
    - Perform road maintenance to prevent road deterioration or failure and to prevent road generated sedimentation that exceeds Oregon Department of Environmental Quality (ODEQ) standards.

1.4.5 Objectives Specific to the Matrix LUA (RMP pp. 20, 46, D-2):

16. Manage developing timber stands on available lands to promote tree survival and growth to:

- Achieve a balance between wood volume production, quality of wood, and timber value at harvest;
- Increase the proportion of merchantable volume in the stand;
- Produce larger, more valuable logs;
- Harvest small trees as commercial wood products instead of letting them decline in vigor and die as the stand develops[7];
- Maintain good crown ratios and stable, wind-firm trees (RMP p. D-2) by applying silvicultural treatments to manage density with a commercial thinning.

17. Produce a sustainable source of forest commodities (primarily timber) from the Matrix LUA to provide jobs and contribute to community stability (RMP pp. 1, 20, 46-48) by developing timber sales that can be successfully offered to the market place. Select logging systems based on the suitability and economic efficiency of each system to successfully implement the silvicultural prescription, protect soil productivity and water quality, and meet other land use objectives (RMP p. 47).

18. Provide early successional habitat (RMP p. 20)

[7] The RMP term for this is "anticipate mortality", p. D-2.

1.4.6 Objectives Specific to the Riparian Reserve LUA (RMP pp. 2, 5-6, 7-8, 9-15, D-6; NWFP pp. B-31, C-32):

19. Maintain and restore water quality, aquatic ecosystem functions and stream conditions embodied in Aquatic Conservation Strategy (ACS) objectives 1-7 by designing the project to comply with ODEQ water quality standards:

- Maintain effective shade for streams pursuant to BLM's agreement with the State of Oregon.
- Develop, maintain and use new and existing roads to comply with ODEQ water quality standards for peak flows and sediment.

20. Maintain and restore the species composition and structural diversity of forest plant communities embodied in ACS objectives 8 and 9 by designing the project to:

- Apply silvicultural treatments in the RR to develop forest stand characteristics that maintain and/or restore the hydrology and sediment regimes of the watershed.
- Apply silvicultural treatments in the RR to provide a diverse vegetation community to provide riparian and wetland functions and habitat to support populations of riparian-dependent plant and animal species.
- Apply silvicultural treatments in the RR to develop long-term structural and spatial diversity, and other elements of late-successional forest habitat.
- Conduct thinning operations in forest stands up to 80 years old, regardless of origin, to develop large conifers and hardwoods for habitat and to recruit future large coarse woody debris, large snag habitat and in-stream large wood.

Additional Notes: The NWFP Record of Decision (NWFP/ROD, p. B-31) states that "Active silvicultural programs will be necessary to restore large conifers in Riparian Reserves." The NWFP/ROD (p. C-32) and the RMP (p. 11) management action/direction for BLM is to apply silvicultural practices for RR to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives. These objectives would be accomplished by commercial thinning within the Riparian Reserve LUA concurrent with commercial thinning in the adjacent Matrix unit. Commercial thinning in RR removes merchantable material only when it is consistent with the purposes for which the Riparian Reserves were established (RMP pp. 9-15, D-6, NWFP p. B-31). The RMP (p. D-6) states that merchantable logs may be removed "where such action would not be detrimental to the purposes for which the Riparian Reserves were established". EA section 3.12.1 describes the project's compliance with the ACS, including the nine ACS objectives.

1.5 Decisions to be Made

The following decisions will be made through this analysis:

1.5.1 Timber Harvest

1. To determine at what level, where, and how to commercially thin trees on BLM-administered lands to meet Matrix and Riparian Reserve LUA objectives and timber resources program objectives within the project area (EA section 1.2.2).
2. To determine at what level, where, and how to implement regeneration harvest on BLM-administered lands to meet Matrix LUA objectives and timber resources program objectives.

3. To determine at what level, where, and how to implement the connected actions.
4. To determine at what level, where and how to meet ACS objectives within Riparian Reserves in the project area.

1.6 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 (objectives 4,7,8,12);
2. Provide for a sustainable supply of timber and other forest products on a predictable and long term basis (objectives 1,4,7,8,9,10,11,16,17);
3. Contribute to a healthy forest ecosystem with habitat that will support populations of native plant and animal species (objectives 6,13,14,18,20);
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 (objectives 2,3,6,19,20);
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 (objectives 5,7,15,17,19).

1.7 Conformance with Land Use Plan, Statutes, Regulations, and Other Plans

BLM has designed these projects to comply with the O&C Act, the FLPMA and other relevant statutes and authorities (EA Sec. 1.7.1) 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.

In summary, the three projects conform to the:

- O&C Act, 1937: The proposed commercial thinning is designed to contribute to the objectives of the O&C Act as described in EA Sec. 1.4.1.
- Salem District Record of Decision and Resource Management Plan, May 1995 (RMP): The RMP has been reviewed and it has been determined that the proposed thinning activities conform to the land use plan terms and conditions. Implementing the RMP is the reason for doing these activities (RMP p.1-3).
- Salem District Proposed Resource Management Plan/Final Environmental Impact Statement, /September 1994 (RMP/FEIS): The RMP provides management direction to implement the decisions made based on this analysis.
- 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).
- Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, January 2001 (2001 ROD).

The IDT incorporated information from the Crabtree Creek Watershed Analysis (CCWA 2001) and the Thomas Creek Watershed Analysis (TCWA 1996) into the development of the proposed and alternative actions and into the description of the affected environment and environmental effects (*EA Chapter 3*), and are hereby incorporated by reference.

The above documents are available for review in the Salem District Office. Additional information about the proposed activities is available in the Sunday Morning Belly Twister EA Analysis File, also available for review at the Salem District Office.

Survey and Manage Species Review

The project analyzed in this EA is designed to be consistent with court orders relating to the Survey and Manage mitigation measure of the Northwest Forest Plan, as incorporated into the Salem District Resource Management Plan.

In 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. On October 10, 2006, following the District Court's 2006 ruling, parties to the litigation entered into a stipulation exempting certain activities from the Survey and Manage standard (Pechman exemptions), including thinning projects in stands less than 80 years old (Exemption A).

Thinning in stands younger than 80 years in the SMBT project would be designed to comply with Pechman Exemption A. Stands 80 years and older were surveyed according to current survey protocol.

1.7.1 Relevant Statutes/Authorities

This section is a summary of the relevant statutes/authorities that apply to these projects. BLM designed all three projects to conform to these statutes and authorities.

- **Oregon and California Act (O&C Act), 1937** (43 U.S.C. §1181a et seq.) – The O&C Act governs BLM-administered O&C lands in western Oregon. It requires BLM to manage O&C lands for permanent forest production, in accord with sustained-yield principles to protect watersheds, regulate streamflow, provide for recreational facilities, and contribute to the economic stability of local communities and industries.
- **Federal Land Policy and Management Act (FLPMA), 1976** – Defines BLM's organization and provides the basic policy guidance for BLM's management of public lands.
- **National Environmental Policy Act (NEPA), 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.
- **Endangered Species Act (ESA), 1973** – Directs Federal agencies to ensure their actions do not jeopardize threatened and endangered species.
- **Clean Air Act (CAA), 1990** – Provides the principal framework for national, state, and local efforts to protect air quality.
- **Archaeological Resources Protection Act (ARPA), 1979** – Protects archeological resources and sites on federally-administered lands. Imposes criminal and civil penalties for removing archaeological items from federal lands without a permit.
- **Clean Water Act (CWA), 1987** – Establishes objectives to restore and maintain the chemical, physical, and biological integrity of the nation's water.
- **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. The initiative also provides for more timely responses to disease and insect infestations.

- **Migratory Bird Treaty Act, 1918 -** Protects migratory birds (16 U.S.C. 703).
- **Executive Orders 11644 (1972) and 11989 (1997)** - Direct BLM to control off-road vehicle use so as to protect public lands.

Additional authorities and management direction are described in EA section 3.12 Table 24. Additional details pertaining to statutes, authorities and management direction are presented in the discussions of specific resources throughout the remainder of this EA.

1.8 Scoping and Identification of Relevant Issues

1.8.1 Scoping

1.8.1.1 Internal Scoping

The Interdisciplinary Team (IDT) of BLM resource specialists conducted internal scoping through the project planning process, which includes record searches, on-site field examinations of the project area by IDT members, 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 all similar timber management projects.

1.8.1.2 External Scoping

Source Incorporated by Reference: Walton 2014, Sunday Morning Belly Twister Scoping Comment Analysis and Response Report, (Scoping Report)

BLM conducted external scoping for this project by means of:

- A scoping letter sent out to approximately 38 federal, state and municipal government agencies, nearby landowners, tribal authorities, and interested parties on the Cascades Resource Area mailing list on February 24, 2014.
- An open house at the Gates Fire Hall on March 19, 2014 from 2:00 – 6:00 p.m. Resource specialists were available to discuss the Sunday Morning Belly Twister and ThunderKat projects. The open house included a tour to two Turnridge Timber Sale regeneration harvest units completed approximately 10 years ago. Advertising included: the scoping letter described above, a press release which was carried by the Canyon Weekly in at least two editions (March 5 and 12, 2014), the BLM website, and handbills posted on local community bulletin boards. Approximately 15 BLM personnel were available to answer questions and lead the field trip. Nine members of the public signed the attendance registration.
- The scoping letter and maps were posted on the BLM website.
- BLM received approximately six comment letters/emails during the scoping period.

1.8.1.3 Scoping Comments Received

Six comment letters and emails were received. Two of these were from individuals (GH and KS), four from organizations. The organizations are, in alphabetical order:

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

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, seral stages, silvicultural prescriptions and special status plants.
2. Hydrology, water quality and Riparian Reserve treatments.
3. Fisheries, aquatic habitat, aquatic species, instream wood and listed fish.
4. Soil and site productivity.
5. Wildlife, terrestrial habitat, special status species (terrestrial/avian), snags and CWD.
6. Air quality, fuels and fire.
7. Public safety, visual resources (VRM), recreation, public access and OHV use.
8. Economic viability and socioeconomics.
9. Roads, transportation system and logging.
10. NEPA, land use allocations (LUA), Resource Management Plan (RMP), planning and law.
11. Climate change and carbon storage.
12. Miscellaneous.

The scoping comment letters and emails are available for review at the Salem District BLM Office, 1717 Fabry Road SE, Salem, Oregon. EA Section 5.2 provides a summary of the topics raised in scoping comments. A detailed listing of scoping comments and BLM responses was prepared as a separate report and is available for review with the scoping comment letters and emails. The IDT considered scoping comments in developing the list of relevant issues to be analyzed in this EA (Section 1.8.2).

1.8.2 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, determine whether the proposed action should be modified, and/or determine the degree of the project's effects on elements of the environment. Analysis of these issues provides a basis for comparing the environmental effects of the action alternatives and the No Action alternative, and 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), analyzed the environmental effects, and reviewed scoping comments.

Issue 1: The Effects of Management Actions on Vegetation and Forest Stand Characteristics

How proposed management actions would change vegetation and forest stand characteristics, both short term and long term and how these changes would affect attainment of objectives for each LUA.

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

How proposed management actions would 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.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.4, 2.2.1, 2.2.2, 2.3.1.1, 2.3.1.2, 3.1, 3.2, 3.4, 3.8

Issue 2: The Effects of Management Actions on Hydrology and Water Quality

How proposed management actions would affect water quality including sediment from roads, sediment from forest management activities, sediment from landslides, sediment caused by unauthorized OHV use, and water temperature.

How proposed management actions would affect water quantity (peak flows).

How proposed management actions would affect stream channels.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.4, 2.3, 3.5, 3.6, 3.12

Issue 3: The Effects of Management Actions on Fisheries, and Aquatic and Riparian Habitats

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

How proposed management actions would comply with ACS Objectives in the Riparian Reserve.

How proposed management actions would affect stability of steep slopes above streams.

How proposed management actions would affect large wood recruitment.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.4, 2.3, 3.5, 3.6, 3.12, 5.1

Issue 4: The Effects of Management Actions on Soils and Site Productivity

How proposed logging operations would affect soil compaction, disturbance and erosion and their effects on site productivity.

How proposed road construction would affect site productivity.

The elements of this issue are addressed in the following sections of this EA: 1.1. 1.4, 2.3, 3.7, 3.12

Issue 5: The Effects of Management Actions on Wildlife Populations and Habitats

How proposed management actions would affect protection of terrestrial animals with special status (T/E, Survey and Manage, sensitive, etc.) and their habitats.

How proposed management actions would affect protecting / providing habitat and forage for terrestrial animals, including big game, that do not have special status.

How proposed management actions would affect snag, coarse woody debris, remnant trees and large tree habitats.

How proposed management actions would affect development of structural complexity and late-successional forest characteristics at stand and landscape levels.

How proposed management actions would affect wet meadow edge habitat.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.4, 2.3, 3.3, 3.8, 5.1

Issue 6: The Effects of Management Actions on Fire Hazard, Fire Suppression Capabilities, and Air Quality

How proposed management actions would affect potential wildfire ignition, intensity and resistance to control.

How proposed management actions would affect access for fire suppression resources.

How proposed fuel reduction (burning) would affect air quality.

How proposed road closure would affect potential wildfire ignition and access for fire suppression resources.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.4, 3.9

Issue 7: The Effects of Management Actions on Public Safety, Visual Resources, Recreation, Public Access and OHV Use

How proposed management actions would affect public safety, visual resources, recreation and public access.

How logging, road construction, road closure and related actions would affect unauthorized OHV use.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.4, 2.3, 3.7, 3.10

Issue 8: The Effects of Management Actions on Sustainable Supplies of Timber, Economic Viability, and Socioeconomic Factors

How proposed management actions would affect sustainable timber supplies to contribute to revenues, jobs and community stability in the long term.

How proposed management actions would affect the economic viability of the project and its ability to contribute to revenues, jobs and community stability in the short term.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 3.1, 3.3, 3.4, 3.9, 3.12

Issue 9: The Effects of Management Actions on Access and Logging Systems

How proposed management actions would affect access for timber harvest, forest management operations, fire protection and public use of the lands in both short and long terms.

How road construction, use, maintenance and treatments would comply with ODEQ water quality standards.

The elements of this issue are addressed in the following sections of this EA: 1.1, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 3.5, 3.6, 3.7, 3.9, 3.10, 3.12

1.8.3 Issues Considered, Not Analyzed in Detail

Carbon Storage/Emissions: BLM did not analyze quantitative carbon storage or emissions for this project because it would not provide any additional information needed for a reasoned choice among alternatives for this project. BLM has sufficient information from analysis of four previous commercial thinning projects[8] in the Cascades Resource Area for the Decision Maker to make an informed decision between alternatives because the SMBT project falls within the range covered by the projects analyzed and is expected to have similar results.

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.

Update RMP Matrix Objectives: The IDT for the SMBT project did not analyze potential changes to RMP Matrix objectives or management direction because it is outside of the scope of the SMBT project EA. The FLPMA requires BLM to manage public lands in accordance with the applicable land use plan, which is the Salem RMP. The FLPMA does not require agencies to revisit an RMP each time an EA is prepared for an action implementing the RMP. The IDT reviewed the public scoping comments and supporting documentation presented and has analyzed the SMBT project based on available data, field reviews and current scientific information applicable to assessing the effects to resources and to the quality of the human environment. The appropriate vehicle for updating land use allocations and objectives is the ongoing plan revision and BLM encourages interested parties to participate in the plan revision process.

Chapter 2: 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."

BLM has identified a Proposed Action and one Alternative Action to analyze:

The IDT developed the proposed action to provide a sustainable supply of timber in the near term (approximately five years) by contributing to the Salem District annual allowable sale quantity (RMP p. 46) and in the long term (several decades) by managing developing forest stands to meet future timber harvest and other objectives (EA section 1.4).

[8] Airstrip, Gordon Creek, Highland Fling, and Power Mill thinning projects.

The IDT also developed the alternative action which includes regeneration harvest instead of commercial thinning on 65 acres of the stands included in the proposed action. In addition to the reasons for developing the proposed action, the IDT developed this alternative to implement management direction to apply silvicultural systems that are planned to produce, over time, forests which have desired distribution of seral or age classes (RMP p. 46); to schedule regeneration harvests at the age which produces maximum average annual growth over the lifetime of a timber stand[9] (p. 48, D-1) to contribute to local, state and national economies by increasing the economic efficiency of timber harvest; to offer a higher volume of timber for sale consistent with court orders; and to provide high quality early successional habitat (p. 20).

2.2 Planning and Implementation Process

2.2.1 Planning Process

BLM planned this project, including the two action alternatives (EA section 2.3), using an Interdisciplinary Team (IDT) process. An IDT composed of experienced professional resource specialists developed and analyzed the proposed and alternative actions, connected actions, project design features and mitigation measures. The IDT requested comments from the public and other interested parties and agencies during this process through "scoping" (EA section 1.8.1) and considered these comments when developing and analyzing the alternatives (EA Section 5.2). 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 (see EA section 5.3).

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 Final Decision Record and Rationale (DR), to be published later. The proposed action and alternative action, including the project design features (PDF), form the best management practices (BMP) developed on a site-specific basis for the projects analyzed in this EA (RMP Appendix C, RMP/FEIS Appendix G).

2.2.2 Implementation Process

BLM proposes to implement the Sunday Morning Belly Twister project as multiple timber sales. In this analysis the proposed treatment units are divided into three Blocks for analysis and discussion: Sunday Morning, Belly Twister and Bent Beekman (EA section 1.2). These Blocks may be further divided into multiple timber sales for implementation.

For each timber sale BLM would determine the final boundaries of the timber sale units and designate which trees would be retained and which trees would be cut and removed or cut/treated and left in place. BLM would develop the timber sale contracts to implement the actions selected from the proposed action, alternative action, connected actions and the PDF analyzed in this EA. The timber sale contract would require the operator to accomplish the preventive and restorative practices analyzed in this EA. In all timber sale contracts, BLM enforces compliance through normal contract administration procedures where performance is monitored by authorized BLM personnel. The Contracting Officer enforces compliance with the contract and would suspend operations if the operator fails to perform the required preventive and restorative

[9] Culmination of Mean Annual Increment (CMAI) is the age in the growth cycle of a stand at which the mean annual increment for volume is at its maximum, or culmination.

practices. BLM timber sale contract requires bonding in an amount sufficient for BLM to complete restoration work if the operator fails to perform the contract requirements.

2.3 Alternatives Developed

The proposed and alternative actions were developed by BLM to provide for sustained yield of timber products both immediately (within approximately five years) and for several decades while increasing habitat diversity and complexity across the landscape of BLM-managed lands to provide components of healthy ecosystems. Stand conditions, the expected effects of the proposed and alternative actions, and the expected effects of taking no action will be described in detail in chapter 3 of this EA.

2.3.1.1 Proposed Action

Project Overview

To meet the objectives described in EA Section 1.4, BLM proposes to commercially thin approximately 1500 acres of 40-102 years old forest stands in the following Land Use Allocations (LUA): Matrix, including both General Forest Management Area (GFMA) and Connectivity/Diversity Block (CONN); and Riparian Reserve (RR).

The proposed action was specifically developed to meet the needs for forest products in the short (five years) and intermediate terms (a few decades) and to contribute to habitat diversity as part of a healthy forest ecosystem as described in EA 1.3. The project was generally designed to contribute to meeting RMP objectives and management actions/direction for RR and Matrix LUA (RMP pp. 9-15, 20-22) and Resource Programs (RMP pp. 22-67).

Proposed Treatments

In the Matrix (GFMA, CONN)

BLM proposes to commercially thin at total of 978 acres in Matrix: 630 acres of 45-102 year old forest stands within GFMA and 348 acres of 37-102 year old forest stands within CONN. For Matrix objectives, refer to EA section 1.4.1. The following is a summary silvicultural prescription (how the stand would be thinned). Specifically, the prescription proposes to:

- Thin approximately 32 percent of the Matrix acres in the project vicinity (See footnote 3, section 1.2) as shown in Table 2;
- Retain conifer trees that generally are larger than the average diameter for the stand, emphasizing the largest, healthiest and best formed dominant and co-dominant trees that would be expected to produce the highest long term timber value. Vary the spacing to achieve this;
- Maintain existing species diversity. Specifically retain: a component of minor conifer species, especially western redcedar; all hardwoods, especially golden chinquapin of any diameter, and bigleaf maple and black cottonwood larger than 17 inches diameter (21 inches in 11S-1E sec. 1); Pacific yew; and conifers larger than 35 inches diameter. Retain these trees on site if they must be felled to facilitate safe and efficient logging. Minor conifer species may be thinned to the target basal area when found in clumps;
- Retain a component of understory and intermediate trees, especially western redcedar and other shade tolerant species, to provide structural complexity in the developing stand;
- Cut and remove excess suppressed and intermediate trees, and co-dominant trees that are directly competing with the trees selected for retention (“thin from below”) to make light, water and nutrients available for healthy growth of those trees to be retained;

- Maintain spacing to provide adequate growing room for retained trees based on target relative density of approximately 30-40. Due to variation between forest stands, this would result in retaining from approximately 50 to 140 trees per acre, except as described below (see Table 13, EA Section 3.4.1);
- Maintain an average canopy cover of retained dominant and co-dominant trees of at least 40 percent (typically ranging from 55 to 70) percent following thinning;
- Maintain a mix of the species that are currently present in the stand and increase the proportion of western redcedar;
- Retain sufficient unmerchantable tree tops and limbs on site for nutrient cycling;
- Protect trees which have been identified as part of Salem's tree improvement program;
- Exclude identified "wet areas" (areas with high water tables) from treatment by not thinning or operating equipment within them;
- Implement low density thinning (LDT) openings of up to one acre each on up to one percent of the total treatment acreage (15 acres of openings), retaining up to approximately 12 trees per acre. Openings would be located on gentle slopes, away from open roads, and most commonly on south to west aspects. Treat fuels to provide access for big game, provide seed-beds for grasses and forbs, and encourage growth of deciduous shrubs and understory vegetation and other ground cover. Retain up to approximately10 percent of the slash piles. Seed with native grasses/forbs and plant shrubs and/or western redcedar if needed based on future field surveys by BLM specialists, and;
- Four proposed units have treatment prescriptions which differ from the above:
    - Units 8A&C: Thin from below, retaining approximately 42 of the largest, most vigorous conifers. Other than the relatively low number of trees to be retained because the average diameter is larger than in other units, the prescription is essentially the same as described above.
    - Unit 15A: Thin all conifers heavily to a relative density of approximately 15, retaining approximately 20-25 trees per acre. Retain the largest and best formed conifers, especially western redcedar, and all hardwoods. Target mistletoe infected western hemlock for removal. Prepare the site and plant approximately 200 western redcedar tree seedlings per acre. Remove the overstory in approximately 20 years, leaving a stand of mistletoe resistant western redcedar with a cohort of legacy trees.
    - Unit 27A: Thin all conifers from below, retaining approximately 52 trees per acre. Cut and remove all merchantable conifers within a radius of ten feet beyond the crown drip-line of any remnant trees greater than 48 inches diameter. Create gaps in the stand for a total of up to ten percent of the stand area, approximately four acres.
    - Unit 35B: Thin all conifers from below, retaining approximately 58 trees per acre. Retain all conifers larger than 23 inches diameter in the Riparian Reserve portion of the unit and all trees larger than 35 inches diameter in the Matrix portion of the unit. If any of those trees must be felled for safe and efficient logging they would be left onsite as CWD. Create gaps in the stand for a total of up to ten percent of the stand area, approximately two and a half acres.

In the Riparian Reserve (RR)

BLM proposes to commercially thin approximately 522 acres of dense, uniform 37-77 year old forest stands as one part of a management prescription to increase forest stand structural diversity within the RR. Specifically, the prescription proposes to:

- Commercially thin up to 18 percent of the RR acres in the project vicinity as shown in Table 2 and retain a minimum 50 percent canopy cover;[10]
- No treatment of approximately 82 percent of the RR in the project vicinity, allowing these stands to develop naturally and provide a different element of complex stand structure at the landscape level. These untreated areas in the SMBT RR include:
    - Stream protection zones (SPZ) – strips of untreated forest adjacent to streams;
    - Potentially unstable slopes;
    - Areas where stand structure already provides, or is developing, desired levels of structural complexity without silvicultural treatment;
    - Stands that have trees too small or poorly stocked to be commercially thinned;
    - Areas where logging is not feasible; and
    - Wetlands and areas with high water tables ("wet areas").
- Retain a component of understory and intermediate trees, especially western redcedar and other shade tolerant species, to provide structural complexity in the developing stand;
- Some of the low-density thinning areas may be partly or completely implemented within the RR to increase species and structural diversity, provide habitat for terrestrial species and/or enhance special habitats such as wet areas and meadows adjacent to treated areas.
- Create snags and CWD as feasible during and/or immediately after timber harvest operations.

Logging Systems

BLM developed a basic logging systems plan (see Logging Report) designed to comply with the 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 BLM timber sale contract provisions and administration. There are many combinations of specific equipment and operating methods which could be used and the final 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. BLM would analyze 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 BLM determines that the impacts and effects are within the scope analyzed, BLM would document the determination and approve the proposed logging plan.

Examples of this principle include:

- Skyline yarding generally has less impact than ground based logging, so skyline yarding an area analyzed for ground based logging would generally be approved.
- Not building a road generally has less impact than building it, so a logging plan that avoids building a road would generally be approved.

[10] There are several terms to describe how much of the area above the ground is occupied by tree crowns. Some of the terms used in this EA and other documents which are incorporated by reference include: Wildlife reports tend to use the term "canopy cover" where vertical projections from the ground may give results of more than 100 percent canopy cover due to multiple canopy layers. Hydrology reports tend to use "crown closure" to indicate the percentage of vertical projections that hit foliage rather than are open to the sky. Fire and fuels reports refer to crown density or crown bulk density as an indicator of how much potential fuel is in the canopy and silviculture reports focus on several measures of how fully trees are occupying the site.

- A rocked road surface is generally more stable than a natural surface road, so rocking a road would generally be approved when it is not analyzed for decommissioning after use.
- Hand falling generally has less impact than mechanized falling with a processor, so hand falling would generally be approved.
- Relatively few but larger landings or relatively many but smaller landings than anticipated would generally be approved because the total area impacted would be similar.

Some proposed logging plans may have some elements which would reduce impacts while other elements would increase impacts. For example: a proposal to extend or add a road spur (increased impacts) to skyline yard an area analyzed for ground based logging (decreased impacts); or a proposal to lengthen one road and shorten another; or to modify a road location would be evaluated by BLM to determine if the impacts and effects would be within those analyzed. If so, the change would generally be approved. Minor adjustments to boundaries and acreages between logging systems in a unit would not be documented because they would not have any potential to change the analysis or effects.

Table 1: Thinning Acres by Land Use Allocations and Logging Systems

T.S. R. E. Section, Units	Unit Acres	Acres by RMP Land Use Allocation and Logging Systems*									
		Matrix: GFMA			Matrix: CONN			Matrix Total	Riparian Reserve		
		GB	Sky	Total	GB	Sky	Total		GB	Sky	Total
Sunday Morning Block											
11-1-15A	21			0	9	3	12	12	4	5	9
B	23			0	3	8	11	11	5	7	12
C	112			0	52	25	77	77	11	24	35
D	22			0	15		15	15	7		7
E	26			0	7	2	9	9	13	4	17
11-1-16A	46			0	23	14	37	37	7	2	9
11-1-17A	141	85	20	105			0	105	29	7	36
B	11	11		11			0	11			0
11-1-27A	45			0	26	11	37	37	1	7	8
B	23			0	8	5	13	13	1	9	10
R-o-W	11	4		4	7		7	11			0
Subtotal	**481**	**100**	**20**	**120**	**150**	**68**	**218**	**338**	**78**	**65**	**143**
Belly Twister Block											
10-1-35A	130			0	68		68	68	62		62
B	36			0	16		16	16	20		20
11-1-1A	10	10		10			0	10	0		0
B	66	13	7	20			0	20	9	37	46
C	21	3	4	7			0	7	10	4	14
D	103	69	28	97			0	97	2	4	6
E	21	21		21			0	21	0		0
11-1-3A	75	41		41			0	41	34		34
B	189	94		94			0	94	95		95
C	165	86		86			0	86	79		79
D	24	13		13			0	13	11		11
11-2-5A	61	12		12	43		43	55	6		6
R-o-W	15	9		9	1		1	10	5		5

T.S. R. E. Section, Units	Unit Acres	Acres by RMP Land Use Allocation and Logging Systems*									
		Matrix: GFMA			Matrix: CONN			Matrix Total	Riparian Reserve		
		GB	Sky	Total	GB	Sky	Total		GB	Sky	Total
Subtotal	**916**	**371**	**39**	**410**	**128**		**128**	**538**	**333**	**45**	**378**
Bent Beekman Block											
11-2-8A	95	34	58	92	3		3	95			0
C	7		7	7			0	7			0
R-o-W	1	1		1			0	0			0
Subtotal	**103**	**1**	**65**	**100**	**3**		**3**	**102**			**0**
Tot. Ac.	**1500**	**506**	**124**	**630**	**281**	**68**	**349**	**979**	**411**	**110**	**521**

*Logging Systems: GB = Ground Based; Sky = Skyline Yarding

Table 2: Project Vicinity, Project Area, Untreated Area and Yarding Systems for the Proposed Action

LUA	Project Vicinity Acres *	Percent of Project Vicinity	Untreated Area			Project Area*			LUA Percent of Project Area	Yarding Systems Acres		
			Ac	% of LUA	% of Vicin.	Ac	% of LUA	% of Vicin.		Ground Based	Skyline	R-o-W (GB)
GFMA (Matrix)	1605	27	975	61	16	630	39	11	42	492	124`	14
CONN (Matrix)	1449	24	1101	76	18	348	24	6	23	272	68	8
Subtotal Matrix	3054	51	2076	68	35	978	32	16	65	764	192	22
Riparian Reserve	2901	49	2379	82	40	522	18	9	35	407	110	5
Total	5955	100	4455		75	1,500		25	100	1,171	302	27
Percent of Project Area Acres										78	20	2

*Project Vicinity is BLM managed lands in the sections that contain the Project Area. The Project Area is the area proposed for treatment.

Connected Actions

Road Work (EA Section 7.1-Maps):

BLM would require the following road work to maintain the transportation system and facilitate logging operations and log hauling. Roads would be constructed to access harvest units in the Matrix LUA and may be rocked if needed for efficient logging operations or resource protection. These roads may be in both Matrix and Riparian Reserve LUAs. Roads would be constructed, improved or renovated, and maintained[11] to access BLM managed lands as follows:

[11] Road work terms: Construct = Build a new road; Improve = Upgrade to better than the original design; Renovate = Restore to its original design; Maintain = Upkeep of a currently useable road; Close = Gate, block or treat surface to prevent unauthorized vehicle use; Stabilize = Measures to prevent erosion; Decommission = Remove culverts and measures to prevent all vehicle use for longer than a decade.

Table 3: Road Work for the Project

Roads	Maintain Existing Roads	Construct New Roads	Renovate Existing Roads	Improve Existing Roads	Road Surface	After the Project
10-1E-23, 25, 28, 33, 35.2; **11-1E-**1.1, 1.3, 3.1, 4, 4.1, 4.3, 8, 15, 15.3, 16, 17.2, 17.3, 21.1, 21.2, 22.4, 27.4	33.41				Rock	Maintained, Open system roads
Spurs 7, 8, 14, 18, 22, 23, 24, 33, 34, 35 (last 1000 ft.), 36, 37 ext., 38, 39		2.82			Natural	Stabilize and Close, Except Decommission last 1000 ft. of Spur 35
Spurs 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 16, 17, 19, 21, 20 ext, 26, 28, 29, 35 (first 3000 ft.), 40		5.64			May Rock	Stabilize and Close
Spur 11		0.19			Rock	Maintained, Closed (pvt. gate)
11-1E-3.3; **Spur** 36			0.25		Natural	Decommission 0.09 mi., Stabilize & Close 0.16 mi.
10-1E-34.1; **11-1E-**1.2, 1.5, 1.6, 1.7, 1.9, 3, 3.2, 15.2, 17, 17.1; **Spur** 13			5.27	0.21	May Rock	Stabilize and Close, Except 0.13 mi. private road
10-1E-35.1, 35.3; **11-1E-**15.4, 15.6, 17.4, 27, 27.5; **11-2E-**5.2, 6.5			2.36		Rock	Open
Total	33.41	8.63	7.88	0.21		

Culverts

- Cross Drains (not associated with a stream channel): New – 11; Replacement – 15
- Stream Crossings: New – none; Replacement – 36. Three of these would replace log fills; approximately 15 would replace culverts in or near the project area; and the remainder would replace culverts on the haul route.

Hauling and Haul Routes

BLM has identified haul routes serving different portions of the project area. These are a combination of BLM and private roads and are shown in Table 3 and on the maps in EA section 7.1. See Table 16, EA section 3.6.1 for details of road numbers and distances to listed fish habitat.

Rock Source

Pit run rock, aggregate, soil and boulders for use on project roads and berms would be obtained from commercial sources and established BLM quarries.

Landings

BLM would require the timber sale operator to construct ground based and skyline landings according to the approved logging plan (see Project Design Features (PDF) introduction and PDF numbers 4 and 5 in Table 5). Landings would be located primarily on and adjacent to

roads. Vegetation would be cleared for the landing and immediately adjacent to the landings to permit swinging and stacking logs for sorting and loading, and for piling logging slash and debris. At landings, machinery would operate on skid trails, roads, and the portions of landings designed for machine operations to limit compaction to only a portion of the cleared area. The remainder of the cleared area for the landing would be used only for temporary stacking of logs, slash and debris.

Fuels Treatments

Fuel reduction treatments would be conducted in selected areas to reduce the potential for human caused wildfire ignition, to reduce the potential for wildfire to cross property lines between BLM and private land, and to reduce both the intensity and severity of potential wildfires in the long term (compared to untreated fuels).

Fuel reduction treatments may include hand, machine, and landing pile construction; covering portions of piles with plastic sheeting; and burning piles within treatment areas, along roads, or along property lines. Other options include slash pullback, slashing, lopping and scattering, and firewood cutting. In lieu of burning, BLM and operator may remove slash at landing areas to be used as mulch to cover roadbeds during stabilization.

Post treatment fuels surveys would be conducted and the Stereo Photo Series for Quantifying Forest Residues in the Douglas-fir Type of the Willamette National Forest (General Technical Report PNW-GTR-258, Ottmar, Hardy, Vihnanek May 1980) or the Stereo Photo Series for Quantifying Forest Residues in Coastal Oregon Forests (General Technical Report PNW-GTR-231, Ottmar, Hardy) would be used to help identify areas with increased fuel loads.

All prescribed burning would require a project level Prescribed Fire Burn Plan that adheres to smoke management and air quality standards, meets the objectives for land use allocations, and maintains or restores ecosystem processes or structure. The burn plan would comply with the Northwest Oregon (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 office in accordance with the Oregon State Implementation Plan and Oregon Smoke Management Plan.

Table 4: Fuels Treatments for Proposed Action

Harvest Type	Total Acres	Broadcast Burn Acres	Hand Pile Acres	Machine Pile Acres	Landing Piles
Commercial Thin	1458	0	7	129	276
Low Density Thin	15	0	15	0	0
R/W	27	0	0	0	0
Totals	**1500**	**0**	**22**	**129**	**276**

Preventing Unauthorized Off-Highway Motor Vehicle (OHV) Use (RMP p. 41)

BLM would block skid trails and make them impassible for OHV as part of the timber sale contract, as described under Project Design Features. Block closed roads and/or make them impassible for OHV to effectively eliminate OHV use while making it feasible for fire suppression personnel to open those roads with equipment commonly used for wildland fire initial attack response. Road and skid trail closure methods would be designed for each site to avoid causing erosion and avoid damaging retained trees. See Project Design Features (Table 5, EA section 2.3).

Special Forest Products (SFP) (RMP p. 49)

BLM would sell permits for collecting Special Forest Products from the harvest units if there is a demand for the products, and collection would not interfere with proposed project operations or have effects beyond those analyzed in this EA. Special Forest Products are useable vegetation that can be harvested/collected from the forest and may include: edible mushrooms, firewood, posts and poles, and native plants for transplant or traditional use.

Snag and CWD Recruitment

In contract operations some retained trees (not designated for harvest in commercial thinning) are usually damaged, killed or felled incidental to contract operations. Within project units, the BLM contract administrator would designate up to two per acre standing and two per acre felled trees larger than approximately 21 inches diameter to be left in place as recruited snags and CWD. In the Riparian Reserve portions of treated units, additional trees may be topped, girdled or felled if needed to reach short term target numbers of snags and CWD based on needs identified during surveys by BLM specialists.

BLM would recruit snags and down logs in mid seral stands in Riparian Reserve Land Use Allocation following Terrestrial Recommendation #2 in the Crabtree Creek Watershed Analysis (CCWA p. 7-8). Implementation would follow the guidelines set forth in the Mid-Willamette LSR Assessment (LSRA pp. 127-134) with some modifications based on current research, and would emphasize long-term CWD objectives (Strategy 3). These treatments would be done in incremental treatments, or "pulses", over the next four decades based on field surveys by BLM resource specialists.

Treatments to recruit snags and CWD would involve tree girdling, felling, topping and/or limbing for the purposes of creating standing dead material, deformed trees, down logs, and small openings. These treatments would be done in locations throughout the project vicinity, not limited to the portions of Riparian Reserve which would be treated as part of the proposed action. These treatments would be designed to provide additional snag and CWD material in phases to meet long-term objectives for the amount and diversity of size and decay classes desired according to guidelines and ongoing assessments. The long-term objectives described in the LSRA include the presence of 2-5 large (>21 inches diameter) snags per acre and 500-1500 cubic feet of CWD. The first of these incremental treatments in project area units would be done within one year after thinning as part of the proposed action.

Project Design Features

This section summarizes the project design features that would further reduce the project's effects on the affected resources described in EA Chapter 3. Project design features described in this section would be implemented in the Sunday Morning Belly Twister timber harvest project.

The interdisciplinary team (IDT) of resource specialists developed 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 RMP (pp. 23-24, C-1 – C-2). The IDT selected this set of PDF based on its combined experience, training, professional judgment, field analysis of this project area and familiarity with ongoing published research.

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 risk of effects to the resources are no greater than those described in EA Chapter 3. BLM

would require the operator to implement each of the following project design features, unless otherwise stated.

The standard BLM timber sale contract would require the operator to submit a written operations plan which: identifies personnel doing the work; identifies the equipment to be used for operations, and describes how the personnel propose to use the equipment to accomplish the work in compliance with contract provisions and in accordance with the project design 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 BLM 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. BLM timber sale contract requires bonding in an amount sufficient for 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: 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 5: Project Design Features

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	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 (>20 percent increase in soil bulk density) by logging operations to less than ten 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.	♦	♦	♦	♦						
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.	♦	♦	♦	♦						

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
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 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 BLM approved plan to prevent more than light soil compaction[12] 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.	♦	♦	♦		♦	♦	♦			♦
8. 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.	♦	♦	♦	♦	♦	♦	♦			
9. In regeneration harvest units, choose operating and site preparation techniques that retain organic material to the extent feasible.	♦	♦	♦	♦	♦	♦	♦			
10. Implement erosion control measures where BLM management 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.	♦	♦	♦	♦	♦	♦				

[12] Compaction categories for increases in bulk density compared to undisturbed soil, derived from text of Soils Report: Light ≤10 percent; Moderate 10-20 percent; Heavy >20 percent.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
11. 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.		♦		♦		♦		♦		
12. Locate unit boundaries to provide Stream Protection Zones (SPZ) within the Riparian Reserve along both sides of all identified streams (SPZ widths are slope distance): • Within 1.0 mile of listed fish habitat, SPZs are minimum 100 feet wide on each side of perennial streams and 50 feet on intermittent streams. • For all other streams, SPZs are minimum 60-85 feet wide (dependent on tree height and hill slope, Salem District revised guidance 10/08/2010) on each side of the stream and 30 feet on intermittent streams.				♦						
13. Locate unit boundaries to provide buffers, minimum 50 feet radius, around all identified live fruiting bodies of *Bridgeoporus nobilissimus*.										
14. Directionally fall trees[13] in the harvest units so that they generally do not enter the Stream Protection Zone (SPZ) or adjacent untreated stands.				♦						
15. If any trees or snags in the SPZ or *Bridgeoporus* buffers must be felled for safe logging operations, BLM would require the operator to leave them on-site as near to the stump as feasible in order to create CWD habitat.				♦						♦
16. When additional trees are identified for cutting to facilitate safe logging operations (hazard trees, skid trails and yarding corridors, attaching cables, etc.), 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 for each unit. In the RR, such trees larger than 21 inches dbh would be retained in place as CWD. In Matrix such trees larger than 35 inches dbh would be retained in place as CWD.										♦
-										
17. 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. (RMP C-2)										
18. Limit the width of skid trails to 12 feet. (IDT, standard BLM timber sale contract provision.)										
19. Allow skidding (dragging logs behind a skidder) and other ground based logging operations during periods of low soil moisture content (RMP C-2), generally considered to be the dry season approximately June-October (IDT) (RMP/FEIS pp. 4 – 12-13).		♦		♦		♦				♦

[13] 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.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
20. Re-use existing skid trails whenever feasible for logging operations according to the approved logging plan.	♦	♦	♦	♦		♦				♦
21. 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.	♦	♦	♦	♦		♦				♦
22. Generally limit uphill skidding to slopes where skidders would not break traction to avoid soil displacement.[14]	♦	♦	♦	♦						♦
In Skyline[15] and Other Cable Yarding[16] Operations: RMP/FEIS (pp. 2-34 through 2-37; 4-11 through 4-13; G-1,2)										
23. Design the 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.	♦	♦	♦	♦						♦
24. 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)										
25. 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.	♦						♦	♦		♦
26. A Prescribed Fire Burn Plan would be initiated and signed by the Authorized Officer prior to any prescribed burning activity.	♦	♦					♦	♦		♦
27. Burning would be conducted in accordance with the Salem District 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.	♦	♦				♦	♦	♦		♦
28. Prescribed burning may include broadcast burning, landing pile or machine pile burning, swamper burning, or handpile 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.	♦	♦	♦	♦	♦	♦	♦			♦
29. When hand, machine, or landing piles are identified by the Authorized Officer as the specified fuels treatment the following requirements would	♦	♦	♦				♦			♦

[14] 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. BLM field experience confirms that 20 percent slope consistently provides for adequate traction when skidding uphill while steeper slopes require additional site-specific evaluation.

[15] 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).

[16] "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.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
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 4 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: o Machine and landing piles would only be constructed within 25 feet of designated roads and landings. o 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: o A track mounted hydraulic excavator shall be used to pile woody debris. o 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. o Operating techniques would be designed to prevent gouging, soil compaction and displacement, and erosion. o Away from roads, the excavator shall be required to work on a slash mat in order to reduce compaction. o 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. (RMP C-7) o 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. (RMP C-9) o Machine piles would not be constructed within 25 feet of property lines and unit boundaries, or on slopes greater than 35 percent.										
30. Lopping and scattering of fuels would be incorporated where fuel loading is relatively heavy but not heavy enough to warrant burning.	♦						♦	♦		♦
31. 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.	♦						♦	♦		
32. Oregon Occupational Safety and Health Administration and 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.	♦						♦	♦		

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
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)										
33. 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).		♦	♦	♦						
34. 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.		♦	♦	♦						♦
35. 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.			♦	♦						
36. 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.			♦	♦						♦
37. 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.			♦	♦						♦
38. In addition to the above, limit hauling on road 11-1E-8 east of where it crosses the 16/21 section line near the quarter corner and roads 11-1E-15, 21.1, and the segments of 21.2 in sections 21 and 22 to dry season and dry conditions, restricting haul during the wet season and/or wet conditions.			♦	♦						♦
39. Limit haul on road 11-1E-21.2 in section 15 and road 11-1E-22.4 to dry season and dry conditions as above unless measures are implemented to prevent all sediment from being transported to streams.			♦	♦						♦
40. BLM authorized personnel would visually monitor turbidity (a visible reduction in water clarity)[17] 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.			♦	♦						♦

[17] 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.

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
41. 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, 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.				♦						♦
42. If road-generated sediment transport to streams and the resulting turbidity does not comply with ODEQ water quality standards during the wet season, BLM would not allow log hauling from this project in order to prevent adding to cumulative effects of sediment and turbidity.				♦						
43. Close and stabilize all natural surface roads after use to reduce changes to natural drainage patterns, prevent erosion, and prevent unauthorized use by motor vehicles (including OHV).		♦		♦		♦		♦		♦
44. To close roads, use techniques such as barricades, debris, or roughening to make these roads impassable for motor vehicles.		♦		♦		♦		♦		♦
45. 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.		♦		♦		♦		♦		♦
46. 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.								♦		♦
47. 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.		♦		♦				♦		♦
48. 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.		♦		♦						♦
49. Seed and mulch all disturbed soil at stream crossings with native species seed approved by BLM and sterile mulch (free of non-native seed). Place rock, logs or woody debris as necessary to stabilize disturbed soil.		♦		♦		♦				
50. 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.										

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
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)										
51. Retain large remnant trees and generally protect them from logging damage. Individually designate such trees that are found inside unit boundaries for retention.	♦				♦					♦
52. Maintain at least ninety (90) percent of snags larger than 15 inches diameter and taller than 15 feet intact and standing during logging and site preparation activities.[18] (IDT BMP based on Wildlife Report)					♦					♦
53. Retain existing Coarse Woody Debris (CWD) meeting 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)		♦			♦					♦
54. Plan road and landing locations to avoid impacts to snags larger than 15 inches diameter and taller than 15 feet whenever BLM determines it is safe and feasible to do so.					♦			♦		♦
55. Plan road and landing locations to avoid impacts to large remnant trees and snags and other live trees larger than 36 inches DBH[19] whenever BLM determines it is safe and feasible to do so.	♦				♦					♦
56. Retain the following categories of green trees to meet objectives described in EA section 2.3.1.1: In all LUA retain: • Western redcedar (WRC) – all trees larger than 19 inches dbh and all trees smaller than 9 inches dbh; • Hardwood trees unless individually identified for removal; • All conifer species (except WRC, see above) – all trees larger than 35 inches dbh and all trees smaller than 7 inches dbh. In RR retain all of the above plus: • All conifer species (except WRC, see above) – generally all trees larger than 25 inches dbh. To retain these trees means that they would not be removed from the forest stand. They may be felled (cut or knocked over) to provide for safe and efficient logging. If they are felled, they would be left onsite and left as near to their original location as feasible while providing for safe and efficient logging practices.	♦				♦					♦
57. 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).	♦				♦					

[18] 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).

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

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
58. Avoid incidental unapproved damage[20] 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.										♦
59. Retain trees which have been girdled, topped, damaged or felled to facilitate logging (up to 2 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.										♦
60. Low density thinning (LDT) areas 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. LDT areas in RR would be limited to areas where special habitats can be enhanced or species diversity increased. Locations would be determined by BLM based on site examinations. LDT areas would generally be circular. Areas are proposed for this project would total up to one percent of the project area.										♦
61. 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.		♦		♦		♦				
62. Within LDT areas: seed with forage species and/or plant with shrubs or tree seedlings as needed based on field surveys by BLM resource specialists.		♦				♦				
63. Within LDT areas, 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.		♦								
64. Clean all ground-disturbing logging and road construction equipment, and the vehicles used to transport this equipment to the project area, 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.						♦				
65. False brome (*Brachypodium sylvaticum*) and meadow knapweed (*Centaurea pratensis*) populations would be treated with an approved herbicide prior to any timber harvest activities to reduce the possibility of spread of these species. This would be done under the Vegetation Management EIS.										

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

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
66. No habitat modifying operations (falling, yarding and road construction) would be allowed within disturbance range (0.25 miles) of known northern spotted owl (NSO) sites during the nesting season(March 1 – July 15) unless appropriate NSO surveys indicate that there are no nesting spotted owls within the disturbance range.					♦					♦
67. 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:										
68. 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.									♦	

Seasonal Restrictions and Operational Periods

The Seasonal Restrictions, Modifications and Operating Periods are summarized in Table 6.

Table 6: Summary of Seasonal Restrictions and Operational Periods

Seasonal Restriction	Reason	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All disturbance activities in units 35B and 8A & C, March 1-July15.	Minimize disturbance during spotted owl breeding and nesting season			■	■	■	■	■					
Hauling, based on conditions	Water quality and sedimentation, protect fish												
Hauling on road 11-1E-8 east of the sections 16/21 quarter corner; and roads 11-1E-15, 21.1, and the segments of 21.2 in sections 21 and 22	Eliminate potential sedimentation to protect Listed Fish Habitat (LFH). Restricts haul from units 15C, D, & E.	■	■	■	■								■
Prevent all sediment from entering streams or restrict hauling on road 11-1E-21.2 in section 15 and road 11-1E-22.4.	Eliminate potential sedimentation to protect LFH. Requires extra prevention or restricts haul from 15A & B.												
Skidding operations	Soil protection, site productivity, water quality	■	■	■									■
Other ground-based logging operations	Soil protection												

Seasonal Restriction	Reason	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Road Construction / Stabilizing / Haul on Natural Surface Roads	Erosion control, road damage												
In-water work: stream culvert maintenance	Protect fish and aquatic habitat												
Logging operations	Fire season, ODF regulated use												

KEY			
	White: Operations typically do not require additional PDF to protect resources.	Gray: Operations may be prohibited (restricted) or require additional PDF to protect resources, or allowed as planned depending on conditions.*	Black: Operations are often prohibited (restricted). If allowed, are typically modified by added PDF to protect resources.

* Seasonal conditions, equipment, operations plans and other factors would be considered by BLM to determine whether operations may proceed normally, whether additional site specific restrictions and operating methods would be required, or whether all operations of this type would be prohibited to achieve objectives and protect resources.

2.3.1.2 Alternative Action – Regeneration Harvest of 65 Acres

Project Overview

The IDT developed an alternative for regeneration harvest of 65 acres because forest stands in units 8A and C meet management direction to "[s]chedule regeneration harvest…at or above the age which produces maximum average annual growth over the lifetime of a timber stand" in the GFMA LUA (RMP p.48). These forest stands will reach culmination of mean annual increment (CMAI)[21] within a decade, so regeneration harvest would result in producing the maximum average timber volume on a sustained yield basis, the primary objective for this alternative. The IDT identified 58 acres of these forest stands in unit 8A and 7 acres in unit 8C for potential regeneration harvest instead of the commercial thinning prescription in the proposed action. Regeneration harvest is proposed only in GFMA, not in CONN or RR.

The IDT recognizes that maintaining the full range of age classes in the rotation (in GFMA rotation is scheduled at CMAI, approx. 70-110 years; in CONN the rotation is set as 150 years [RMP p. 48]) is important for maintaining sustained yield as required by the O&C Act to "provide a sustainable supply of timber" as required by the RMP (pp. 1, 20, 46).

The RMP (p. 46) also identifies objectives for Matrix land to "provide habitat for a variety of organisms associated with both late-successional and younger forests" and to "provide early successional habitat". The IDT determined that providing high quality early successional habitat at a scale larger than the canopy gaps described in the proposed action is a secondary objective for the 65 acres of regeneration harvest proposed in this alternative.

On the remaining 1435 acres described in the proposed action, the alternative is identical to the proposed action, including connected actions. In the 65 acres of regeneration harvest BLM would conduct site preparation and reforestation as described below. Logging systems and road management would be the same under both alternatives.

[21] Culmination of Mean Annual Increment (CMAI) is the age in the growth cycle of a forest stand at which the rate of annual increase in timber volume is at its highest. After this age, the ***rate*** of volume increase starts to decrease, though the ***total amount*** of volume continues to increase. At culmination, mean annual increment (MAI) equals periodic annual increment (PAI).

Proposed Treatments in Regeneration Harvest Units

Sixty-five (65) acres of 102 year old timber stands are proposed for regeneration harvest as an action alternative to the proposed action. In Unit 8A, the 58 acres below the 10-1E-23 road in sections 6 and 8 and the 7 acres of unit 8C are proposed for regeneration harvest.

BLM records identify approximately 138 acres of 102 year old timber in this contiguous stand, with approximately 102 acres in GFMA and the remainder in RR. The upper portion of this stand borders an identified area of RA 32 habitat to the north and the IDT determined that regeneration harvest of the entire stand would potentially impact the RA32 habitat to the north, so a suitable buffer would be required. The IDT identified the 58 acres of GFMA below road 10-1E-23 in unit 8A and the 7 acres of unit 8C (also GFMA), as candidates for regeneration harvest.

All treatments proposed for the remaining 1435 acres of commercial thinning are identical to the proposed action. The regeneration harvest alternative may be selected for all or part of units 8A and C, or may be implemented in multiple projects, see EA 2.4.1.4.

Connected Actions

Except as described below, all connected actions are identical to the proposed action.

Landings

The landings used to log the proposed regeneration harvest area may be slightly larger than the landings used to log the same area under the proposed action due to the need to deck more logs awaiting transportation to the mill. The portion of the landings used for equipment operation would be the same size as for thinning, but more adjacent area may have understory vegetation cleared for decking logs.

Fuels Treatments, Including Site Preparation

In addition to the fuels surveys and fuels treatments described for the Proposed Action, broadcast burning for fuel hazard reduction and site preparation would be done in the regeneration harvest areas. Approximately 12,000 feet of fire trails would be constructed by hand around the forested borders of the regeneration harvest units. Fire trails would consist of an area up to ten feet wide where fuels would be removed and a trail approximately two feet wide constructed to mineral soil within the fuel clearing area.

Post-treatment fuels surveys would be conducted in the regeneration harvest units and a site and condition specific burn plan prepared. If the fuels surveys indicate that another treatment such as hand pile/burn or lop and scatter would be more appropriate on some or all acres the treatment recommendation would be changed accordingly. Alternative treatments are less impacting than broadcast burning and may be substituted without additional effects analysis.

Table 7: Fuels Treatments for Alternative Action – Regeneration Harvest 65 Acres

Harvest Type	Total Acres	Broadcast Burn Acres	Hand Pile Acres	Machine Pile Acres	Landing Piles
Commercial Thin	1393	0	7	126	267
Low Density Thin	15	0	15	0	00
Regeneration	65	65	0	0	9
R/W	27	0	0	0	0
Totals	**1500**	**65**	**22**	**126**	**276**

Reforestation

Regeneration harvest units would be planted with native conifer seedlings during the first planting season after site preparation. Seedlings would be grown from seed collected from parent trees adapted to the seed zone and elevation band of the site. Species planted would be primarily Douglas-fir and Noble fir, though western redcedar and other minor species may also be planted. Retained western hemlock trees would be expected to provide natural seeding for that species. Approximately 300 seedlings per acre would be planted, generally on a 12 X 12 feet spacing. Additional long term stand maintenance would be done according to BLM's normal silvicultural practices.

Preventing Unauthorized Off-Highway Motor Vehicle (OHV) Use (RMP p. 41)

Block skid trails and make them impassible for OHV as part of the timber sale contract, as described under Project Design Features. Block closed roads and/or make them impassible for OHV to effectively eliminate OHV use while making it feasible for fire suppression personnel to open those roads with equipment commonly used for wildland fire initial attack response. Road and skid trail closure methods would be designed for each site to avoid causing erosion and avoid damaging retained trees. See Project Design Features (Table 5, EA section 2.3).

Special Forest Products (RMP p. 49)

BLM would sell permits for collecting Special Forest Products from the harvest units if there is a demand for the products, and collection would not interfere with proposed project operations or have effects beyond those analyzed in this EA. Special Forest Products are useable vegetation that can be harvested/collected from the forest and may include: edible mushrooms, firewood, posts and poles, and native plants for transplant or traditional use.

Project Design Features

In addition to the project design features (PDF) described for the proposed action, BLM would implement the following PDF for the regeneration harvest units:

Table 8: Project Design Features Applicable to Alternative Action, Regeneration Harvest

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
In the Regeneration Harvest Alternative for Units 8A&C: RMP (pp. 21, 25, 26-27, D-2); CCWA (pp. 7 - 8, 9): Management Recommendations for the Oregon Red Tree Vole, September 27, 2000.										
69. Retain 10-12 green trees per acre (average, both aggregated and dispersed) for recruiting snags and CWD and developing a large green tree component. Up to two per acre of these green trees may be hardwoods >20 inches DBH.	♦				♦		♦			♦
70. Retain and protect large remnant trees (older than 200 years) and early decay class snags by excluding them from harvest units, designating green tree retention areas, locating yarding corridors, and designing site preparation practices to avoid cutting or damaging identified trees and snags.					♦		♦			♦

Project Design Features (RMP/FEIS references for key points)	Applicable Resources / Objectives									
	Vegetation	Soil	Water	Fish	Wildlife	Invasives	Fire /Air	Public	Cultural	Economic
71. Top or girdle up to four green conifer trees per acre to reduce windthrow potential and create cull trees/snags to meet short-term snag requirements.	♦				♦					♦
72. All flammable debris shall be removed from the area within a five (5) foot radius of retained green trees, and wildlife trees and snags marked with orange painted "W"s.	♦				♦		♦			♦
73. Retained green trees shall be protected as feasible to prevent more than four trees per acre mortality from prescribed fire. Techniques such as lighting patterns to minimize heat delivered to tree crowns by the convection column, pre-wetting around retained trees and snags, and/or fire trails around aggregated retention areas shall be used to reduce mortality..	♦				♦		♦			♦
74. Seasonally restrict habitat modifying activities affecting spotted owls (timber harvest, road construction and prescribed burning) on unit 8A March 01 – July 15, to reduce disturbance during nesting season. May be waived if owls are not present.					♦		♦			♦
75. Seasonally restrict habitat modifying activities affecting migratory birds (falling and yarding) on units 8A&C April 15 – July 31, to reduce potential for unintentional take of migratory birds, their nests, eggs and nestlings.	♦				♦		♦			♦
76. Protect known locations of red tree voles by retaining a habitat area ≥10 acres with at least one site potential tree height between the nest tree and the habitat area boundary.	♦				♦		♦			♦
77. Reforest regeneration harvest units by planting conifer seedlings.	♦	♦			♦	♦	♦			

2.3.1.3 No Action Alternative

The No Action alternative describes the baseline against which the effects of the proposed action can be compared, i.e. the existing conditions in the project area and the continuing trends in those conditions if BLM does not implement the proposed project. Consideration of this alternative also answers the question: "What would it mean for the objectives to not be achieved?" The "No Action alternative" means that no timber management actions, fuel reduction treatments, or connected actions would occur.

If this alternative were to be selected, the following activities would not take place in the project area at this time: silvicultural treatments; timber harvest; road construction, renovation, improvement or closure; stream crossing restoration projects such as culvert upgrades or removal of failing culverts; and fuel reduction projects (both within and outside of timber harvest areas). 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.

The No Action alternative may be selected for individual units or portions of units as well as for the entire project area.

Only normal administrative activities and other uses (e.g. road use, programmed road maintenance, harvest of special forest products on public land) would continue on BLM within the project area.

On private lands adjacent to the project area, forest management and related activities would continue to occur.

2.3.1.4 Alternatives Considered But Not Analyzed In Detail

BLM considered other forest stands in the project vicinity for treatment during early stages of project development.

- Approximately 1156 additional acres of forest stands were initially identified based on stand age and other information in BLM's data base. These stands were dropped from further consideration and analysis early in the IDT process for a variety of reasons such as: the stand does not need to be treated; logging problems; stream protection; green tree reserve; or wildlife protection.
- Approximately 98 acres within the boundaries of areas considered are existing roads.
- The IDT dropped approximately 314 acres of forest stands which were originally part of the project units analyzed in this EA from further consideration and analysis early in the project development process. Reasons for dropping these acres include: stream protection zones; RR not needing treatment to meet ACS objectives; logging problems; and wildlife protection, including dropping unit 8B which became a red tree vole (RTV) habitat area (EA section 3.8.1, Wildlife).

Road System and Access:

The IDT considered an alternative to construct approximately 800 feet of road from the end of the 11-1E-15.3 road to the private road system to the north, and obliterate a portion of the 11-1E-15 road which is contributing sediment to the stream network. The IDT determined that the -15 road could be repaired to meet management objectives at a much lower cost than purchasing rights to use the private system, even if the private owner is even willing to grant such rights. The IDT dropped this alternative from further consideration and analysis.

Implement Regeneration Harvest (Alternative Action Only) in Multiple Entries Over a Two to Four Decade Period Rather than Single Entry:

The IDT considered this to be within the scope of the two alternatives analyzed since it would essentially involve selecting the proposed action or No Action alternative for part of the units analyzed for regeneration harvest and selecting the alternative action for the remainder of the units at this time. Prior to implementing a regeneration harvest in all or part of the remainder of the units, the IDT would need to determine whether the analysis in this EA would be adequate at that time, or if additional NEPA analysis would be required.

Reserve the Stands in the Project Area for Carbon Storage:

This alternative was not analyzed in detail for the following reasons. This alternative:

- Does not respond to the purpose for the project (EA section 1.2);
- Is not in conformance with the 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 RR are managed to help develop late successional habitat conditions in line with the Aquatic Conservation Strategy. The RMP does not include a LUA that reserves lands or stands for carbon storage; and

- Is substantially similar in design to the No Action alternative which is analyzed in the EA, in that this alternative would leave the stands unaltered and unmanaged just as under the No Action alternative.

Recreation Emphasis:

This alternative was not analyzed for the following reasons:

- Precluding timber harvest and connected actions does not respond to the purpose for the project (EA section 1.2);
- The project area and vicinity were not selected for any special recreation designation in the RMP;
- Dispersed recreation opportunities would continue to be available in the project area and vicinity except within active logging units during actual operations; and
- The recreation emphasis alternative would be substantially similar to the "No Action alternative".

Change Matrix Objectives to Emphasize Recreation and/or Other Uses:

This alternative was not analyzed because changing RMP land use allocations or management objectives is beyond the scope of this project.

Manage for Long-Duration Early-Seral Habitat:

An alternative to extend the duration of early seral habitat by not planting conifers or doing any vegetation management treatments to promote conifer growth was not analyzed because it does not fully comply with RMP timber management objectives in the Matrix land use allocations and it is not an approved pilot, research or demonstration project.

Chapter 3: Affected Environment and Environmental Effects

3.1 Analysis Assumptions

General

Timber management activities will occur on BLM-administered lands allocated to planned, sustainable harvest. The type, quantity, and impacts of allocating these lands for the type and quantity of these timber management activities were analyzed in the Salem RMP/FEIS for both the short-term (10 years) and long-term (decades). Under the RMP, this applies to Matrix lands, both GFMA and CONN, in the proposed project area.

Future timber management activities on those BLM-administered lands will re-use the transportation system of skid trails, landings and truck roads proposed for this project.

The RR LUA on BLM-administered lands will be managed for protection of watershed values such as water quality and aquatic habitat and for terrestrial wildlife habitat on both a local and landscape level. Where the RR overlays Matrix, RR management direction supersedes Matrix direction.

If the proposed action is implemented, no further silvicultural treatments would be done for approximately the next 20 years in Matrix stands in the project area. In Matrix stands BLM would evaluate the stands for potential timber harvest in approximately 20 years – either a second entry commercial thinning or regeneration harvest.

If the alternative action is implemented, the regeneration harvest units would be treated for site preparation and planted with a mix of conifer species. The reforested sites would be examined annually until the planted trees were determined to be established, then periodically after that to determine needs for silvicultural treatments over the next two to five decades. No further silvicultural treatments would be done for approximately the next 20 years in the thinned Matrix stands as described above.

In RR stands, BLM would evaluate these stands, and other stands in the watershed, approximately each decade to determine if further silvicultural treatment is needed to recruit snags and/or CWD or to meet other RR objectives.

Climate change may increase the duration and severity of wildfire season to an unknown extent during the project period (three to five years), but that any such overall increase would not be expected to exceed the conditions used to model fire potential for this time period.

Most private industrial forest lands in these watersheds will be intensively managed with regeneration harvests scheduled on commercial economic rotations occurring at 30-60 year intervals (PRMP/FEIS 1994, p. 4-3 and BLM observations of recent trends in industrial forest management).

Vegetation/Silviculture

As relative density (RD)[22] increases above 50 percent, competition for light, nutrients and water begins to reduce growth rates and increase stresses on individual trees and on the stand as a whole.

Forest stands with relative densities above 65 percent have lower tree vigor, higher mortality of suppressed trees, and higher susceptibility to insects, disease, and more severe fire behavior than stands with lower densities (Perry, 1994; Hann and Wang 1990; Curtis 1982). These conditions reduce stand resiliency and resistance to environmental stresses.

Soils

There would be no impacts to fragile sites that are not suitable for forest management because BLM practice is to locate proposed timber harvest unit boundaries to avoid those areas which are classified as "Non-suitable". All BLM managed lands are classified as Suitable for timber production, Suitable but Fragile for a variety of reasons (e.g., nutrient status, compacted surfaces, slope gradient, etc.), or Non-suitable.

Potential reductions in growth and yield from compaction caused by logging operations are within the standards analyzed in the FEIS/RMP because less than ten percent of the ground surface is compacted (≥20 percent increase in soil bulk density) by logging operations including ground based equipment, landings, and skyline yarding.

There is no potential productivity loss from post-harvest erosion because field monitoring of commercial thinning projects from 2007-2012 has shown that soil erosion resulting from the proposed action would be so minimal as to not affect site productivity.

[22] Relative density (RD) is a measure of crowding in a stand of trees, expressed as a percentage of density (based on number and size of trees) relative to a theoretical maximum density. Curtis Relative Density (RD) is calculated by dividing the basal area per acre by the square root of the quadratic mean diameter. Other common ways of communicating density in a forest stand include trees/acre, basal area/acre, average spacing and crown or canopy closure.

Air Quality/and Fire Hazard /Risk

Climate change may increase the duration and severity of wildfire season to an unknown extent during the project period (three to five years), but that any such overall increase would not be expected to exceed the conditions used to model fire potential for this time period.

Recreation/Visuals/Rural Interface

Access to the project area will continue to be a combination of uncontrolled access from public roads and access controlled by private gates and road owner policy.

The public road haul routes used for this project have been continuously used for timber haul for several decades and timber haul from this project would not change the nature of traffic near residences and other public uses.

3.2 Methodology

General

The forest condition information was compiled from a variety of sources including BLM corporate data, stand exams, and field surveys by BLM personnel.

The RMP/FEIS provided general vegetation information for the Salem District planning area as of September 1994.

Research publications provided ongoing baseline information specific to forest vegetation and the impacts of managing or not managing forest stands (see specialist reports for publications specifically relied upon in developing the SMBT project).

GIS data, aerial photographs and satellite imagery, BLM's Forest Operations Inventory (FOI) records, resource specific field surveys (see the following EA sections for specific surveys conducted) and field reconnaissance by BLM resource specialists were used to describe vegetation, habitat and plant and animal species present on BLM lands.

Vegetation

For stand structure information, Stand Exams were conducted in 2012 and additional stand information was gathered by BLM personnel.

BLM Silviculturist and Wildlife Biologist analyzed the data using the ORGANON growth analysis and projection computer program and used it as the basis for the description of existing vegetation and forest stand characteristics and for developing the prescriptions that would be implemented under the proposed action (EA Tables 12 and 13, Silvicultural Prescriptions).

Threatened/Endangered/Special Status/Special Attention Botanical Species: BLM botanist for Cascades Resource Area conducted two types of surveys within the project area and vicinities; Known Site Surveys (Data Search) and Field Surveys (Botanical Inventory).

Hydrology

BLM's Hydrologist researched public records for beneficial uses and various aspects of water quality and stream status.

The Hydrologist examined the project area and vicinity to determine current status of stream conditions, water quality, stream locations and wetlands.

The Hydrologist used the State of Oregon Risk Assessment tool to evaluate the immediate and cumulative effects of potential harvest on peak flows in area streams.

The hydrologist evaluated roads, stream crossings and proposed logging and road work plans to evaluate current and potential sources of sediment.

Fisheries and Aquatic Habitat

BLM Fisheries Biologists conducted surveys to determine resident fish distribution. Survey methods commonly used include data in State and Federal records, field surveys of channel and stream habitat characteristics including barriers to fish passage, shocking, and snorkel surveys of project area streams. Fish presence and habitat surveys for the SMBT project were conducted in May, 2013.

BLM civil engineering staff, logging systems engineer, fisheries biologist and hydrologist examined locations and conditions of existing culverts, proposed stream crossings, and log hauling roads at various times during 2012 - 2014.

Soils

Soil maps and descriptions of project soil characteristics are available at the Natural Resource Conservation Service web site: http://www.or.nrcs.usda.gov/pnw_soil/or_data.html.

Site specific conditions on BLM lands in the project area were mapped and field-verified in the Timber Production Capability Classification (TPCC) database (Power and Tausch, 1987).

BLM Resource Specialists for soil and hydrology visited the project area multiple times, performing both formal surveys and informal reconnaissance, including digging small pits, to evaluate site specific conditions.

Wildlife

Cascades Resource Area Wildlife Biologists assessed potential effects to terrestrial species by using the following methodologies:

Wildlife Biologists compiled a list of Wildlife Special Status/species of concern in the Cascades Resource Area using BLM wildlife databases, BLM Special Status Species lists (BLM IM OR-2012-018), Oregon Biodiversity Information Center lists (ORBIC 2013), various wildlife field guides, literature, and texts.

The Wildlife Biologists determined the presence of special habitats, and the amount of snags and down logs present from stand exam data, aerial photos, and field review.

BLM Wildlife Biologists visited the project area during the 2011, 2012 and 2013 field seasons and examined habitats in and adjacent to proposed SMBT project units.

From the Cascades Resource Area list, the Wildlife Biologists compiled a list of Special Status/species of concern documented or suspected to occur in the SMBT project area based the proposal's geographic location, elevation, and knowledge of habitats present gained through air photo interpretation, stand exam data, GIS information, and field reconnaissance. For each of those species they determined habitat associations and the presence or absence of suitable habitat. The resulting list of special status species which are known or suspected to occur in the SMBT project area and their habitat preferences are included in Table 6 of the Wildlife Report (not EA Table 6) which is incorporated by reference into this EA.

For migratory and resident birds BLM's Wildlife Biologists developed a list of migratory bird species of conservation concern and/or focal species which may breed in the SMBT project area

(Altman and Hagar 2007; Altman 2012). These species and anticipated short and mid-term responses are listed in Table 7 of the Wildlife Report.

For northern spotted owl (NSO): The Crabtree Creek and Thomas Creek areas have a long history of northern spotted owl surveys that date back to the early 1980s. Additional surveys for northern spotted owls will be conducted to determine presence in the future.

Surveys for red tree voles and Survey and Manage mollusks were conducted on project units which are over 80 years old. Two mollusk surveys were conducted – fall 2013 and spring 2014 – and no Survey and Manage mollusk species were found. (Protocol from Duncan et al. 2003) Red tree vole surveys were conducted in Spring 2013, results are documented in Section 3.7 of this EA. No surveys for red tree voles or Survey and Manage mollusks were conducted in stands with a stand age of less than 80 years old (Pechman exemption, 2006).

For Coarse Woody Debris (CWD) information, Stand Exams were conducted in 2012. Additional stand information was gathered by BLM personnel.

Cascades Resource Area wildlife biologists assessed the suitability for treatment of Riparian Reserve stands adjacent to proposed Matrix thinning units by:

- Field examinations of those Riparian Reserve stands to assess stand complexity and other habitat characteristics based on their training and professional experience.
- Consulting with the Silviculturist and examining stand exam data.
- Consulting with the Cascades Resource Area Logging Systems Specialist to determine if treatment is feasible using existing roads or roads to be constructed for managing Matrix land when the Wildlife Biologist determined that silvicultural treatment could benefit habitat conditions.

Fire and Fuels

The Cascades Resource Area Fuels Management Specialist assessed air quality and fire hazard and risk by using the following methodologies:

For Coarse Woody Debris (CWD) information, Stand Exams were conducted in 2012. Additional stand information was gathered in 2013 by BLM personnel.

Fire Regime and Condition Class descriptions to determine fire frequency and vegetation characteristics are located at: (http://www.nwcg.gov/teams/wfewt/archive/message/FrccDefinitions.pdf)

The modeling predictions for fire regime and condition class come from the LANDFIRE Rapid Assessment Vegetation Models.

(http://www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html)BLM

Wildfire frequency information was gathered from the Oregon Dept. of Forestry web site and is available at: (http://oregon.gov/ODF/FIRE/HLCause.pdf).

Fuel models were determined by using the 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, BLM Warehouse, Boise, Idaho (Anderson, 1982)

Current and potential logging slash residues were determined by conducting a visual "walk through" and by consulting the 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), and the Stereo Photo Series for Quantifying Forest Residues in Douglas-fir hemlock Type of the Willamette National Forest. General Technical Report PNW-GTR-258 U.S. Department of Agriculture - Forest Service, Pacific Northwest Research Station. Siuslaw National Forest. (Ottmar, Hardy, Vihnanek, 1989).

Cultural Resources

BLM Cultural Resources specialist reviewed BLM records to identify previously recorded cultural resource sites and examined additional historical references and aerial photographs to identify field locations of reference sites and determine areas of potential cultural resource site occurrences.

Under the direction of the District cultural Resource Specialist, Cultural Resource assistants then surveyed the project area, focusing on previously recorded sites and on areas having potential to contain cultural resources, based on observations of topography, water sources, trails and improvements that may have been suitable for camping, settlement and other human activities.

3.3 General Description from Watershed Analyses and Late Successional Reserve Assessment

Sources Incorporated by Reference: Thomas Creek Watershed Analysis (TCWA), 1996; Crabtree Creek Watershed Analysis (CCWA), 2001; Willamette Late-Successional Reserve Assessment (LSRA), 1998.

The SMBT project area is located in the Crabtree and Thomas Creek 5th field watersheds in Linn County, Oregon. The Crabtree Watershed is 100,022 acres just south and east of the 75,066 acre Thomas Creek Watershed. BLM manages about 18 and 17 percent respectively of the two watersheds.

Most of the land in these two watersheds has been managed for timber harvest on both private and public lands beginning in the 1930s. Public lands comprise approximately 36 percent of the Crabtree Creek Watershed (CCWA Chp. 5, p. 4) and 33 percent of the Thomas Creek Watershed (TCWA, Chp. 5, p. 29). Desirable stand characteristics described in both Watershed Assessments and the LSRA include: larger trees (than are currently available) for a large green tree component and for recruitment of large standing and down dead wood (snags and CWD) in future stands; multi-layered stands with well-developed understories; and multiple species including hardwoods and minor conifer species (CCWA Chp. 7, p. 14; TCWA Chp. 7, p. 99). The TCWA Terrestrial Recommendation 1 specifically recommends density management (commercial thinning is a method of managing density) in RR, LSR and CONN to develop and maintain older forest stand characteristics in younger age classes than they would develop without management intervention.

3.4 Vegetation and Forest Stand Characteristics

Sources Incorporated by Reference: 2014 Foster, Sunday Morning Silvicultural Prescription; 2014 Foster, Belly Twister Silvicultural Prescription (Silvicultural Prescriptions); Stand Exam Data and Analysis.

Additional Sources: BLM archival records including *Metzger's Atlas* and other timber sale records, silvicultural treatment records, and aerial photography; BLM GIS data; field observations by BLM resource specialists; Thomas Creek Watershed Analysis (TCWA), 1996; Crabtree Creek Watershed Analysis (CCWA), 2001; Vegetation Treatments Using Herbicides on BLM Lands in Oregon Final Environmental Impact Statement (Vegetation Management EIS), 2010.

3.4.1 Affected Environment

Overview of Stand Development, Historical Influences, and Land Status

Prior to extensive clearcut logging in the watershed during the 1930s through the 70s, the Crabtree Creek and Thomas Creek watersheds contained large stands of late-successional and old growth forest, especially in the upper reaches of the watersheds. Douglas-fir, western hemlock and western red cedar were the predominant species at lower elevations with increasing components of noble and silver fir in the higher elevations. Old-growth stands and individual large legacy trees that remain in the project vicinity are scattered and often relatively small and most are found in the upper reaches of the watersheds.

Before intensive management of the forested landscape of the Cascade foothills, natural disturbances and "prescribed" fire conducted by indigenous peoples maintained a spatial mosaic of stand structure that likely included a greater proportion of high quality early seral habitat than currently exists. A century of aggressive fire suppression and intensive forest management have created a greater diversity of stand age classes and more total early seral habitat today than probably existed historically. The quality of much of today's early seral habitat in the project vicinity and surrounding private lands is generally considered to be poor because intensive forest management practices on private industrial timberlands truncates natural successional pathways of forest development by planting monocultures of conifer species and treating those stands to inhibit the establishment of early seral brush and hardwoods. BLM regeneration harvest units in the project vicinity have not been managed as intensively as private forests so they provide more forage and brush species and contain more legacy trees, snags and coarse woody debris than nearby private lands. The last BLM regeneration harvests in the project vicinity were completed approximately 12-15 years ago.

BLM archival records show a series of timber sales that covered most of the project area being active from the late 1930s through the early 1970s. Long term timber production was the primary land use objective on both public and private lands in that era, so clearcuts followed by site preparation, reforestation and thinning were the core of the silvicultural systems used to produce a sustainable crop of timber. Additional management actions have continued in the project vicinity and surrounding private lands, some of which are ongoing.

Site preparation was most commonly broadcast burning (ignite fire throughout the entire unit), which was often done as the fall rains began. Fall burning was efficient because cured fuels burned thoroughly to leave the ground clean and ready for reforestation, and because the fall rains would "mop up" remaining fire with minimal time and cost to prevent large-scale forest fires. At that time snags and cull logs were considered to be a nuisance that harbored insects and disease and were a fire danger, all of which threatened the future value of the timber crop. The hot fires in dry fuels "efficiently" burned up snags and large rotten and cull logs so that they would not create a long-term fire hazard or interfere with reforestation and other future operations.

Reforestation was commonly accomplished by "natural seeding" from trees that survived site preparation and trees in adjacent stands. Site preparation was intended to expose mineral soil, which was essential to provide a seedbed for reforestation by natural or aerial seeding. When stocking surveys indicated a need, supplemental aerial seeding or planting tree seedlings would be used to supplement the natural seeding. Since the last half of the 20th century, planting tree seedlings has been the most commonly used method of reforestation. Many of the stands in the project area were apparently reforested with natural seeding since BLM records show supplemental seeding or planting for only about half of the units.

Some of the stands in the project area were pre-commercially thinned (PCT) to promote growth and timber values. Two of the stands have previously been commercially thinned. Three of the stands were treated with herbicides to control competing vegetation before that practice was halted on Federal lands in the 1980s. These treatments were prescribed with the assumption that the stands would be commercially thinned 20 to 30 years after precommercial thinning, often followed by a second commercial thinning in another 20 to 30 years. Regeneration harvest was planned at culmination of mean annual increment (CMAI), generally anticipated as between 70 and 110 years of age (RMP, p. 48). CMAI is a measure of when the growth rate of the timber stand slows down. This full cycle from timber harvest through planting, thinning and other treatments to harvest of the next generation of timber is called a "rotation".

See Figures 1 through 9 in EA Chapter 1 for photos and LIDAR modeling of current stand conditions.

The following three tables, compiled from the CCWA, chapter 5, pp. 4-6, and TCWA Chapter 5, pp. 29-33 show the seral stage acres in the Fifth Field Watersheds, seral stage acreage on federal lands by LUA, and the definitions used for seral stages. This acreage shows general patterns well, but acres may differ from current BLM GIS data which is used elsewhere in this EA.

Table 9: Seral Stage Acres by Ownership - Crabtree and Thomas Creeks Watersheds

Seral Stage used for Watershed Analysis	BLM Ownership Acres	Non-Federal Ownership Acres	All Lands Acres
Crabtree Creek Watershed			
Old-growth	3,821	3	3,824
Mature	2,588	4,269	6,852
Closed Sapling	3,078	22,762	25,844
Open Sapling/Brush	7,641	10,756	18,395
Early-Grass/Forb	288	9,839	10,122
Nonforest	591	34,376	34,990
Total	**18,007**	**82,005**	**100,027**
Thomas Creek Watershed			
Old-growth	1,857	1,423	3,280
Mature	2,493	1,527	4,020
Closed Sapling	1,825	16,802	18,627
Open Sapling/Brush	3,829	21,896	25,725
Early-Grass/Forb	2,488	6,853	9,341
Nonforest	534	13,539	14,073
Total	**13,026**	**62,040**	**75,066**

Table 10: Seral Stage Acreage on Federal Lands by LUA in Each Watershed

Seral Stage		GFMA	%	CONN	%	LSR	%
Crabtree Creek Watershed							
Early/grass/forb		146	2	57	1	85	1
Open Sapling/brush		3,205	44	2,127	53	2,309	35
Closed Sapling		2,412	34	460	11	206	3
Mature	Late Seral	939	13	367	9	1,282	19
Old-Growth	Late Seral	440	6	1,018	25	2,363	35
Non-forest		66	1	31	1	494	7
Total		**7,209**		**4,061**		**6,738**	
Thomas Creek Watershed							
Early/grass/forb		1,322	23	1,018	20	107	5
Open Sapling/brush		1,818	32	1,573	31	439	20
Closed Sapling		1,048	18	659	13	119	5
Mature	Late Seral	536	9	1,024	20	933	42
Old-Growth	Late Seral	800	14	568	11	488	22
Non-forest		194	4	195	5	145	6
Total		**5,718**		**5,037**		**2,231**	

Table 11: Seral Stage Definitions

Seral Stage used for Watershed Analysis	Age Class	Diameter Range (Inches DBH)	Seral Stage used for Wildlife Habitat*	Age Class
Open/Grass/Forb	0 to 10	0	Early Seral	0 to 30
Open sapling/brush	10 to 40	<10	Early Mid Seral	30 to 40
Closed Sapling	40 to 80	11 to 20	Mid Seral	40 to 60
			Late Mid Seral	60 to 80
Mature	80 to 200	21 to 30	Early Mature Seral	80 to 120
			Mature	120 to 200
Old-growth	> 200	> 30	Old-Growth	> 200

* See footnotes to Table 18, EA Section 3.8.1.

Current Forest Stand Structure

The forest stands proposed for treatment are well stocked to overstocked, mid-seral to early mature seral conifer-dominated stands that have reached the stem exclusion stage of development. Additionally, the stands comprising units 8A, 8C, 35B, 15E and 27A each have characteristics which differ from the general description for all stands and will be described separately. Detailed descriptions of each unit are found in the Silvicultural Prescriptions. Table 12 provides a summary of how key descriptors are applied to each unit.

Stand exams show that most of the stands in the project area range from 37 - 70 years old (as of 2013) and are predominantly Douglas-fir or western hemlock, with components of true fir (grand, noble and silver), western red cedar and hardwoods. Units 8A&C are 102 years old. 35B and 27A are two-storied stands with a weighted average age[23] of 77. Unit 15E is 51 years

[23] Average age calculation was weighted by basal area, which yields an older average age than the mean of tree ages. Using a grove of five trees as an illustration: One tree is 38 inches diameter and 150 years old; the other four trees are 19 inches diameter

old and is a highly variable stand dominated by western hemlock which is heavily infected with dwarf mistletoe which is limiting the productive capacity of this site for growth and timber value.

Each of these stands has reached the stand exclusion stage of development where the tree crowns have occupied the site (grown together) to the point where new trees cannot successfully establish in the stand and where self-thinning through suppression mortality, self-pruning, and crown recession are ongoing.

These stands are generally healthy with little evidence of disease, except for some dwarf mistletoe in western hemlock trees and some *Phellinus weirii* (laminated root rot), both of which are a natural part of forest stands and contribute to structural diversity across the landscape but reduce timber production and value.

Field observations and GIS analysis show that early-successional habitat/early-seral forest structure is lacking on BLM land in these watersheds, especially in the 0-10 year age class. Small openings with early seral vegetation are lacking in many of the proposed units.

The Silvicultural Prescriptions provide detailed descriptions of the forest stands for each proposed unit. Table 12 shows a summary of how the major descriptors were used for each unit.

Table 12: Unit Level Descriptions from the Silvicultural Prescriptions

Unit	Belly Twister & Bent Beekman Blocks										Sunday Morning Block								
	1					3	5	8	35		15					16	17	27	
	A	B	C	D	E	A	A	A,C	A	B	A	B	C	D	E	A	A	A	B
Stand Development																			
Age[24], as of 2013	63	53	52	37	45	57	51	102	43	77	49	37	46	51	50	54	50	77	70
Early Mature Seral								*											
Late Mid Seral	*									*								*	*
Mid Seral		*	*		*	*	*		*		*		*	*	*	*	*		
Early Mid Seral				*								*							
Stand Condition																			
Even-Aged	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*		*
Two-Aged										*								*	
Well-Stocked		*		*	*	*			*		*	*	*			*	*	*	*
Over-Stocked	*		*				*	*		*				*	*				
Stem Exclusion	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*
Poor Understory	*	*	*	*		*	*	*			*	*	*	*	*	*	*	*	*
Simple Structure				*	*		*	*			*	*				*			*
Variable Structure	*	*	*			*			*					*	*		*	*	
Phellinus (root rot)																	*		
Dwarf Mistletoe	*	*	*					*							*				

and 70 years old. The large tree has a basal area of approximately 8 square feet while each of the smaller trees each have about 2 square feet. Weighting age by basal area, the single 150 year old tree accounts for half of the stand for a weighted average of 110 years. A simple mean of tree ages (150 + [4 x 70] = 430 years, divided by 5 trees) yields an average age of 86.

[24] Stand ages for even-aged stands were determined by the mean age of dominant and co-dominant trees sampled during stand exams, or from BLM reforestation records. Stand ages for two-storied stands were determined by a basal area weighted average of sampled trees. In unit 27A overstory trees were not cored for age so 200 years age was used as a surrogate for trees larger than 35 inches diameter. Sample trees were cored for age in all other units.

Unit	Belly Twister & Bent Beekman Blocks										Sunday Morning Block								
	1					3	5	8	35		15					16	17	27	
	A	B	C	D	E	A	A	A,C	A	B	A	B	C	D	E	A	A	A	B
Species - major																			
Douglas-fir				*	*	*	*	*	*	*	*	*	*	*		*	*	*	*
Western hemlock	*	*	*												*				
Species - minor																			
Douglas-fir	*	*	*												*				
Western hemlock				*	*	*	*	*	*				*	*		*	*	*	*
True firs		*	*			*	*	*					*	*	*	*	*	*	*
Western redcedar	*	*	*	*	*	*			*				*	*	*	*	*	*	*
Hardwoods						*							*	*	*	*	*	*	*
Past Management																			
Natural seed	*	*	*				*	*						*	*			*	*
Plant/Aerial seed				*	*	*	*		*		*	*	*			*	*		
Precommercial Thin				*	*				*		*								
Other[25]		CT						CT					BS			AS	AS		
Elevation																			
3500-4000							*												
3000-3500								*											
2500-3000		*	*	*	*			*											
2000-2500	*	*	*	*					*										
1500-2000						*			*	*	*			*					
<1500											*	*	*	*	*	*	*	*	*

[25] CT = Commercial thinning. AS = Aerial Spray with herbicides. BS = Basal Spray with herbicides.

Table 13: Stand Information by Unit

T-R-S Unit	Initial Ac.[1]	EA Ac.[2]	Stand Age[3]	CWD LF/Ac.[4]	Snags/100 Ac.[5]		Trees/Ac		Curtis RD		Average Diameter			
				Hard / Soft	15-25" Hard / Soft	25"+ Hard / Soft	Now	After Thin	Now	After Thin	Now	20 Yr. No Thin	Immed. After Thin	20 Yr. After Thin
Belly Twister and Bent Beekman Blocks														
10-1-35A	160	130	43	0/115	0/0	0/0	154	86	47	34	15.7	20.2	17.4	22.6
B	89	36	77	132/605	0/0	0/120	147	58	68	37	19.3	22.3	23.7	27.4
11-1-1A	11	10	63	0/456	0/0	0/0	332	69	90	34	13.6	15.6	19.9	23.0
B	89	66	53	34/143	0/0	0/0	147	66	59	35	17.5	19.9	21.2	24.1
C	32	21	52	0/580	270/0	0/40	263	118	69	37	13.3	16.5	15.1	19.1
D	108	103	45	0/99	80/170	0/0	216	106	59	35	13.3	16.4	15.5	22.5
E	23	21	45	0/85	0/0	0/0	236	107	51	30	11.7	14.8	13.7	18.0
11-1-3A	120	75	57	12/265	0/0	0/20	158	55	60	32	16.9	20.1	22.7	27.0
B	212	189												
C	170	165												
D	25	24												
11-1-5A	66	61	51	0/228	0/0	0/60	315	80	75	29	12.4	15.0	16.6	21.7
11-2-8A*	118	95	102	17/112	130/130	60/150	138	42	68	34	20.3	22.2	28.1	30.5
C*	20	7												
10-1-35C	18	0	Unit dropped by IDT.											
11-2-6A	65	0	Unit dropped by IDT.											
BT&BB R/W	16	16	Right-of-Way total for Belly Twister and Bent Beekman blocks.											
Other	650	0	Additional acres considered and dropped by IDT, Belly Twister and Bent Beekman blocks											
Sub-Total	1992	1019	Total acres considered by IDT for Belly Twister and Bent Beekman blocks.											

Note: 11-1-3A, B, C and D are all part of the same forest stand, divided into operational units by streams.

Note: 11-2-8A & C are both part of the same forest stand, divided into operational units by a stream.

* Note: 11-2-8A & C: 58 acres of 8A and all 7 acres of 8C comprise the regeneration alternative. Initially there were three units in 11-2-8, A, B and C. 8B was dropped from further consideration early in the planning process when it became part of the RTV habitat area and some reports and maps identify the remaining two units in section 8 as 8A and B instead of 8A and C.

T-R-S Unit	Initial Ac.[1]	EA Ac.[2]	Stand Age[3]	CWD LF/Ac.[4]	Snags/100 Ac.[5]		Trees/Ac		Curtis RD		Average Diameter			
				Hard / Soft	15-25" Hard / Soft	25"+ Hard / Soft	Now	After Thin	Now	After Thin	Now	20 Yr. No Thin	Immed. After Thin	20 Yr. After Thin
Sunday Morning Block														
11-1-15A	37	21	49	90/0	0/0	0/0	214	111	60	38	13.9	17.9	15.7	20.3
B	26	23	37	0/137	0/0	0/0	189	106	54	36	13.9	18.0	15.5	21.0
C	120	112	46	0/138	0/0	0/0	181	74	55	32	14.5	18.5	18.6	23.1
D	24	22	51	0/380	0/240	0/20	220	77	79	39	16.3	19.4	21.0	23.5
E	26	26	50	0/255	0/0	0/50	218	20-25	73	15	15.6	18.3	26.8	31.1
11-1-16A	51	46	54	23/154	0/60	0/30	229	98	63	35	13.7	17.5	16.3	20.7
11-1-17A	155	141	50	31/44	0/0	0/0	201[6]	157	60	35	14.3	17.2	15.0	17.8
B	12	11												
11-1-27A	54	45	77	49/226	0/120	0/80	149	52	62	35	18.0	22.4	25.0	29.4
B	23	23	70	0/58	0/0	0/0	130	75	55	38	18.1	21.1	20.5	24.3
C	12	0	Unit dropped by IDT											
D	16	0	Unit dropped by IDT											
SM R/W	11	11	Right-of-Way total for Sunday Morning block											
Other	537	0	Additional acres considered and dropped by IDT, Sunday Morning block											
Sub-Total	1104	481	Total acres considered by IDT for Sunday Morning block											
For the full Sunday Morning Belly Twister Project:														
Total	3,096	1,500	**Total Acres Considered** and **Total Acres Selected** for full analysis by the IDT.											

Notes for Table 13

1. Initial Acres – The approximate mapped area proposed to be examined by IDT.
2. EA Acres – The approximate area selected by the IDT to include in the proposed action.
3. Stand Age – As of January 2013, calculated as a weighted average of ages sampled in Stand Exams.
4. Coarse Woody Debris – Linear feet per acre of dead and down wood, minimum dimensions of 20 inches diameter large end X 20 feet long, from Stand Exam data. Displayed as Ft. Hard CWD / Ft. Soft CWD. Hard CWD in decay classes 1 and 2. Soft CWD is decay classes 3, 4 and 5.
5. Snags – "0+" is less than 1 snag per 100 acres. Number per acre of dead standing trees, minimum dimensions of 15 inches diameter (DBH) X 15 feet tall, from Stand Exam data. (Converted from "Snags/100 Acres" in the stand exam and Wildlife reports, rounded to 0.01, equivalent to 1 snag/100 acres.) "0+" indicates that snags were observed but either were not sampled or were found in densities lower than 1 snag/100 acres.
6. Metrics shown for all species. For conifers only: Trees/Ac. = 70; RD = 33; Dia. immediately after thin = 18.0 inches.

Threatened or Endangered (T/E), Special Status Plant Species (SSS) and Survey and Manage (S&M)

No T/E vascular plants or suitable habitat were found during field surveys and there are no known sites within the project area as determined by a known site data search.

Known sites for two species of concern were identified during a Known Site data search of the proposed project area and vicinity. Each species is listed as both Special Status and Survey & Manage.

- The fungus *Bridgeoporus nobilissimus* (BRNO) (Bureau Sensitive/S&M A) is known to exist in Section 5, 6 and 7, T11S, R2E, W.M. and is within areas identified as part of the proposed project. In 2013 a 100 percent survey of the BRNO population potentially impacted by the proposed SMBT project found only two live fruiting bodies, one of which is outside of any proposed treatment unit. In 2000 a 100 percent survey of 3314 acres of suitable BRNO habitat included the known BRNO population within the SMBT project vicinity. In 2007 a management plan to ensure the long term viability of the Snow Peak BRNO population was written, based on the results of those surveys. Research conducted on these BRNO populations shows that within a stand which is infected with BRNO approximately 20 percent of live noble fir and silver fir trees may be host to this fungus, although the fruiting body may be absent. As elements necessary to support the BRNO fungus are depleted from the host over the years, mortality of the fruiting bodies occurs naturally.
- The vascular plant *Corydalis aquae-geldae* (Bureau Sensitive/S&M C) is known to exist in Section 1, T11S, R1E, W.M. and Section 5, T11S, R2E, W.M. and is within areas identified as part of the proposed project.

No additional Special Status or Survey & Manage species were identified during field surveys and there are no additional Known Sites within the proposed harvest area or close proximity.

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*), bull thistle (*Cirsium vulagre*), St. John's wort (*Hypericum perforatum*), scotch broom (*Cytisus scoparius*) meadow knapweed (*Centaurea pratensis*) and false brome (*Brachypodium sylvaticum*). All of these species are Oregon Department of Agriculture list B species.

3.4.2 Environmental Effects

3.4.2.1 Proposed Action

Stand Structure and Development - Matrix (GFMA and CONN) LUA

Observed Characteristics and Direct Effects Immediately after Thinning:

Immediately following timber harvest the thinned stands would appear less crowded with space between the crowns of trees that allows light to reach lower limbs and the forest floor. The average diameter of the stand would be increased because most of the small merchantable trees would be removed from the stands. The stands would be more uniformly spaced and more

uniform in diameter and height than before treatment. Most of the smaller-than-average-diameter, diseased and low vigor trees would be removed from the stand though some deformed trees would still be present. Low density thinning areas would act as lightly shaded areas where forage species would grow. Some logging damage (see EA section 2.3.1.1 and Table 5, Project Design Features (PDF)) would be evident.

The following stand models illustrate one acre areas after harvest, showing anticipated height class and diameter class distributions of conifers, hardwoods, snags and down wood. Additional details are found in the Silvicultural Prescriptions. The following two figures show units which are fairly typical of the stand treatments proposed.

Figure 9: Unit 15 A After Harvest, Model

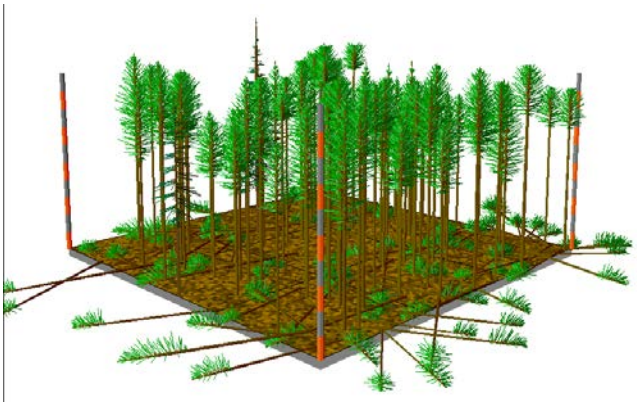
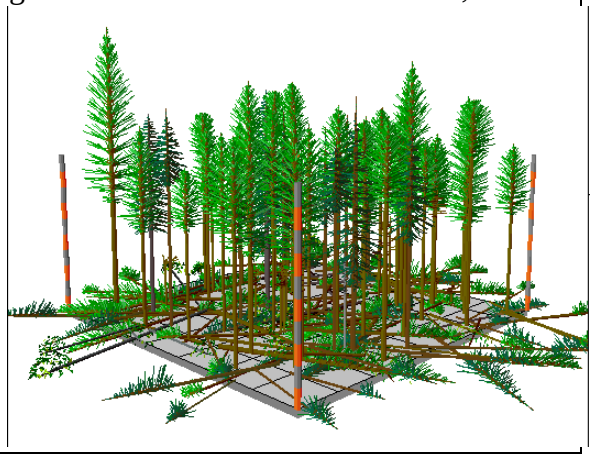


Figure 10: Unit 3A After Harvest, Model



Units 8A&C, 27A and 35B would all fall within the above descriptions, at the upper end of the diameter range for the project area stands with fewer, larger trees retained.

Unit 15E would retain fewer conifer trees at a wider spacing than described above. Site preparation would remove much of the slash and understory brush from the stand in the short term, which would allow the planted western redcedar to become established and grow.

The next two figures illustrate thinning in units 8A and 15E which are described separately.

Figure 11: Unit 8A, Proposed Action, Thinned, Model

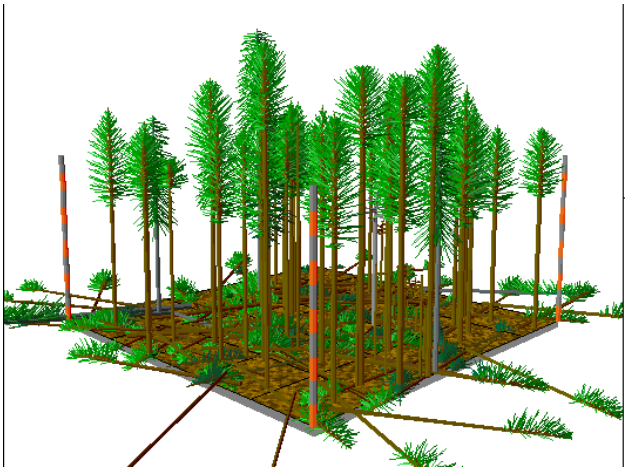
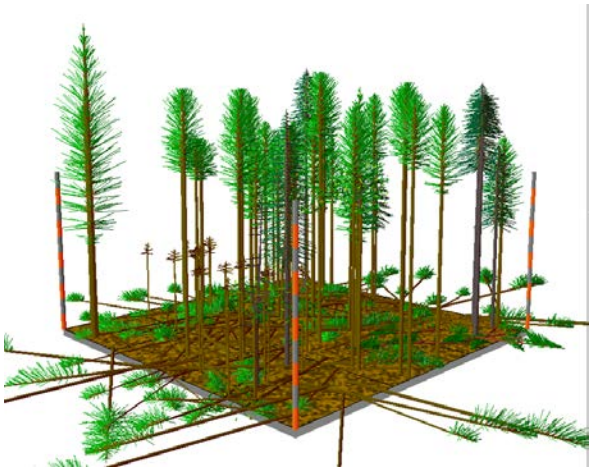


Figure 12: Unit 27A, Two-Storied Stand After Thinning, Model



Observed Characteristics and Trends in the Long Term:

Tree crowns in the forest canopy would grow to fill the spaces between trees until the site is fully occupied in approximately 20 years, resulting in an increased growth rate until crown closure, followed by a gradual reduction in growth rate if the stand is not treated (thinning, partial cut or regeneration harvest) at that time. Understory vegetation, both forage species and brush, would increase as light reaches the forest floor, then become less vigorous as the canopy closes and shade increases. During this cycle brush species and conifer regeneration would eventually out-compete forage species, especially in low density thinning areas. Established understory conifers would increase in vigor and growth rate and additional conifer seedlings would be expected to grow where logging operations exposed mineral soil to create a seedbed, then growth rates would slow as the canopy closes again. These trends develop because any forest site has the resources – nutrients, water and light – to support a given amount of growth which is distributed among either many small trees and other vegetation, or fewer large trees.[26] Some trees would be expected to develop decay, die, and/or fall because of logging damage, wind damage, insects, disease, suppression mortality of understory conifers, and/or lightning.

Brush and forage species would become established and grow in the small scale created openings of up to one acre within the interior of units where the wildlife biologists determine that there is insufficient high quality early seral habitat in the immediate area of those units. Since few (approximately 12 per acre) live trees would be retained in these openings, early-seral, shade-intolerant ground cover and brush species which are largely absent under closed canopies and in intensively managed forest stands would grow for two to several decades. In the gaps where western redcedar is planted, canopy layering would develop as the trees grow and shade-intolerant species would decline in vigor over the next several decades.

[26] Thinning trees in forest stands is the same concept as thinning carrots in a vegetable garden. Typically, many more seeds sprout than the garden can support and the crowded carrots would be small and unhealthy if the number of carrots is not reduced (density management or thinning). The first thinning may be done when the carrots are too small to be used in a salad (precommercial thinning). When some of the carrots are harvested during the growing season they may be large enough to use (commercial thinning) and the ones left in the ground will grow larger until harvested in the fall (regeneration harvest).

In unit 15E the overstory removal proposed for 20 years later would remove the larger trees which would otherwise have been sources for continued dwarf mistletoe infection, leaving an established stand of western redcedar with other conifers and hardwoods mixed in.

Figure 13: Unit 15E, Heavy Thinning, Mistletoe Control, Model

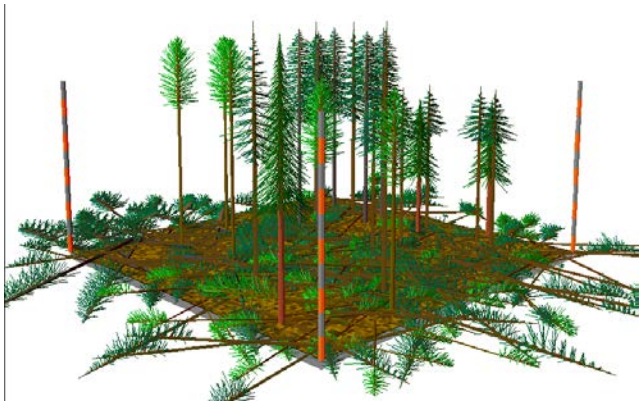
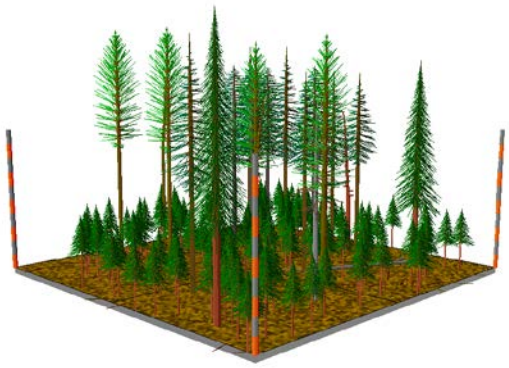


Figure 14: Unit 15E, After Thinning, Western Redcedar Understory Developing, Overstory Not Removed, Model



Indirect Effects:

The increased growth rate of the retained trees would result in these trees growing larger in diameter over the next twenty years than they would if the stand were not thinned (EA Table 9). Larger average diameters in a timber stand typically result in higher timber values, consistent with Matrix objectives (EA section 1.4.1). Larger diameter trees also provide source material for higher quality snags, CWD and legacy trees for future stand management. Larger crowns are correlated with increased vigor of individual trees and of forest stands and provide habitat for species which prefer large limbs and crowns. Increased vigor and density of understory brush and ground cover would provide forage, cover and habitat for a variety of species through its growth cycle, declining in vigor as the canopy closes in two to three decades.

Increased vigor of trees and vegetation within the stands and the increased complexity at a landscape level foster greater resistance and resiliency to disturbance events including wind, fire, disease and insects.

The small scale openings would provide elements of structural, species and spatial diversity (heterogeneity) for several decades. Due to the small scale of these openings, BLM expects that long-term sustained yield reductions would be negligible.

In units 8A&C, 27A and 35B understory development trends would be similar to the other stands, but would be expected to be more vigorous due to the wider spacing of overstory trees. The large limbs of the remnant trees in unit 27A (with the clearing) would continue to grow in both length and diameter, contributing to their “wolf tree” characteristics.

In unit 15E, the species composition of the stand would change from western hemlock dominated to being a grove of western redcedar over the next two to five decades. Western redcedar is not a host for dwarf mistletoe.

Figure 15: Nearby "Lost Lulay, Unit 10" Prior to Thinning	Figure 16: Nearby "Lost Lulay, Unit 10" After Thinning
	
Additional Comments on Figure 15: Typical dense stand with complete canopy closure, similar to those proposed for treatment. Note the lack of ground cover vegetation and understory. Sec. 25, T10S, R1E. K. Walton, 2009	Additional Comments on Figure 16: Typical stand resulting immediately after thinning treatment. Sec. 25, T10S, R1E. K. Walton 2013

Stand Structure and Development - Riparian Reserve

Observed Characteristics and Direct Effects Immediately after Thinning:

Immediately following timber harvest the thinned stands would be very similar to the adjacent Matrix stands. The stands would be more uniformly spaced and more uniform in diameter and height than before treatment, but would likely be more variable than in the adjacent Matrix because BLM would mark additional large and deformed, asymmetric trees for retention and CWD recruitment. Most of the smaller-than-average-diameter, diseased and low vigor trees would be removed from the stand though some deformed trees would still be present. Some logging damage would be evident. Some (up to 2 per acre each) additional snags (girdled trees) and CWD would be added to the stands by not removing some merchantable trees which would be damaged by equipment or felled to facilitate logging. (EA section 2.3.1.1 and Table 5, Project Design Features (PDF))

Observed Characteristics and Trends in the Long Term:

Tree and forest stand growth patterns would be similar to those described above for the adjacent Matrix stands. In addition, the following characteristics also occur in the Matrix stands, but are described here because they contribute to achieving stand structure objectives for this LUA. As the tree crowns grow into the open spaces, limbs would grow much larger diameter and longer because they live longer rather than dying and self-pruning while they are still relatively small diameter.

Understory trees retained or regenerated in the stands after logging would grow faster over the next 20 years or so than they would under a closed canopy, then some of them would die from suppression mortality after the crowns close again in approximately 20 years and become snags and down woody debris. Trees would continue to die, break, and/or fall due to disease, lightning, windthrow or snowbreak which would add to the numbers of decadent and asymmetric trees, snags and dead/down wood in the stands. Silvicultural treatments may also be done to create additional habitat features in the future.

Indirect Effects:

As described above for the adjacent Matrix stands, increased growth rates would result in fewer, but larger diameter, trees in the stands compared to unthinned stands. In addition to the effects described for the adjacent Matrix stands, the following effects which contribute to meeting the objectives of the RR LUA are described here:

Just as with the larger diameter of the overstory (dominant and co-dominant) trees, retained trees in the understory (intermediate and suppressed) would also grow larger in diameter due to increased sunlight penetrating through the canopy until the canopy closes and again suppresses those trees over the following several decades. Some of those would eventually die from suppression mortality in the next several decades and the resulting snags and down woody debris would persist longer as dead wood habitat and be valuable to more species than if they had died while they were small diameter trees.

The trees would develop deeper crowns which have more whorls of live limbs growing on a larger proportion of the total height of the trees because the limbs live longer. Deep crowns and large limbs provide microclimate and habitat features that are different from the shallow crowns and small diameter limbs found in an overstocked stand and provide habitat for species which prefer large limbs and crowns.

When large trees with large crowns die or fall over the next several decades, additional sunlight would reach the forest floor and stimulate growth in patches of the understory. Where a closed canopy remains intact, the understory would decline in vigor over the next several decades. These differences increase the structural complexity of the understory.

Threatened, Endangered, Special Status and Survey and Manage Plant Species

There would be no identifiable effects on 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 habitat for Special Status Species (SSS) or any known or undiscovered SSS populations from this project because the nature of thinning the forest would not change these habitats in a way that would preclude those species. Potential undiscovered populations include seasonal fungi species.

Live BRNO fruiting bodies would be adequately protected by minimum 50 feet radius untreated buffers as determined in the 2007 Management Plan for the Snow Peak BRNO population. BLM anticipates that thinning overstocked timber stands to promote growth of larger diameter true fir would help ensure the survival of this species in managed stands.

Invasive/Non-native Plant Species

BLM examined past timber harvest areas near to the proposed project area and found no evidence to indicate that adverse impacts from invasive/non-native species would occur as a result of the proposed project.

Cumulative Effects

No short term (1 decade) cumulative effects at the Crabtree Creek or Thomas Creek Watershed level would be expected with regard to forest cover because the proposed thinning would maintain a forested setting in the same age class as before thinning and would not change overall vegetation patterns in the watershed.

Long term (2 or more decades) cumulative effects are expected to begin accelerating development of currently underrepresented late-successional forest characteristics on 500 RR acres.

No cumulative effects to Threatened, Endangered (T/E) and Special Status Species (SSS) would be expected because no suitable habitat to support T/E species was identified within the proposed project boundaries and no SSS were found.

There would be no direct, indirect or cumulative effects to T/E species because no suitable habitat to support them was identified within or adjacent to the project area. Suitable habitat for SSS would remain in the proposed thinning area because thinning would modify but not remove such habitat, and habitat for SSS would remain undisturbed adjacent to the proposed thinning areas. The proposed project would not contribute to the need to list any SSS as Threatened or Endangered because no known populations would be affected and habitat would still be present in the project vicinity.

BLM does not anticipate that the project would contribute measurably to the cumulative effects of invasive/non-native species in Oregon because: project design features would generally prevent the spread of invasive species populations or introduction of new species in the project area; any populations that may establish would be short lived (<10 years) because native species are strong competitors and would revegetate the sites; and because projects similar to that of the proposed project had little to no difference in their invasive/non-native species population composition or numbers. (Botany Report)

3.4.2.2 Alternative Action – Regeneration Harvest of 65 Acres in Units 8A & C

Stand Structure and Development

In all areas except the 65 acres analyzed under this alternative for regeneration harvest the effects are identical to the Proposed Action because the proposed treatments are identical. Only the effects of the regeneration harvest on those 65 acres or forest stands bordering those units will be analyzed in this section.

Observed Characteristics and Direct Effects Immediately after Treatment:

Immediately after timber harvest and site preparation the stands would appear very open with an average of 10-12 green trees per acre both scattered and aggregated within the units, recently fire-killed snags, and pre-existing snags and coarse woody debris. Small diameter (less than 6 inches) logging slash and debris would be absent over most of the unit, though some areas would

retain varying amounts of slash due to variations in burning conditions. Most of the duff layer would be present because burning would be timed so that most of the moist duff would not burn and some mineral soil would be exposed by the combination of logging and fire.

Existing brush and ground-cover plant species would begin to sprout from existing stumps and root systems within weeks after site preparation and grow rapidly from the established root systems. Planted tree seedlings – approximately 435 per acre in a mixture of Douglas-fir, noble fir and western white pine – would begin to grow the first season after site preparation and planting. Both herbaceous and tree species would sprout from seed in exposed mineral soil and begin to grow.

Observed Characteristics and Trends in the Long Term:

Ongoing surveys would determine if additional planting, snag creation, CWD creation or other silvicultural practices would be implemented during the next two decades to meet management plan guidelines. Over the next several decades the new cohort of trees would grow toward the mid-seral stage, eventually shading out the understory unless silvicultural practices were used to alter the trends.

Many of the retained green trees would survive as legacy trees within the growing forest stand while others die and become snags or CWD. The surviving green trees would develop large crowns as limbs continue to grow instead of self-pruning under a closed canopy. Wind, lightning, insects, disease and silvicultural practices would be expected to turn more live conifers into snags and CWD during the next few decades.

Understory vegetation would increase in vigor for two or more decades, then decline in vigor as conifer crowns close together and increasingly shade the forest floor. Silvicultural practices may be used to alter these trends according to the management plan in place in the future.

Figure 17: Unit 8A Immediately After Harvest, Model

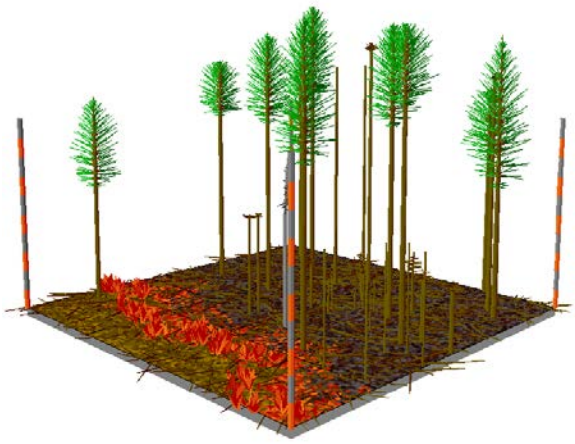


Figure 18: Unit 8A Five Decades After Harvest, Model

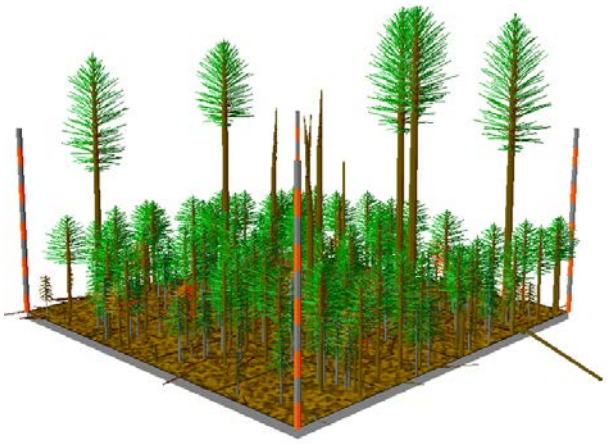
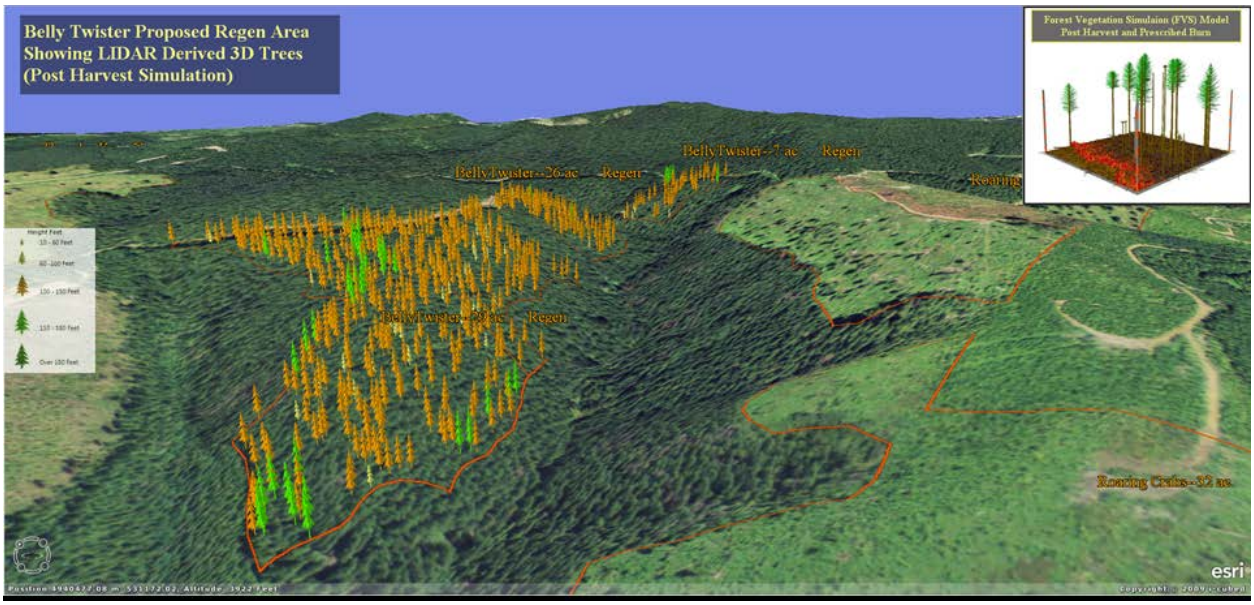


Figure 19: Projection of Unit 8A After Regeneration Harvest Based on Stand Modeling and LIDAR 3D Data



Indirect Effects:

Regeneration harvest at or near CMAI would maximize timber volume harvested in the long term in these stands. Reforestation with commercially valuable species of conifer seedlings would provide for future sustained yield timber harvest in these units and would establish conifer forest stands decades faster than would occur without planting conifer seedlings. Allowing brush and ground cover vegetation to grow along with the planted conifer seedlings would provide early seral forest structure that is more similar to natural successional development than the industrial practices which control brush and ground cover growth. Legacy trees, snags, CWD and large diameter trees as source material for future snags and CWD would persist in these stands for many decades.

The following photos show two regeneration harvest units completed on nearby BLM lands approximately 12-15 years ago, illustrating the green trees and snags retained and the conifer reproduction and understory vegetation growing now.

Figure 20: Roaring Crabs Regeneration Harvest Unit

Roaring Crabs regeneration harvest unit, approximately 12 after harvest and site preparation. Illustrates leave trees, snags, conifer regeneration, woody debris, brush and ground cover development. T. 11 S., R. 2 E., Sec. 5. K. Walton, 2013

Figure 21: Stretcher Regeneration Harvest Unit

Stretcher regeneration harvest unit, approximately 10 years after harvest and site preparation. Illustrates leave trees, snags, green tree retention clump, conifer regeneration, woody debris, brush and ground cover development. T. 10 S., R. 1 E., Sec. 25. K. Walton, 2013

3.4.2.3 No Action Alternative

Stand Structure and Development (all land use allocations)

In the short term these stands would remain overstocked and changes to their current condition would be slow. BLM has observed the following trends in similar overstocked stands which are not treated:

Height growth would continue at approximately the current rate while diameter growth continues to slow. Slower diameter growth develops stronger wood with a higher proportion of heartwood compared to faster growth, but it takes longer to develop source material (large diameter live trees) for recruiting the large-diameter dead wood (snags and CWD) that are especially valued as habitat (EA section 3.7, Wildlife). Heartwood is generally stronger and more decay resistant than sapwood, so a higher percentage of heartwood with smaller growth rings tends to result in suitability for some high-strength wood products and more durable dead wood which persists longer in the forest stand.

The limbs of closely spaced trees in an overstocked stand touch and interlock, blocking most of the sunlight from reaching anything below the dense canopy. Lower limbs of dominant and co-dominant trees, the entire crown of trees in the intermediate and suppressed positions, and understory vegetation in the stand would continue to be shaded. In addition to competing for light, all vegetation would compete for limited nutrients and water. Competition for site resources of light, water and nutrients leads to the following trends:

As lower limbs in the crown self-prune, crown size relative to the height of the tree (crown ratio) would continue to decrease. This leaves tall, clean boles with no limbs below a relatively small crown. Once the live crown ratios decline to less than 25 percent it becomes very unlikely that

individual trees will respond to a thinning designed to maximize tree growth and stand structural development.

As this trend continues trees begin to look like “Christmas trees on top of telephone poles”, which affect habitat characteristics. Since lower limbs are shaded by adjacent trees, very few crowns develop large diameter limbs which may reduce stand vigor and so reduce resilience and resistance to disease, insects, wind and fire. Clear boles with small knots contribute to higher lumber grades while small diameters contribute to higher logging and processing costs.

The smallest trees would die from lack of sufficient site resources, a process called “suppression mortality” which naturally thins the stand. Over time, suppression mortality limits or eliminates conifers from the understory positions in the stand. This natural thinning process creates relatively large numbers of small diameter snags from the smallest trees in the stand. Small diameter snags tend to be short-lived in the stand, falling to become short-lived, small diameter woody debris on the forest floor. Trees which die from suppression mortality are lost as potential commercial forest products.

Understory vegetation including conifer reproduction, brush and ground cover plants would decrease in abundance, size and species diversity without sufficient light reaching the forest floor.

The accumulation of small diameter dead and decaying wood on the forest floor increases fuel loads without green vegetation to hold moisture. This increases potential for fire spread and resistance to control in the stand (EA section 3.8, Fire).

Windthrow potential would increase because individual trees in overstocked stands develop weak root systems so that resistance to windthrow comes from the cumulative strength of many trees with interlocked crowns rather than individual trees having strong root systems and strength in the bole. When something changes from normal wind conditions (e.g. an exceptionally strong storm or an industrial timber style clearcut adjacent to the stand), windthrow can occur at scales from a few trees to several acres.

Trees would continue to grow with a slower rate of diameter increase compared to thinned stands, yielding larger numbers of smaller diameter stems with denser wood (higher ring count per inch) and a higher proportion of heartwood compared to thinned stands. In GFMA stands these trends affect sustained yield timber production because: The future logging costs per unit of wood volume would be higher for many small logs compared to the same board foot volume in fewer large logs. The market for wood with those characteristics would probably be different from the faster grown wood that results from thinning, but there are too many market variables to predict relative value. Suppression mortality would result in those trees never being harvested for wood products, reducing the total net yield and value of the stands over the full rotation.

In Riparian Reserve and LSR stands these trends are important because: The long term, indirect effects of stands developing from overstocked stands often delay or preclude characteristics associated with some late-successional and old-growth stands such as large diameter trees, snags and CWD; large crowns with large diameter limbs; healthy conifers in understory and intermediate canopy positions; and well developed understories of brush and ground cover species. Many of the desired characteristics would eventually develop without silvicultural management but these fully to overstocked conifer stands are overrepresented at the landscape level on BLM lands and “No Action” would miss the opportunity to increase the variety of stand

types across the landscape (diversity) which provides a wider variety of stand structures and habitat for a variety of species than large tracts of uniform stands provide.

The dominant trees in some existing old-growth forest stands have long (100 feet), clean boles, while others developed with large limbs much nearer the ground (less than 50 feet). It appears (BLM observations, personal communication) that the first type grew from dense stands that self-pruned and the large trees survived for centuries while many of the smaller trees died and allowed multiple stories to develop. The "No Action" alternative would trend toward extensive stands of relatively uniform and dense second growth forests developing along the first trajectory while bypassing the opportunity to introduce the second trajectory in the stands proposed for treatment under the action alternatives.

Tappenier et al. (1997) determined that the complex stand structure associated with some old-growth forest stands with large limbs lower on the bole apparently developed with low stocking levels (as low as 40-50 trees per acre) rather than from self-thinning of overstocked stands. Stands with this type of old-growth trajectory based on lower densities would be rare in the uniform stands in this watershed without management action.

Threatened/Endangered/Special Status/Special Attention/ Survey & Manage Plant Species and Invasive / Non-native Plant Species (including Noxious Weeds)

No changes to existing conditions and trends would be expected.

One of those trends is for BRNO fruiting bodies to die as they deplete the elements necessary to their survival from existing true fir stumps. If they are able to establish in small diameter trees, the small stumps decay relatively quickly to the point where they cannot support live BRNO fruiting bodies.

3.5 Hydrology

Sources Incorporated by Reference: Hawe, 2013, Hydrology/Channels/Water Quality: Specialist Report for the Proposed Sunday Morning Belly Twister Project, etc. (Hydrology Report); Fisheries Report.

3.5.1 Affected Environment

Project Area Precipitation and Basin Hydrology

The project area is located in the Oregon Western Cascades range at elevations between 1,000-3,500 feet[27]. About one-half of the project units are in the transient snow zone (TSZ), an elevation 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. About half of the proposed treatment units are below this elevation in the rain zone. The project area receives approximately 60-120 inches of rain annually and has a mean 2-year precipitation event of 4.4 inches in a 24-hour period (estimated at: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm).

The project is in the Middle Crabtree Creek, Beaver Creek and Neal Creek sixth field watersheds with approximately 67,587 combined acres (106 miles^2) in drainage area. All are tributary to the

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

fourth field South Santiam River (HUC #17090006). The South Santiam is the municipal water source for the City of Jefferson and thus the project lies within the municipal watershed.

Project vicinity stream channels (ACS Objective 3)

The project area is situated in the Western Cascades physical province and streams reflect the geologic origin of the area (Benda et al. 2005). Most of the terrain around the treatment units is composed of undifferentiated tuffaceous sedimentary rocks; tuffs; and basalt.

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 Crabtree Creek, Roaring River and Neal Creek (tributary to Thomas Creek).

The Cascades Resource Area Hydrologist determined that all channel reaches he observed in the project vicinity were in "proper functioning condition" (PFC) (USDI, 1998) 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 streambanks and maintain channel characteristics. [28]

Intermittent channels

The small headwater tributary channels formed in the deep soils of the benches and ridges in the project vicinity flow intermittently on the surface before disappearing underground, returning to surface flow again down-slope. It's likely that ground water and subsurface flow, as opposed to surface run-off, is the primary system of water delivery to these channels. Most are moderate gradient (4-10 percent) with small substrates (sands and small gravels) reflecting the adjacent soils. Utilizing the Montgomery-Buffington typology (Montgomery & Buffington, 1997), these channels would be classified as colluvial: "small, headwater streams at the tips of a channel network that flow over a colluvial valley fill and exhibit weak or ephemeral fluvial transport." Most of the intermittent streams adjacent to project units have too low of a gradient to be subject to debris torrents or landsliding.

[28] 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 (i.e., placing additional wood structure, repairing infrastructure, thinning adjacent forest, etc.).

Figure 22: Intermittent headwater tributary in Section 15

Hawe, 2013

Figure 23: Perennial channel in the project area tributary to Church Creek

Hawe, 2013

Perennial channels

The small headwater tributaries adjacent to the proposed treatment units eventually reach larger perennial channels that flow to the main Crabtree Creek channel. These larger 3rd order streams have entrenched into the relatively resistant bedrock forming constrained valleys with moderately steep adjacent slopes (average 50-60 percent). There is a low to moderate supply of gravel and cobble sized material actively transported in these Rosgen "B3" channel types. Utilizing the Montgomery-Buffington typology, these perennial streams would be classified as step-pool channels: "Step-pool morphology generally is associated with steep gradients, small width to depth ratios, and pronounced confinement by valley walls."

Some of these channels are shaded by dense stands of second growth conifer; others are dominated by hardwoods with an understory of salmon berry and shrubs, such as the channel in Figure 23 above. Wood and shade are in abundant supply, banks are stable and channel morphology is controlled by bedrock features with a cobble-boulder bed. These channel types are highly resilient and unlikely to be altered significantly by disturbance.

Existing roads and stream channels

In most locations culvert dimensions (shape, area and slope) are adequate to allow for the transport of most or all of the water, sediment and organic materials from upstream. In this case, the stream is said to be "at grade" and channel morphology upstream of the road fill is not affected.

In some cases (see EA section 2.3.1.1, Proposed Action - Connected Actions) undersized culverts and/or collapsed road beds have restricted the passage of water, sediment and organic materials from upstream resulting in the deposition of sediment above the crossing and the stream is said to be "aggraded". The length of aggraded channel upstream of culverts is generally restricted to less than 100 feet in the small streams in the project area and varies with channel slope and the supply of material and water.

There are several perched culverts throughout the project area where culvert outflows erode the channel bed. Perched culverts may restrict upstream passage for aquatic organisms.

Figure 24: Outfall of a perched culvert, road 11-1E-15.

P. Hawe, 2013

Figure 25: Small forested wetland in the project vicinity.

P. Hawe, 2013

Project area wetlands

One wetland is identified on the National Wetlands Inventory map in the SE¼ of section 16. Other wet areas are identified in BLM GIS themes. BLM personnel examined these sites and others which were not previously mapped and corrected our data to reflect field surveys. All identified wetlands and areas with high water tables ("wet areas") have been excluded from treatment areas.

Project Area Hydrology (ACS Objective 6)

Stream flow

The gage hydrograph from the USGS gaging station (#14188610) on Schafer Creek which is tributary to Crabtree Creek in Section 8 shows stream-flow typical of smaller Western Cascades streams where most runoff occurs during winter storm events. Peak flows occur following a rapid and substantial depletion of the snow-pack during prolonged rain-on-snow periods (ROS) in the transient snow zone (TSZ) estimated to lie between 1,500 feet and 3,000 feet elevation, such as in February 1996 when the Shafer Creek gage recorded over 400 cubic feet/second (cfs), estimated to be at or above a 100 year flood return interval event. Smaller peaks occur in Schaffer Creek in late April and May during spring snowpack melt-off.

Base-flow or low-flow occurs during late summer and early fall when mean stream discharge drops below one cfs. Many small headwater channels (referred to as "intermittent" in this analysis) dry up completely during this period.

During field review of project channels BLM Hydrologist did not note any evidence that would indicate channel adjustments to increased peak flows such as channel incision or bank erosion. The steep bedrock channels in the project area are highly resistant and channel morphology in these settings generally does not adjust in response to flow increases that could result from ROS events (Grant *et. al.*, 2008).

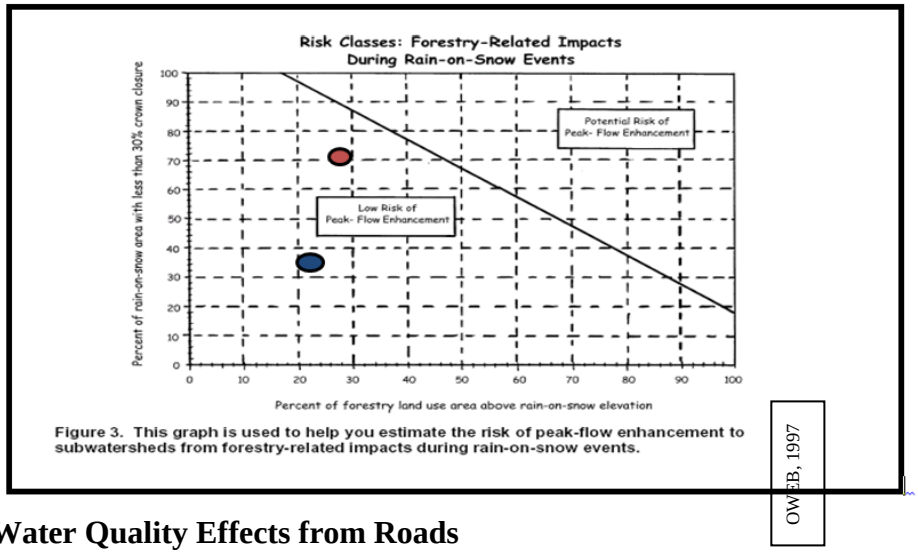
Potential for peak flow augmentation due to current conditions of forest harvest

Middle Crabtree Creek (MCC) and Neal Creek (NC) 6th field watersheds currently have a low risk for peak-flow enhancement due to forest openings in the project area (OWEB, 1997). (Beaver Creek was not evaluated because it is almost completely below the ROS elevation of 1,500 – 3,000 feet). This low risk is primarily because these watersheds are largely outside the elevation zones for ROS events – 28 and 34 percent respectively for MCC and NC watersheds – and the risk of peak flow enhancement varies with the proportion of the watershed which is both in the ROS area and has crown closure of less than 30 percent. Seventy percent of MCC and 21 percent of NC ROS areas have been recently harvested and have crown closure of less than 30 percent, based on BLM GIS data, analysis of 2012 satellite imagery, and field reconnaissance by BLM personnel. Table 14 and Figure 26 show the areas and percentages used and how the resulting analysis places both watersheds well into the "low risk of potential peak flow enhancement" area in the graph used to determine risk classes for forestry-related impacts.

Table 14: Risk of Peak Flow Enhancement by Sixth Field Watershed in Sunday Morning Belly Twister

6th Field Subwatershed Name	*Watershed Area (acres)*	*Percent of Watershed in ROS Areas*	*Percent of ROS area with <30% Current Crown Closure*	*Peak-Flow Enhancement Risk*
Neal Creek –6th	17,236	34% (5,831 acres)	21% (1,237/5,831 acres)	Low
Middle Crabtree Creek –6th	25,149	28% (7,013 acres)	70% (4,924/7,013 acres)	Low

Figure 26: Graph for Determining Risk of Peak Flow Augmentation



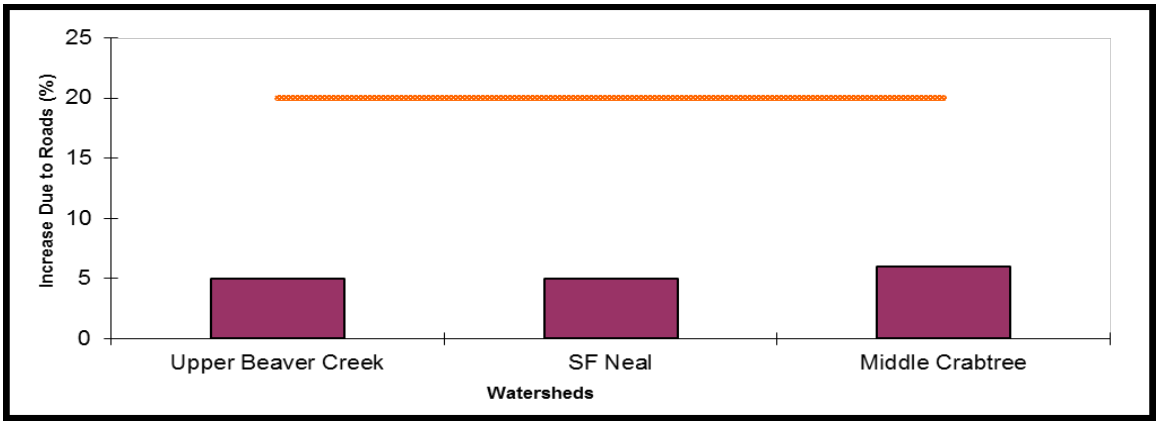
Peak Flow/Water Quality Effects from Roads

Watersheds in the project vicinity are currently at low risk for augmentation of peak flows due to the road network because the watersheds analyzed would have only a 5-6 percent increase in stream length due to stream/road intersections. Toman (2004) and Wemple et al. (2003, "the Wemple study") identified roads as potential contributors to increased peak flows in the western Cascades, acting as an extension of the stream network when ditches intercept water and route it

directly to streams. The Wemple study indicates that stream drainage increases of approximately 20 percent or greater (indicated by the line in Figure 27) have the capacity to alter the timing and quantity of peak flows.

As a surrogate for risk, the increase in drainage density due to road/stream intersections was calculated for the two seventh field watersheds (Upper Beaver and South Fork Neal) and one sixth field watershed (Middle Crabtree Cr) in the project area. Calculations used 200 feet of increased stream length for each road/stream intersection since cross-drain culverts and road design would divert water flowing in ditches and on road surfaces to stable, vegetated slopes so that only short segments of the ditch would drain water to streams and increase the stream network.

Figure 27: Estimated Stream Channel Network Expansion at Road-Stream Intersections for Project Watersheds



BLM engineering, hydrology and fisheries biology specialists examined road surfaces in the project vicinity and determined that most of them are well maintained and in good condition with little potential to contribute fine sediment to area streams. The design of these roads (both rocked and natural surface) prevents direct drainage to streams by routing run-off to stable, vegetated slopes where it infiltrates. Road surface materials such as rock are used to prevent sediment generation in places where fine sediment could be routed to streams. Traffic on wet roads may "pump" fine sediment to the road surfaces where it can be transported by runoff. Some road segments in the Church Creek area, primarily in the south half of section 15, T. 11 S., R. 1 E. currently have the potential to route fine sediment directly into streams and raise turbidity levels.

Project Area Ground Water

The Oregon Department of Environmental Quality (ODEQ) has not identified any groundwater pollution problems within project watersheds. The Oregon Water Resources Department (OWRD), together with ODEQ is responsible for the regulation and protection of ground water quality and quantity in Oregon.

Factors affecting the quantity, quality, location and flow of groundwater and the interactions between surface flow and subsurface flow are understood only in a general sense. While the endless variability of topography (land form), soil type and condition, lithography (rock formations), weather patterns and vegetation cannot be reliably quantified, BLM Hydrologist describes some of the factors that contribute to current groundwater conditions.

These soils have infiltration rates between 0.25 – 2 inches/hour. Under natural conditions, most precipitation either drains through the soil profile or is transpired by vegetation rather than becoming surface runoff.

Areas of existing compaction from previous logging does not have an identifiable effect on overall infiltration or groundwater in the project vicinity because these compacted areas are generally scattered and at different stages of recovery so runoff infiltrates vegetated soil within a few feet of where rain falls on compacted soils.

Forest roads and landings can intersect groundwater and reroute it through ditches to surface streams, which can alter subsurface flow and may result in a proportionate reduction in water available for ground water storage. When cross-drains route the water from ditches back to stable, vegetated slopes it infiltrates back into the soil within a short distance. Forest roads have been continuously present in the project vicinity for several decades.

Local lithology also dictates the quality of groundwater and, by extension, sets the base conditions for the quality of surface water. Ground water in western Cascades volcanic material is typically low in dissolved salts and nutrients with a slightly acidic pH. Temperature is a function of the soil and subsurface temperatures which vary only slightly throughout the year, hovering between 5-10 degrees Celsius.

Water Quality and Beneficial Uses

Oregon Department of Environmental Quality (ODEQ)

The State of Oregon designates the beneficial uses for which all waters of the state are utilized. Water quality standards are ultimately meant to protect beneficial uses of water in the state, as designated by the State of Oregon, http://www.deq.state.or.us/wq/standards/uses.htm.

Designated Beneficial Uses and Water Rights

Identified site specific beneficial uses of surface water from the project area are displayed in Table15.

Table 15: Beneficial Uses Associated with Streams in the Project Area

Stream (Watershed) Project Action	*Beneficial Use*	*Information Source*
Crabtree Creek, Roaring River and Neal Creek (South Santiam) Timber harvest: density management, road construction and reconstruction, log hauling.	Salmon rearing and spawning	Fisheries Report. Downstream from project area.
	Resident fish & aquatic life	Fisheries Report. Adjacent to some project units on perennial streams and some tributaries.
	Irrigation & Domestic Drinking Water	WRIS.Downstream from most units.
	Municipal Drinking Water	Source Water Assessment. Intake in South Santiam:

Source: WRIS = Water Rights Information System of the Oregon Department of Water Resource: http://www.wrd.state.or.us/OWRD/WR/index.shtml

Both resident and anadromous fish are downstream from some of the proposed units (see EA section 3.6, Fisheries). Additional beneficial uses include: industrial water supply, wildlife and hunting, fishing, boating, anadromous fish passage, water contact recreation, aesthetic quality.

Designated beneficial uses for the Willamette may be viewed on-line at: *http://www.deq.state.or.us/wq/standards/uses.htm*.

Municipal Water Providers and Source Water Assessments

The City of Jefferson withdraws water from the Santiam River to treat and provide city residents with drinking water. A *Source Water Assessment* for the water provider is available on-line at: http://www.deq.state.or.us/wq/dwp/docs/swasummary/pws00408.pdf. The source water 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. In addition to withdrawals for municipal water consumption, there are withdrawals downstream of the project area for domestic use, irrigation and livestock watering. Maps are available online at: http://www.wrd.state.or.us/OWRD/WR/index.shtml.

Water Quality

The ODEQ's 2010 Integrated Report on surface water quality is a database compilation of streams (http://www.deq.state.or.us/wq/assessment/2010Report.htm) which do not meet the state of Oregon's water quality standards. The water quality parameters with the potential to be affected by forest harvest and road construction and maintenance include stream temperature, dissolved oxygen (DO) concentrations (both inter-gravel and in water), and turbidity. Additional water quality parameters (e.g., nutrients, pesticide and herbicide residues, bacteria, etc.) are not highly sensitive to forest harvest and road construction (U.S.E.P.A., 1991) and were not reviewed for this analysis.

Stream Temperature

Roaring River, Crabtree Creek, and Neal Creek are all listed as not meeting State of Oregon water quality standards for summer stream temperatures (http://www.deq.state.or.us/wq/assessment/2010Report.htm). The ODEQ has developed a Total Maximum Daily Load (TMDL) for the Willamette basin. The South Santiam Water Quality Restoration Plan (WQRP) details how BLM will implement the TMDL on federal lands (U.S.D.I. BLM, 2007). BLM has agreed to 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.

Based on stream temperature data collected in 2000 and the high levels of shade along project reaches, its likely stream temperature in the project area on BLM lands already meets state standards.

Salem District BLM collected summer stream temperatures at three locations in the project area watersheds: Neal Creek main-stem, South Neal Creek headwaters and on an unnamed headwater tributary to Roaring River. The Neal Creek main-stem (T. 10 S., R. 1 E., section 23) data indicated that 7-day maximums remained below the state threshold throughout the summer of 2000. Similarly, the South Fork Neal Creek (T. 10 S., R. 1 E., section 27) and the Roaring River tributary (T. 11 S., R. 1 E., section 5) data indicated that 7-day maximums remained below the state threshold throughout the summer of 2000.

Field surveys, review of aerial photographs and LIDAR data indicate that shading is near to full potential along most of the small streams on public lands in and adjacent to the project area with canopy closure exceeding 80 percent along most reaches.

The average temperature in Crabtree Creek where it flows through BLM land (above river mile (RM) 32.7) adjacent to the project area is currently within state water quality standards for temperature (≤16.0 degrees Celsius (C)) and does not exceed critical levels for salmon and trout spawning and rearing. (South Santiam Water Quality Restoration Plan (WQRP), USDI BLM, 2007, pp. 30-35, citing Shafer Creek as the reference standard.)

Dissolved Oxygen, pH, and Conductivity

No data for these variables in the immediate project area was located for this assessment. Considering the cool stream temperatures in the project area, together with full forest cover, it is likely that DO and pH levels are within the range of natural variation and meet state standards.

Sediment Supply, Transport and Turbidity

Mass wasting

The project vicinity was field reviewed for mass wasting potential and no unusual or highly unstable areas were found and there are no mapped landslide features in the project vicinity. Mass wasting is the primary process responsible for the bulk of sediment production and transport in mountainous terrain. Sediment transport in headwater basins is dominated by highly episodic, large erosion events so short term approaches to understanding, measuring, studying and quantifying sediment transport and yield are likely to miss the most important events.

Surface erosion, stream bank and channel erosion

Soil surface run-off or overland flow (water moving over the surface with the energy to erode soil) is rarely observed on forest slopes (Leopold, 1997). Due to the high infiltration capacity of local soils, heavy vegetative growth and deep layers of surface organic material (i.e., soil duff-layer), surface erosion on undisturbed forested land in the project vicinity is rare.

Unusual levels of stream bank and channel erosion were not observed in field surveys of streams in the project vicinity. Historically, channel roughness throughout forested regions in Western Oregon was quite high due to large quantities of wood in channels and the activities of beaver. Streams in the project area appeared to currently have moderate levels of wood in place with well vegetated banks which provide bank and channel roughness which provide stability and resistance to erosion.

Stream power increases with higher peak flows and with narrowing or increasing the gradient of a channel, such as may occur when a culvert is installed, which could increase the rates of bank and/or channel erosion. Indicators of increased stream flow (relative to historic ranges) in project area streams were not noted during field surveys. Channel adjustments at culverts were within the range expected for these channel types.

Turbidity and Sediment

During winter field reviews of area streams water clarity appeared cloudy and moderate turbidity levels were noted. “Milky” or cloudy water clarity appears to be endemic to local streams and it is likely this is a “natural” condition in these channels due to the high silt-clay content of local soils. No site specific data for stream turbidity in the project area was located for this assessment.

3.5.2 Environmental Effects

3.5.2.1 Proposed Action

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 from timber harvest or logging operations. Stream banks, channel beds and wetlands are protected from direct physical alteration or disturbance by harvesting equipment with stream protection zones (SPZ) where no harvest or logging equipment operations would be done.

The proposed action is unlikely to affect stream flow (see the following discussion under watershed hydrology) 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.

There would be no new locations where stream channels or wetlands are impacted by roads since no new road construction would cross them. Replacement of failing log fill stream crossings and failing, undersized and perched culverts would provide improved stream flow and passage of sediment, organic materials and aquatic organisms and will eliminate the chronic erosion and turbidity at these sites. Some slight channel adjustment to grade or width may occur within the first year (varies with the timing and magnitude of storm events) following disturbance as the channel reaches equilibrium with flow and sediment transport. Based on previous experience with these type of channel crossings, BLM's hydrologist has determined that long term effects to channel function or morphology from disturbance at these sites would be unlikely because the channels are resilient (i.e., they resist change) and would adjust to accommodate the disturbance without creating bed or bank instability. Channel morphology adjustments would be unlikely to extend more than 100 feet upstream or downstream from the site of disturbance.

Redesigning and improving 0.3 mile of the Church Creek Spur road in section 15 would ultimately improve channel processes in the vicinity of this road by removing impediments to wood and sediment transport in the stream network.

Cumulative Effects - Channel and Wetland Morphology/Physical Integrity

BLM specialists have determined, based on field examinations, experience with similar projects and published research cited earlier in this section of the EA, that channel adjustments would be limited to the area within 100 feet upstream to 100 feet downstream of the disturbance sites for log fill/culvert replacements and decommissioning/improving the Church Creek Spur Road. Channel adjustments at the site of disturbance, if they occur at all, would be of relatively low magnitude and limited to within one year after disturbance. This would not result in alterations to channels or floodplains downstream or elsewhere in the watershed.

In all other locations, the proposed action would not result in any direct effects to channel or wetland morphology and therefore would have no cumulative effect.

Since channels in the project area already have properly functioning dimensions and form and the project would not alter channels or floodplains except for the limited magnitude and time described, there is no cumulative effect to contribute to.

Project Area Hydrology (ACS Objective 6)

Mean Annual Water Yield

The proposed action would likely result in some incremental increase in annual water yield correlated to the partial removal of the conifer over-story (Troendle et al., 2006). However, 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

The potential increase in mean annual water yield may result in a slight increase in base flow (summer low flow). (MacDonald, 1991) Any increase would be undetectable because it would be smaller than errors in flow measurements.

The project would not likely affect water yield due to changes in 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 and no studies have documented reductions in fog drip with forest stand thinning.

Peak Flow

The increase in snow accumulation and melt-off during ROS events would remain below a level likely to result in measureable increases in peak flows because the proposed action would not increase openings (areas with <30 percent canopy closure) within the TSZ in project watersheds according to the State of Oregon risk assessment methodology (OWEB, 1997).

Peak Flow Effects from Roads

The proposed road construction has a low risk of altering watershed hydrology or peak flows because intercepted water does not reach stream channels any faster than precipitation which falls on the forest floor because:

- The 8.6 mile of new road construction is located on slopes generally under 30 percent and would not require full bench or cut and fill construction. Roads constructed on these surfaces result in little or no sub-surface disturbance. These roads 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 quickly infiltrates into the ground.
- Compacted skid trails and landings from logging operations would have a similar lack of effect because intercepted rainfall would also be drained to the adjacent undisturbed forest floor where it quickly infiltrates.

Groundwater

The proposed action has little capacity to affect groundwater patterns because they are intimately linked to peak and base flows at the surface, which are unlikely to be affected by the project.

Watershed Hydrology: Cumulative Effects

The proposed project carries no risk for contributing to any existing cumulative effects to watershed hydrology because the watersheds are currently at a low risk for impacts and there would not be any detectable direct or indirect effects to the watershed's surface flows or ground water. 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.

The project would not result in any detectable change in stream temperature, would maintain stream temperatures in their current range and would protect beneficial uses. The streams are all currently well shaded and the project would maintain that shade by maintaining SPZ that do not remove any vegetation from the primary shade zones and by retaining minimum 50 percent canopy cover (>85 percent canopy closure) in the secondary shade zones so there would be no increase in sunlight on the water to warm the water. The project meets or exceeds the requirements *Northwest Forest Plan Temperature TMDL Implementation Strategies* (USFS and BLM, 2004) designed to protect summer stream temperatures by maintaining shade. Wilkerson, et al. (2005) and Groom, et al. (2011) found that similar or less (maintaining 25 percent density to within 25 feet of streams) shade retention resulted in no detectable changes in stream temperature.

Summer Stream Temperature Maximums in Intermittent Streams

The project would be unlikely to result in any measurable alteration of temperature regime in intermittent streams in the project area because water does not flow on the surface during most summers so water is not exposed to direct solar radiation. Water temperature is influenced directly by soil temperature, which is primarily a function of elevation, aspect and soil type. These streams are further protected by SPZ, which maintains shade, even though reducing stand density near the streams would be unlikely to result in increased water temperature.

Dissolved Oxygen (DO), pH and Conductivity

It is unlikely that this proposal would have any measurable effect on DO levels in project area streams because it would not increase temperature, sedimentation or fine organic material, or reduce re-aeration which are the factors that reduce DO in small forested streams (Hall and Lantz, 1969).

Available data indicates that most forest management activities have little effect on pH or conductivity (USEPA, 1991).

Turbidity

It is unlikely that the proposed action would result in a discernible effect to the levels of turbidity or water clarity in project watersheds or that turbidity levels would reach levels that would impact aquatic organisms or cause additional treatment expense or technical difficulties for the downstream water providers. Sediment transport normally increases during large storm events thus increasing turbidity and reducing the clarity of the water so turbidity increases attributable

to the proposed action would be unlikely to be discernible by the average observer. As stream flows recede sediment would deposit and turbidity would return to background levels at low flow. Road construction/maintenance and hauling are the primary potential sources of fine sediment delivery to streams and are specifically addressed below.

Over time, deposition at some locations could block the culvert and lead to failure of the culvert and fill if not kept open through maintenance to remove material deposited at the culvert entrance. Culvert failure would introduce high levels of sediment but may not be visible because it would be most likely to happen during large storm events with high flows and high turbidity from other sources.

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.

Road maintenance and improvement, including culvert replacement, would not likely exceed the standards for increased turbidity (visible reduction in water clarity) set by the State of Oregon, which would maintain water quality standards and protect beneficial uses in streams in the project vicinity. Water quality standards would be met because:

- Culvert replacement would be done during the driest part of the year in the in-stream work period identified for each watershed. A turbidity plume downstream from the disturbance site may be visible during the actual replacement which would be unlikely to exceed ODEQ water quality standards beyond the mixing zone of approximately 100 meters downstream (Foltz and Yanosek, 2005). Replacement of each culvert would probably be completed during one work day, so any increase in turbidity would be unlikely to exceed eight hours and would likely decrease by an order of magnitude within two hours after disturbance ceases. Culvert replacement is the road maintenance activity which has the highest degree of identified impact.
- There may be increased turbidity relative to background or upstream water clarity during the first winter following the project if storm events wash some of the fines off surfaces disturbed by road maintenance actions and deliver them to the stream. Any increased turbidity would be unlikely to be visible or detectable beyond 800 meters below the site of the disturbance (Foltz and Yanosek, 2005) and would not likely exceed ODEQ standards.
- To further reduce potential increases in turbidity, BLM staff would visually monitor turbidity as required by the State of Oregon during in-channel work at these sites. If Oregon State Standards were exceeded at anytime, BLM would stop all in-stream activities and require the contractor to take appropriate steps to reduce turbidity to acceptable levels.

Hauling

Any increases in turbidity attributable to hauling would be unlikely to exceed ODEQ water quality standards (>10 percent increase relative to background levels) and would therefore protect beneficial uses. 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) because:

- BLM would contractually require the operator to prevent road-generated fine sediment run-off from reaching streams in amounts which would exceed ODEQ water quality standards. Commonly used methods include: grading to improve drainage, adding rock, creating sediment traps and timing haul to avoid generating sediment.
- BLM personnel would visually monitor the road network and turbidity levels at road/stream intersections during wet season/wet weather hauling. If water clarity is visibly altered below the mixing zone it will be assumed that it is approaching limits set by the Oregon DEQ and BLM would require the operator to immediately implement measures to reduce fine sediment run-off into the stream and/or suspend hauling.

Cumulative Effects to Water Quality

The proposed action has little potential for contributing to any cumulative effects to stream temperatures, pH, or dissolved oxygen in these watersheds because it is unlikely to have any measurable direct or indirect effect on these water quality attributes. Current conditions and trends in water quality would likely be maintained under the Proposed Action.

Turbidity increases from the proposed action would be non-detectable on the scale of the sixth field watershed and would be unlikely to contribute cumulatively to turbidity levels in the watershed. Potential direct effects in the short term (during the action and the first winter following) include increased turbidity levels directly below road/stream intersections which would be maintained below the limits required by Oregon DEQ. Cumulatively, because of the limited extent (not visible more than 800 meters downstream of crossings), magnitude (<10 percent of upstream turbidity levels) and duration (primarily during heavy rainfall events in the first winter following road maintenance), turbidity would be within Oregon DEQ water quality standards.

Sediment Regime (ACS Objectives 5)

Forest Management Practices

Forest management practices which could potentially accelerate erosion and sediment supply to streams include: road construction/maintenance, hauling, harvest operations including falling and yarding, and prescribed burning for site preparation. Sediment supply from these sources has been discussed previously in the Hydrology section of this EA. The following discussion is limited to the anticipated effects on the sediment regime.

Harvest operations under the proposed action would not increase bank erosion or channel cutting by altering channel roughness, redirecting flows or altering bank-stabilizing vegetation because SPZs would eliminate most or all disturbance of stream-side vegetation. Potential increases in stream energy due to alterations of peak flows is low, as was discussed previously.

No sediment would be introduced directly into streams, wetlands or ponds by harvest operations because no trees would be felled into or yarded through SPZs.

Increases in sediment delivery to streams due to mass wasting induced by loss of root strength and increases in soil pore pressure are unlikely because areas with potential for slope instability and mass wasting were identified and verified by BLM personnel and excluded from the project area.

- Harvest operations would not increase sediment supply to streams because:

- SPZs on all streams would act to protect banks and filter overland flow or sediment. The effectiveness of SPZ for protecting water quality in forestry operations has been demonstrated in research studies around the world (Norris, 1993).
- Water would normally infiltrate rather than run off and erode soil because forest cover would be retained with at least 50 percent canopy closure in Riparian Reserves in addition to the undisturbed vegetation in SPZ.
- BLM field reviews of skyline yarded units during intense rainstorm events from 2007-2012 found no evidence of overland flow or sediment transport where erosion models had predicted sediment transport under similar conditions (Hawe, 2012).
- Skid trails are too distant from stream channels and other water bodies, and on too gentle of slopes (<35 percent) to deliver sediment to these water bodies.
- BLM personnel monitor harvest operations and would require operators to implement sufficient measures to reduce potential sediment transport to below detectable levels.

Fuel Treatment Operations

Pile burning would be unlikely to have any influence over water quality, stream channels or watershed hydrology and any effects to soils and hydrology would be short term and limited to the immediate site because the piles to be burned would be located outside of SPZs so there is no delivery mechanism by which ash or soil from the pile locations could reach stream channels. Other fuel treatment methods (e.g. lop and scatter, mastication) do not create ash or erosion, so none could be introduced into streams.

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.

3.5.2.2 Alternative Action – Regeneration Harvest of 65 Acres

This analysis focuses only on the effects which could differ between the proposed and alternative actions. The two units (8A&C) proposed for regeneration harvest under the alternative action are only 65 acres total and are contained within a single seventh field watershed. BLM elected to analyze the alternative action on these two units in the context of the smaller watershed because it frames the discussion of potential effects more clearly than the larger sixth field watersheds used to analyze the 1,500 acres of the full project.

Direct and Cumulative Effects to Peak Flows

The Rock Creek 7th field watershed is currently below the threshold for peak flow augmentation and it is unlikely that either the direct or cumulative effects of 65 acres of regeneration harvest proposed in the alternative action combined with anticipated harvest on private industrial lands in the watershed would exceed that threshold in the foreseeable future.

Unit 8A&C drain to the Rock Creek watershed, a 3,767 acre 7th field watershed in the Roaring River 6th field (Crabtree Creek 5th field, South Santiam River 4th field). It drains the slopes on the south and southwest flanks of Snow Peak from 2,000 - 4,000 feet elevation. Average annual precipitation in the headwaters is 120 inches, falling to 60 inches at the mouth of the watershed.

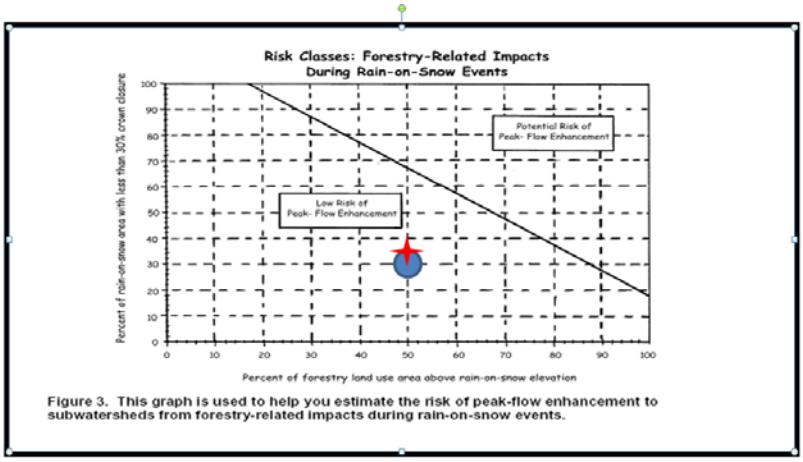
Assuming a 1,500 – 3,000 feet rain-on-snow elevation band (ROS), 1,895 acres of the watershed are in the transient snow zone (TSZ) or approximately 50 percent of the watershed. Of that, 1,559 acres (41 percent) above 1,500 feet are assumed to be in the snow zone and 313 acres (9

percent) below 1,500 feet are assumed to be in the precipitation zone. In fact, these zones vary widely with weather systems during the winter storm season.

Of the 1,895 acre TSZ, 1,807 acres are on private lands, of which 570 acres are currently in an "open" condition (based on 2012 aerial photography and a September 2013 Google Earth® image). 30 acres of BLM lands in the TSZ are in an open condition, for a total of 600 open acres in the TSZ, or 32 percent of the TSZ. Based on the OWEB risk assessment chart (Figure 28) this watershed is currently in a low risk category for potential increases in peak flows resulting from openings in the TSZ.

If BLM adds an additional 65 acres of openings in the TSZ, total openings increase to 660 acres (35 percent of the TSZ). This level of openings remains below the threshold for anticipated increases in peak flows due to openings in the TSZ in this watershed. BLM anticipates that 65 acres of regeneration harvest would not increase the total opening enough to change the current risk rating of "low".

Figure 28: Graph for Determining Peak Flow Augmentation



If 60 percent of the remaining closed forest stand private industrial lands are clear cut in the next 10 years (approximately 750 acres of the total 1,237 acres available), the threshold for potential peak flow effect could be surpassed. The landowner is unwilling to share harvest plans with the BLM, but BLM field personnel estimate that much less than 60 percent of the remaining closed forest on private would be ready for harvest in the next decade, based on observations of stand ages and conditions in the general area, and on observations of the landowner's past practices. Therefore, it is unlikely that the threshold for potential peak flow effects would be exceeded during the next decade. After one decade, many of the currently open stands would grow to at least 30 percent closure and not contribute to augmenting peak flows.

Direct and Cumulative Effects to Sediment Supply

Analysis indicates that the anticipated level of sediment increase would not be detectable on the 7th field watershed scale and would not be of a magnitude or duration that could alter sediment transport, deposition or visible turbidity levels in the watershed.

Soil erosion analysis from FuME (see EA section 3.7.2.2 and the Soils Report) indicates regeneration harvest followed by broadcast burning in this unit could result in a potential increase of 8.4 tons of sediment/year delivered to streams adjacent to units 8A&B. This

represents a 19 percent increase above undisturbed forest (background) sediment yield estimated by the model for this 65 acre site.[29]

For the 3,767 acre Rock Creek watershed (5.9 mi^2), background sediment yield is estimated at 435.2 tons/square mile/year. The 8.4 ton increase in sediment yield due to regeneration harvest and site preparation on units 8A&C would be a cumulative increase of 0.3 percent above the watershed's total sediment supply of 2,561 2 tons/year.

3.5.2.3 No Action Alternative

The No Action alternative would result in the continuation of current conditions and trends at this site as described in the Affected Environment, above.

3.6 Fisheries and Aquatic Habitat

Sources Incorporated by Reference: Zoellick, 2014, Belly Twister Fisheries Specialist Report; King and Zoellick, 2014, Sunday Monday Fisheries Specialist Report (Together, the preceding two reports are referred to as the "Fisheries Reports") and Hydrology Report. Additional Sources Referenced: Logging Systems Report.

3.6.1 Affected Environment

Fish and Aquatic Species: Presence and Habitat in the Project Area

Resident Fish

Coastal cutthroat trout (*Oncorhynchus clarki clarki*; Behnke 1992) are common in portions of the project area. They inhabit multiple 2nd and 3rd order tributary streams to South Fork Neal Creek in Section 35 (T. 10S, R. 1E), and the Roaring River and several tributaries to the river in sections 1 and 3 (T. 11S, R. 1E). They inhabit several larger tributary streams to Crabtree Creek and Roaring River. Additionally, cutthroat trout inhabit several smaller 2nd order headwater streams in all Units. Other 1st and 2nd order tributary streams in the project area are too small and or steep to support fish populations with the exception of low gradient reaches of a 1st order tributary in section 15 that were found to support young of the year Cutthroat trout. Pacific lamprey (*Lampetra tridentata*) inhabit the 3rd order tributary to Church Creek in the central portion of Section 16 (T.11S, R.1E). Cutthroat trout are absent from tributaries to the Roaring River and West Fork Rock Creek in sections 5 and 8 (T. 11S, R. 2E) because of barrier falls that are located downstream of those sections, but inhabit West Fork Rock Creek downstream of the falls. South Fork Neal Creek is a tributary to Thomas Creek. Roaring River and West Fork Rock Creek are tributaries to Crabtree Creek.

Other resident fish known to inhabit Crabtree and Thomas Creek watersheds 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 mainstem reaches of Crabtree, Neal, and Thomas creeks, and the Roaring River. The downstream-most reaches of Crabtree and Thomas creeks also support redside shiner (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis*) and

[29] If fuel loads remained untreated on the site after regeneration harvest and a wildfire burned through the units an additional 46.3 tons/square mile/year of sediment delivery to the stream system would be expected, a 30 percent increase over the yield from undisturbed forest in that 65 acres. This information is for comparison only because BLM is not proposing to leave the fuels untreated.

non-native smallmouth bass (*M. dolomieui*), brown bullhead (*Ameiurus nebulosus*) and yellow bullhead (*A. natalis*) (USBLM 2001, 1996).

Aquatic Species

Aquatic amphibians (Pacific giant salamander *Dicamptodon tenebrosus*, tailed frogs *Ascaphus truei*, and torrent salamander *Rhyacotriton cascadae*) are common to abundant in the headwater portions of W.F. Rock Creek in Sections 7 and 8 (T. 11S, R. 2E; BLM Fish Inventories 2013), where fish are absent because of the presence of one or more barrier falls downstream. Pacific giant salamanders were present in the headwater tributary draining the central portion of Unit 35A (T.10S, R. 1E).

Threatened and Endangered Species

Project units are generally located >1 mile upstream of listed fish habitat (LFH) in Roaring River, Rock Creek, S.F. Neal Creek and Crabtree Creek (Table 16). Two exceptions are units 16A and 17A, in the Sunday Morning block, which are located on intermittent streams about 0.5 mile upstream of LFH in Crabtree Creek.

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). Crabtree Creek, S.F. Neal Creek, Rock Creek, and the Roaring River provide habitat for these species, and are located in the Crabtree and Thomas Creek watersheds of the Upper Willamette River ESU.

Spring Chinook salmon are distributed in the Roaring River to 0.5 miles upstream of its confluence with Crabtree Creek. Winter steelhead trout are distributed 1.4 miles upstream the Roaring River to the Roaring River fish hatchery. Chinook salmon are distributed 30 miles up Crabtree Creek from the Santiam River, to 0.9 mile downstream of White Rock Creek confluence. Winter steelhead trout are distributed 34 miles up Crabtree Creek from the Santiam River to 1.1 miles upstream of Bonnie Creek.

Table 16: Distances to Fish Habitat

Unit Number	Distance to Resident Cutthroat Trout Habitat	Distance to ESA Listed Fish Species Habitat	
		steelhead trout	Chinook salmon
1A	920 ft to Roaring River	4.8	5.5
1B	100 ft to Roaring River	4.9	5.6
1C	0.1 mile to Roaring River tributary	5.1	5.8
1D	380 ft to Roaring River tributary	4.7	5.3
1E	550 ft to Roaring River tributary	5.1	5.8
3A	0.9 miles to Roaring River	2.5	3.2
3B	0.9 miles to Roaring River	2.5	3.2
3C	0.6 mile to Roaring River	2.6	3.3
3D	100 ft to Roaring River	2.5	3.2
5A	1.8 miles to Roaring River tributary	6.9	7.6
8A	1.0 mile to West Fork Rock Creek	3.1	3.4
35A	100 ft to S.F. Neal Creek tributary	4.6	4.8

Unit Number	Distance to Resident Cutthroat Trout Habitat	Distance to ESA Listed Fish Species Habitat	
		steelhead trout	Chinook salmon
35B	0.25 mi to S.F. Neal Creek tributary	5.5	5.7
15A	270' to Church Cr.	1.0	1.0
15B	120' to Church Cr.	0.9	0.9
15C	600' to Church Cr.	1.1	1.1
16A	0.5 mile to Crabtree Cr.	0.5	0.5
16B	675' to unnamed trib Church Cr.	1.2	1.2
17A	0.4 mile to Crabtree Cr.	0.4	0.4
17B	0.5 mile to unnamed trib Milky Fork Roaring River	1.1	1.1
27A	0.1 mile to Beaver Creek trib	14.2	14.7
27B	120' to Beaver Creek trib	13.8	14.3

[a] 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.

Aquatic Habitats

Stream channels in the project area are stable due to vegetation (substrates are generally silt or gravel dominated; BLM Fish Inventories 2013), well-shaded (>90 percent effective shading; BLM Fish Inventories 2013), and stream banks are stable (>90 percent of banks vegetated with riparian and streamside vegetation; BLM Fish Inventories 2013). Crabtree Creek adjacent to the Sunday Morning block flows through a relatively unconfined valley (gradients of 2-4 percent Rosgen B-channel type; Rosgen 1994). Larger tributary streams in or adjacent to project units in the Belly Twister and Bent Beekman blocks include West Fork Rock Creek, South Fork Neal Creek and its tributaries, and Roaring River which have gradients of 4 to 10 percent (BLM 2001). Larger tributary streams in or adjacent to project units in the Sunday Morning block include Church Creek, Beaver Creek, and Milky Fork Roaring River which have gradients of 4 to 20 percent (BLM 2001). In general large woody debris (LW) levels in project streams are low due to historical land use practices.

In-stream habitats of Crabtree and Thomas Creeks are rated in fair to desirable condition (BLM 2001, 1996). Pool frequency and area is generally desirable, but LW levels are severely lacking (USBLM 2001, 1996).

Roads and Stream Crossings

Road construction, maintenance and use and road/stream interactions are discussed in the Hydrology section of this EA (EA section 3.4). The discussion in the Fisheries and Aquatic Habitat section (3.5) is limited to specific aspects of roads and stream crossings which affect fisheries and aquatic habitats.

The following haul routes are paved, or paved at critical stream crossings, and have no potential to deliver sediment to listed fish habitat (LFH, steelhead and Chinook salmon) (BLM Fish Inventories, 2008):

- The haul route for sections 1, 5, 8, and 35 – Neal Creek Road and county road 834, adjacent to steelhead habitat in Neal Creek (10S-1E-23);

- The north haul route from Section 3 where it crosses steelhead habitat in Neal and Thomas Creeks;
- The west haul route from Section 3 crosses LFH in Roaring River (on Fish Hatchery Drive).
- The north haul route from Sections 16 and 17 crosses LFH in Roaring River on Fish Hatchery Drive.

The upper portion of road 10-1E-28 crosses two 1st order tributaries to Roaring River at 1.0 to 1.2 miles upstream of steelhead habitat. The road is well graveled with short ditchlines, 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.

The North haul route from Sections 16 and 17 (road 11-1E-08 west of where it crosses the mid-point of the section line between sections 16 and 21) crosses Milky Fork Roaring River 1.5 miles upstream of LFH. Short ditchlines (< 200 feet long) which collect little water or sediment in that short distance drain to the stream at the crossing. LFH would not be impacted by log hauling on this road at any time of the year because the road is well graveled, thereby minimizing sediment movement, and the channel gradients downstream from this crossing and intermittent first order streams crossed are low (0.5 percent) and more than 0.5 mile upstream of LFH, which would trap and store any potential sediment and prevent it from reaching LFH.

The South haul route from Sections 15 and 16 (road 11-E-08 east of the point described above; and roads 11-1E-15, 21.1, 21.2 and 22.4 from sections 15 and 16 to the Snow Peak Mainline 11-1E-19) crosses multiple tributaries to Crabtree Creek at distances of 0.5 to 1.7 miles upstream of LFH. Part of road 11-1E-15 near where it crosses a tributary to Church Creek 1.6 miles above LFH is currently in poor condition, and the location and alignment of the road make it likely that sediment would move into the stream if the road is disturbed during the wet season. Due to the distance above LFH and the low gradient downstream in Church Creek, it is unlikely that enough sediment to cause visible turbidity would reach LFH. The stream crossings within 0.5 mile of LFH are well-shaped with good rock surfaces which are unlikely to deliver sediment to streams.

In sections 15, 16, 17 and 27 of the Sunday Morning block, there are perched culverts and sections of roads and ditches which hold water. Some ditches flow into tributary streams.

The haul route from Section 27 crosses tributaries to Beaver Creek more than 14 miles upstream of LFH before reaching the paved Snow Peak mainline road.

3.6.2 Environmental Effects

3.6.2.1 Proposed Action

Fish and Aquatic Habitat (ACS Objectives 2, 3, 8)

Stream Channels

The proposed thinning would not impact channel conditions and fish habitat because the Stream Protection Zones (SPZ; minimum 70 feet wide on perennial streams) which serve as no-disturbance buffers 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).

The proposed action would improve current stream channels where culverts are being replaced because current engineering standards require that passage of aquatic organisms be considered in the replacement design (such as eliminating perched culverts) as well as improving water and organic debris passage and reducing aggradation (see Hydrology, EA section 3.5).

Stream Shading and Temperature

The SPZ would prevent disturbance from project actions to the primary shade zone of all perennial streams in the project vicinity and maintaining at least 50 percent canopy in all thinning in the secondary shade zone would result in no change in solar radiation input and stream temperature in the project vicinity (Groom et al., 2011; U.S. Forest Service and Bureau of Land Management TMDL Implementation Strategy, 2005). Summer stream temperatures of intermittent tributaries in the project vicinity would not be affected by thinning because no surface flows would be present in these channels during the summer.

Large Wood (LW)

Thinning in RR would result in faster tree growth rates and an increase in LW availability to 1st and 2nd order tributary streams in the project area over the long term. Stream flows in 1st and 2nd order tributary streams are too small to move large wood to larger streams. SPZs on 3rd order and larger streams are 120-675 feet wide (Church Creek in the Sunday Morning block, which has riparian reserves dominated by big-leaf maple) such that large wood supplies on would be unaffected by tree thinning (McDade et al. 1990).

Sediment and Roads

Little, if any, sediment produced by road surfaces would be likely to reach stream channels and would not impact aquatic habitats or fish populations for the following reasons: Roads to be constructed/renovated/improved would not impact aquatic habitats or fish populations (including LFH) because they would be located and designed to avoid connecting to any live stream and so would not increase the size of the stream network (Wemple et al. 1996). Surfaces of constructed/renovated/improved roads (including culvert replacements) would be constructed to drain surface water to adjacent stable, vegetated slopes where it would infiltrate and not deliver sediment to any stream.

SPZ provide buffers which 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 long-term adverse effects of the culvert replacements and installations on aquatic species or habitat are expected. Over the long-term the addition of the culverts would reduce sediment and turbidity delivery to Church Creek and Milky Fork Roaring River and their tributaries by decreasing the length of ditchlines connected to streams. Sediment transport and turbidity would increase short term (for 1 to 2 days) during the first significant fall rains following the culvert installations. The increased turbidity is unlikely to be visible or measurable beyond 0.5 mile downstream (Foltz and Yanosek 2005). Cutthroat trout may either be displaced from portions of streams with elevated turbidity (and have to compete with greater numbers of fish for food), or their feeding would be disrupted (unable to see prey items; Bjornn and Reiser 1991) by short term increases in turbidity. Specifically:

- Five cross-drain culverts would be added or replaced on roads in section 15. Up to 0.5 mile reach of Church Creek would be potentially affected.
- Five cross-drain culverts would be added or replaced on roads in and immediately adjacent to section 16. Up to 0.4 mile reach of Church Creek would be potentially affected.
- Five cross-drain culverts would be added or replaced on roads in and immediately adjacent to section 17. Up to 0.4 mile reach of Milky Fork Roaring River would be potentially affected.
- No culvert replacements or installations are proposed for section 27.
- Several culverts would be replaced on stream crossings and additional cross-drain culverts installed on roads accessing sections 1, 3, and 35.

Culvert replacement and installation would not impact LFH or cutthroat trout because all LFH and cutthroat trout populations are more than 0.5 mile downstream the culverts proposed for replacement, and increased turbidity is unlikely to be visible or measurable beyond 0.5 mile downstream (Foltz and Yanosek 2005).

Seasonal restrictions on log hauling on part or all of roads 11-1E-08, 15, 21.1, and 21.2; and seasonal restrictions or sedimentation prevention measures on part of road 11-1E-21.2 and road 11-1E-22.4 would prevent all project generated sediment from entering streams and therefore would not impact LFH.

Log hauling and other project traffic on the remainder of roads used for the project would not impact fish and aquatic habitat (including LFH) because the design and condition of existing road crossings provide little or no potential to deliver sediment to streams, and project design features would maintain water quality within ODEQ standards by avoiding sediment input to streams. Avoiding sediment input would be accomplished by: monitoring road surface and weather conditions; avoiding log hauling and other heavy traffic when sediment could be generated and transported to streams; and trapping sediment before runoff enters streams where it cannot be diverted to stable, vegetated slopes.

Threatened and Endangered Species

Proposed thinning would not impact listed fish habitat for the same reasons described above for lack of impacts to resident fish and aquatic habitat.

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 (ie. pool habitat, instream cover, stream depth, etc.) would not be affected.

No direct or cumulative impacts to peak flows are expected (Hydrology Report and EA Section 3.5).

3.6.2.2 Alternative Action – Regeneration Harvest of 65 Acres

This analysis focuses only on the effects which could differ between the proposed and alternative actions. As was done for Hydrology, the analysis is based on the smaller seventh field watershed and affects only the Bent Beekman block. All other effects are identical to those analyzed for the rest of the project.

The Rock Creek watershed (7th field watershed) is currently at low risk for potential increases in peak flows resulting from forest openings in the transient snow zone (TSZ; Hydrology Report, 2013). With the addition of 65 acres of canopy opening (regeneration harvest of Units 8A&C), the watershed remains below the threshold for potential increases in peak flows due to openings in the TSZ (Hydrology Report, 2013). Cutthroat trout and winter steelhead habitat located in W.F. Rock, and Rock Creeks downstream of these units would not be impacted by regeneration harvest. Similar to thinning, regeneration harvest of these units would not affect stream channels, shading, LW, and sediment levels of W.F. Rock Creek. There would be no regeneration harvest in RR and no thinning is proposed in the RR adjacent to the proposed regeneration harvest units. This effectively implements no entry buffers of approximately 200 feet wide on intermittent streams and 400 feet wide on perennial streams.

3.6.2.3 No Action Alternative

Aquatic Habitat

Populations of aquatic species would undergo natural increases and declines related to changes in aquatic habitat condition (changes in stream temperature, sediment delivery events, and peak winter flows). Under the No Action Alternative, canopy closure in primary and secondary shade zones along stream channels would remain similar to current levels, except in response to natural 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). 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 <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 RR.

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 Belly Twister and Bent Beekman blocks of the project area are located more than 2.5 miles upstream of Chinook salmon and steelhead trout habitat in lower Roaring River, and Crabtree, South Fork Neal, and West Fork Rock Creeks. The Sunday Morning block of the project area is approximately one mile upstream of their habitats in lower Crabtree Creek.

3.7 Soils

Source Incorporated by Reference: Hawe, 2014 Soils Specialist Report for the Proposed Sundae Belly Project (Soils Report); Macalady and Bernards 2014, Sunday Morning/Belly Twister Logging Systems Report (Logging Report)

3.7.1 Affected Environment

Soil Series and Characteristics

Typical soils in these project areas formed in colluvium (i.e., material rolling downhill) from basalt, andesite rock and volcanic ash. Soil series mapped in the western foothills portion of the project area are primarily Blachly clay loams, Harrington-Klickitat Complex and Honeygrove clay loams. These soils tend to be deep and well drained with high clay content.

Soils on the southwest slopes of Snow Peak formed in volcanic ash and andesite at higher elevations. These soils tend toward shallower, stony loams on 30-90 percent slopes with lower clay content and higher risk of wind-throw. Soils series mapped here are primarily Cruiser and Keel gravely loam to Yellowstone and Henline stony loams (see Table 17 for a list of soil series and selected properties in the proposed treatment units).

Project area soils are suited for growing Douglas fir and western hemlock. Soil maps and descriptions of project soil characteristics are available at the Natural Resource Conservation Service web site: http://websoilsurvey.nrcs.usda.gov/app/.

Table 17: Primary Soils Series in Treatment Units

Soil Series[1]	Limitations/Hazards	Percent Slope[2]	Percent Clay	Erosion Factor (*Kw*)[3]	% Coarse Fragments[4]
Blachly clay loam	Compaction Slumping and scarring	0-50	27-40	0.17	0
Honeygrove silty clay loam	Compaction Slumping and scarring	0-50	30-40	0.17	0
Harrington-Klickitat Complex	Surface erosion shallow depth windfall	30-75	20-27	0.20	15-30
Henline very stony loam		30-75	7-15	0.10	15-50
Cruiser gravelly loam		30-75	0	0.17	0-5
Bensley-Valsetz stony loams	shallow depth windfall	30-50	15-25	0.15	15-45
Yellowstone stony loam	shallow depth windfall	30-90	10-20	0.10	15-30

[1] Principal soil series in Soil Data Mart data for Linn County Area, Oregon (USDA Natural Resources Conservation Service, 2005). http://www.or.nrcs.usda.gov/pnw_soil/or_data.html
[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, >0.3 = more easily eroded with low infiltration capacity (Brady 1996, Wischmeier and Smith 1978).
[4] Rock fragments > 3" diameter in A and B horizons.

Timber Production Capability Classification (TPCC)

In addition to the large scale County soil mapping, BLM lands in the project area are mapped and field-verified in the Timber Production Capability Classification (TPCC) database (BLM, 1987) which is more precise and accurate than county soil maps and is focused on forest productivity. "The purpose of the TPCC is to interpret soil and land characteristics to assist in timber management planning and in the application of practices which will maintain or enhance production over a long period of time" (Preface to the TPCC Manual)

All lands on BLM are classified as either, s*uitable* for timber production, *suitable but fragile* for a variety of reasons (e.g., nutrient status, compacted surfaces, slope gradient, etc.) or *non-suitable*. All of the proposed treatments are within areas classified as suitable or suitable but fragile and project design (EA Section 2.3.1.1) incorporates TPCC recommendations to reduce potential effects to soils. Non-suitable lands in the project vicinity (e.g., wet areas, areas with high gradient (steep), and areas prone to mass movement) were excluded from proposed treatment areas.

Existing Compaction

The most common "fragile" TPCC classification in the project area is FSR2. This indicates that the area was previously harvested by ground based equipment, typically crawler tractors, and that skid roads and disturbed surface soils comprise more than 10 percent of the unit surface area. The primary recommendation for mitigation on these sites is to till the soils at final harvest to help reduce bulk density.

There is no existing inventory of "compacted surfaces" in the project area. Outside of the visible network of previous skid trails, soil surfaces generally appear to be in a non-compacted state and are covered with a moderately deep layer of surface "duff" (partially decomposed organic material that protects the mineral soil surface). Some slight compaction may persist in the area outside of the visible skid trails and roads, but it is obscured by tree growth and the surface duff layer, and random small pits dug by the IDT soils specialist did not reveal any compacted soil surfaces beneath the duff. It is reasonable to conclude that any remaining compaction outside of road and skid trail surfaces is discontinuous and of no consequence to soil properties or fertility.

The soils specialist observed during field examinations that the old skid trail network is still moderately compacted (10-20 percent increase in soil bulk density). Neither the soils specialist nor the silviculturist on the IDT noted any apparent decrease in forest stand productivity (tree growth) associated with the visible skid trails and the soils specialist specifically noted that "large portions of former skid trails have been obscured by the growth of trees and development of the duff layer."

In section 8, the two units (57 and 8 acres) proposed for regeneration harvest in the alternative action are generally too steep to have been logged with ground based equipment. The smaller unit has some discontinuous skid trails, possibly from salvage logging. These remnant skid trails are not clearly discernible on the ground and are largely recovered.

Based on GIS data and field observation, the soils specialist estimated that 2.1-2.9 percent of the surface area in project area watersheds is road surfaces, ranging from paved highways to barely discernible natural surface roads used during the original logging in the watersheds. Assuming that 10 percent of the areas classified as FSR2 and which were suitable for ground based logging several decades ago have residual compaction from previous logging across all ownerships, approximately 8 percent of the watershed may be classified as moderately compacted soil surfaces.

3.7.2 Environmental Effects

BLM has observed the effects of logging operations in thousands of acres of commercial thinning for several decades under a variety of conditions. The following descriptions of direct effects are drawn primarily from those observations which include formal monitoring, stand measurements, and observations during the course of other duties). The following descriptions of indirect effects are based on analysis in the RMP/FEIS as reflected in the RMP Best Management Practices (BMP), on published research, and on BLM field observations.

3.7.2.1 Proposed Action

Direct Effects on Soil Compaction / Disturbance / Displacement

Ground Based Logging

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 expected extent of skid trails ("[Pathways] created by dragging logs to a landing (gathering point)." FEIS 6-14) combined with the portion of landings which are outside of road prisms and subject to equipment operation would be limited to less than 10 percent of the surface in each project area unit (RMP C-2). The standard Salem District BLM timber sale contract provision requires that skid trails be no more than 12 feet wide and spaced an average of 150 feet apart, resulting in eight percent of the surface area included in skid trails and leaving two percent for skid trail junctions and landing areas outside of rights-of-way.

Compaction in skid trails would generally be concentrated under the tracks or wheels of skidders and would be confined to within the 12 feet wide skid trails. In a study of logging traffic on fine textured soils in northern Idaho, compaction in the area between wheel tracks was much less pronounced and in many of the moisture/slash/depth combinations tested there was little or no statistically significant difference between the center line and the undisturbed reference soil. (Han et al. 2006, pp. 16, 17). This is consistent with personal observations by IDT members of logging operations over the last three decades and of examining numerous existing skid trails from the past century of logging in this Resource Area and noting that generally the center supports more vegetation growth and has a "softer feel" when walking on those skid trails.

Han-Sup Han et al. also found that: 1/ dry soils were most resistant to compaction; 2/ moderately moist soils (21-30 percent) were near to an optimum moisture content for compaction for this fine textured soil and were most easily compacted; and 3/ soils with excessive moisture (though the surface drained to approximately 30 percent, field capacity for this soil) "did not provide support against the equipment's ground pressure and allowed the tires to penetrate into the deeper soil levels" regardless of slash mat (p. 18). The degree of compaction, indicated by penetration resistance, increased from pre-harvest reference levels up to the fourth pass of equipment (1 – harvester, 2 – empty forwarder, 3&4 – loaded forwarder), then generally did not consistently increase with eight additional passes with the loaded forwarder. This pattern is also consistent with multiple references cited in the RMP/FEIS, RMP and Soils Report and with field observations of IDT members as described above.

A single pass with a harvester (or by extension, other equipment with a similar tracked carriage) operating on a heavy slash mat does not does not compact soil to an extent which is likely to inhibit root penetration. Han et al. also noted that "a single pass of the harvester on the slash mat did not increase penetration resistance…at the 10 cm [4 inches] depth" even at the most compactable soil moisture level, but that it did increase resistance at the 20 and 30 cm depths (8 and 12 inches) (pp. 18-20). They noted (p. 17) that past studies (citation made in the original) suggest that compaction exceeding 2500 kPa of resistance would prevent root penetration. The compaction levels on the most compactable moisture level in the study show that compaction from a harvester working on a slash mat does not approach the 2500 kPa level. Sang-Kuyn Han, a co-author, notes in his Master's Thesis (2006, p. 6, citing Han et al. 2006) that "…one pass of a tracked machine does not significantly impact this [fine textured] soil type." This is also

consistent with other studies such as those referenced in RMP/FEIS Appendix S-1, and with BLM IDT member's observations in more recent thinning operations.

Moderate-to-heavy soil compaction (>20 percent increase in bulk density) in the first 12 inches of topsoil would be indicated by ruts up to approximately 6 inches deep. Some of the impacted area would be existing skid trails from previous logging (estimated at 8 percent of the ground-based units) which are already compacted. The soils specialist estimates that the area impacted by surface disturbance and soil compaction from skid trails would be 8-9 percent of the ground based yarding area (1,171 acres, not including road rights-of-way; EA Section 2.3.1; Tables 1 and 2), or approximately 93-105 acres of disturbed and/or compacted soil in skid trails. Heninger et al. 2002 (pp. 234, 242, 243) found that "most" of the skid trails on silty clay loam soils in the western Cascades which were skidded in wet, winter conditions with tracked and rubber-tired skidders "…did not approach root-limiting [bulk densities] for Douglas-fir as reported in the literature." (Literature cited in the article.)

Additional soil surface area would be disturbed to some degree as logs are cut, moved and stacked. Mechanized harvest systems using a tracked carriage move between skid trails, resulting in some disturbance on approximately 50 percent of the surface area as it cuts, limbs, bucks and stacks logs. With careful operation using an appropriate combination of low soil moisture, operating on a slash mat (usually created by limbing trees immediately in front of the harvester and/or placing additional slash in front of the harvester), single pass operations, and operating only on low (<45 percent) slope gradients soil compaction would be discountable since it is not likely to measurably affect bulk density of the soil (Allen et al. 1999). Han, Sup-Han et al. (2006) noted that "A single pass of the harvester on the slash mat did not increase penetration resistance [compaction]". Wronski and Humphreys (1994) found that the type of harvesters used on recent BLM timber sales and working on a slash mat "…can work with minimal impact on all soils in the region irrespective of weather conditions" and that feller-bunchers were not capable of creating slash mats for the machine to work on. These two findings are consistent with recent BLM experience.

In areas where trees are felled and bucked using chainsaws, soil surface disturbance would occur as logs are winched to skid trails because little or no suspension of the leading end of the logs is feasible. The author is not aware of any studies quantifying the areal extent of this disturbance. No compaction would be expected between skid trails from these operations since no heavy equipment would be used between skid trails.

Skyline Yarding

In skyline yarding areas the trailing end of the trees being yarded would usually drag on the surface in the skyline yarding corridor. Impacts usually consist of light, discontinuous compaction and surface soil and duff displacement in a strip approximately four feet wide within a 12 feet wide skyline corridor. The Soils Specialist estimates that 4-5 percent of the 302 acres estimated (Tables 1 and 2) for skyline yarding in the project area would be disturbed and/or compacted in this way, a total of 12-15 acres.

Landings

Heavy compaction at landings would be primarily within the road prism (included in this analysis as part of roads rather than logging systems) and skid trail drop-zone (included in this analysis as part of skid trails) where equipment operates. If additional excavation were to be

required for setting up a skyline tower serving multiple skyline corridors, that area would also be compacted. Additional soil and duff layer would be disturbed and potentially lightly compacted where logs are sorted and stacked prior to loading and where landing slash is stacked during operations. The soils specialist estimates that landing compaction would be expected on approximately 1 percent of the project area, or 15 acres.

Road Construction and Maintenance

Total construction of new roads would displace topsoil and compact subsoil on 8.6 miles or 26 acres (45,400 feet, average 25 feet wide "footprint"). 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 (side slopes <35 percent), so the total width of the clearing would be expected to be around 25 feet.

Drainage structure improvements and/or replacement at several locations would improve drainage and reduce road surface erosion into the surrounding area and streams. Minor short-term roadside erosion would be expected when established vegetation in the ditch and culvert catchment areas is removed, which would be expected to return to very low levels within one or two seasons as litter-fall accumulates and vegetation regrows.

Decommissioning 0.3 mile of road would initiate the process of restoration of natural soil physical and biological conditions on 1 acre. Tilling of the soil surface would reduce bulk density and improve water infiltration rates allowing for plants and trees to establish and grow. Over a period of several decades these surfaces, if not re-disturbed, would gradually return to a pre-treatment condition undiscernible from adjacent soils.

Machine Piling and Pile Burning

Machine piling of slash to reduce fire risk along property boundaries and roads would be expected to disturb and compact approximately 24 acres. Limbs and other logging slash <6 inches diameter would be piled and burned to provide a fire break. Intensity of this disturbance would depend on soil conditions, operator and equipment. Typically, light to moderate soil displacement and compaction of the top 6 inches and duff layer would be dispersed across these surfaces. Where piles are burned, surface organic material (O-horizon) would be removed, 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. Displaced soil would be filtered and retained by the intact vegetation immediately surrounding the burn pile spot. 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. (See Fuels Report and EA section 3.9.)

Other

The proposed action would maintain sufficient mycorrhizae populations because the root systems of most vegetation would remain undisturbed on at least 90 percent of the unit area, and there is no evidence that past disturbance of the area has affected mycorrhizae populations.

The narrow openings created by skid trails (12 feet wide), skyline corridors (14 feet wide) and natural surface road construction (approximately 25-37 feet wide) would not noticeably affect

average tree spacing of 18 to 27 feet average after treatment. The listed widths of these openings are between tree trunks, tree crowns extend into the "open" area.

Many limbs and other logging slash and debris would be expected to remain scattered over the unit areas, except for the 24 acres of fuel reduction described above, because there is no economic or management reason to remove the slash. If an operator yards trees with tops intact and processes them at the landing, fewer limbs would remain scattered over the unit area, but there would be at least as much organic material on the ground as there was prior to logging. This organic material would decay over the next 1-2 decades, becoming part of the O-horizon and returning nutrients to the soil.

Stabilizing skid trails and natural surface roads by shaping (such as water bars), seeding with native species, and/or covering them with slash and debris would promote drainage and prevent water from accumulating in large quantities that could cause erosion. Accumulated litter-fall on the road surfaces would further reduce any potential for surface erosion over the next several years. Blocking skid trails with barriers and logging slash would prevent vehicle use which could cause erosion.

Removal of rock for use on roads would not affect soil productivity because all potential rock sources are already developed rock pits.

Summary of Direct Effects

There would be an overall maximum increase of 180 acres (12 percent of the treatment area) in moderate to heavy compaction/disturbance of soils under the proposed action from all sources, including the full 12 feet width of skid trails spaced 150 feet apart (average) under standard Salem District timber sale contract provisions and machine piling. BLM soils specialist on the IDT estimates, based on past observations, that approximately 31 percent of this disturbance (47 acres) would be of low intensity, meaning soil physical properties would likely recover to pre-disturbance conditions, without active restoration, within several years. Approximately 31 percent of this disturbance (47 acres) would be severe, meaning soil physical properties are unlikely to recover to pre-disturbance conditions without active restoration. The remaining 38 percent of the disturbed soils (87 acres) would be moderately disturbed, meaning soil physical properties would eventually recover to pre-disturbance conditions, without active restoration, following several decades without further disturbance. Approximately 9 acres (0.6 percent) of the treatment area will be actively restored (decommissioning road segments) which would speed up recovery of soil properties at these locations.

The proposed action would not lead to any measurable increase in surface erosion, and soil erosion would remain within the range of background rates. BLM field reviews (Hawe, 2012) of skyline and ground-based logging units on BLM 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 after logging under similar conditions. The project would have no effect on mass wasting processes, as described under Hydrology, EA section 3.5.

Indirect Effects on Site Productivity due to Soil Disturbance - Displacement and Compaction

Soil productivity is the "capacity or suitability of a soil for establishment and growth of a specified crop or plant species, primarily through nutrient availability." (RMP/FEIS Chp. 6, p. 4)

For this project, productivity of these forest stands is indicated by the growth and yield at the stand level as indicated by changes in radial growth (measure of growth) and the corresponding rate of increase in timber volume (the crop). BLM accepts that differences in mean diameter growth and total stand volume and value over the rotation are the net indirect effects on site productivity due to soil disturbance from commercial thinning. General plant species richness and growth may also be a visual indicator, though not measured.

The effect of the proposed action on overall (stand level) site productivity caused by soil compaction and displacement is expected to be too low to measure at the stand level. Thinning results in increased rates of radial growth and understory vegetation (see Vegetation, EA section 3.4), and any potential reductions in growth from soil compaction and displacement would not be discernable. BLM has observed this effect on thousands of acres of similar thinning for several decades. Thinning is a widely accepted silvicultural practice used to accelerate tree growth and is supported by decades of research, observation and practice on public and private lands.

Specifically:

- Light compaction caused by skyline yarding is expected to be too low to cause a measurable reduction in overall yield for the stands.
- Light compaction caused by mechanized harvesters operating on slash mats between yarding corridors and skid trails is expected to be too low to cause a measurable reduction in overall yield for the stands.
- Heavy compaction and displacement in heavily used skid trails and light to moderate compaction and displacement in skid trails with less use is expected to be too low to cause a measurable reduction in overall yield for the stands.

Miller et al. (2007) found that previously reported research showed wide differences in apparent Douglas-fir growth response to soil disturbance in thinning operations while their research found increased growth in individual trees adjacent to skid trails. Compacted skid trails affect no more than 40 percent of the rooting area of trees adjacent to a skid trail and the trees appear to positively respond to reduced competition to a higher degree than they negatively respond to skid trail compaction in the rooting zone, resulting in higher overall growth. Any potential individual tree growth rate reduction caused by compaction on no more than 10-12 percent of the forest stand is undetectable within the overall increased growth and production at the stand level.

Pile Burning

BLM does not expect any discernable loss in site productivity because discontinuous soil disturbance from machine operations as described would not be intense enough to reduce tree growth at a stand level and the burned areas would be scattered and small, potentially impacting only a small portion (<25 percent) of the rooting area of any tree.

Cumulative Effects

Soil Disturbance – Displacement and Compaction

The soils specialist estimated the extent of existing compacted/disturbed soil surfaces in the project watersheds as a whole, including road surfaces, at 10 percent (approximately 6,760 acres). Increasing compacted surfaces by 180 acres in this proposal would result in a 0.3 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 (other than road surfaces) would begin to decrease over time and would approach current levels within a decade as soil surfaces recover through natural processes (e.g., freeze-thaw, animal and insect burrowing, tree fall, root growth, etc.).

Surface Erosion

The proposed action would not lead to any measurable increase in surface erosion, and soil erosion would remain within the range of background rates. Estimated background surface erosion rates in the project area are in the range of the assumed rate of soil formation (0.12-0.8 tons/acre/year, Pimentel, 1987) otherwise there would be no surface soil.

Field reviews (Hawe, 2012) of skyline and ground based logging units on BLM 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.

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. (EA Section 3.4, Hydrology; Hydrology Report)

3.7.2.2 Alternative Action – Regeneration Harvest

Soil Disturbance – Displacement and Compaction

The intensity of compaction and surface disturbance in skyline yarding corridors and at landings would be higher than described for logging the same area with the same logging methods for commercial thinning under the proposed action because the number of logs yarded would be higher. The patterns of compaction and disturbance from logging would be the same as described for the proposed action. No tillage of skyline corridors is recommended in the RMP.

Surface Erosion

Broadcast burning for site preparation after regeneration harvest increases the risk for surface erosion, so surface erosion potential for the alternative action was analyzed with the Water Erosion Prediction Project[30] (WEPP) model. The soils specialist used fuels module (FuME) of WEPP to predict potential changes in erosion and sediment yield from the regeneration harvest and site preparation described in this EA.

The predicted quantity of sediment is likely an overestimate of true volumes. FuME has not been calibrated in western Oregon and it does not account for the high permeability of western Oregon soils or for the filtering effect of approximately 200 feet (minimum) of undisturbed vegetation between the project unit boundary and any stream channel. The model is used to provide a relative comparison of risks between the No Action baseline and the regeneration harvest alternative action.

FuME predicted a total undisturbed forest sediment yield for the watershed of 435.2 tons/square mile/year (1,360 pounds/acre/year – the No Action alternative baseline). Adding sediment yields

[30] Documentation of the WEPP model is available at http://fsweb.moscow.rmrs.fs.fed.us/fswepp

from wildfire (assuming a 400 year return interval) increases the sediment yield to 564.1 tons/square mile/year. The Middle Crabtree Watershed is 25,149 acres, or 39.3 square miles (EA Section 3.5, Hydrology, Table 14) yielding a total of approximately 17,100 tons per year of sediment.

WEPP FuME analysis predicts an increased short term risk of sediment delivery from the proposed treatment over undisturbed forest. Regeneration harvest followed by prescribed burn is estimated to increase sediment yield on the unit by 82.6 tons/square mile/year (258 pounds/acre/year[31]), a 19 percent increase over undisturbed forest levels on the 65 acres proposed for regeneration harvest. This increase in potential sediment delivery on 65 acres represents an increased risk for sediment delivery to local streams due to the proposed action of 8.4 tons of additional sediment/year, especially in the first one to three years immediately following the prescribed burn. An increase of 8.4 tons of sediment per year is an increase of 0.05 percent of the annual sediment yield of the watershed.

If fuel loads remained untreated on the site after regeneration harvest and a wildfire burned through the units an additional 46.3 tons/square mile/year of sediment delivery to the stream system would be expected, a 30 percent increase over the yield from undisturbed forest in that 65 acres. This information is for comparison only because BLM is not proposing to leave the fuels untreated.

Cumulatively, a 0.05 percent increase in watershed sediment would not be detectable or contribute measurably to sediment generated by other actions in the watershed.

Site Productivity

BLM does not expect a measurable loss in timber stand productivity over the next century due to soil compaction and disturbance from logging operations in the regeneration harvest units. BLM is aware that published research, including studies relied on for the 1994 RMP/FEIS (Appendix S), showed wide differences in apparent Douglas-fir growth response to soil disturbance in regeneration harvests. Heninger et al. (2002, p. 244) found that Douglas-fir trees planted in the most compacted parts of skid trails initially showed decreased growth compared to trees planted in the rest of the unit but that after seven years the growth was similar. After ten years, trees planted in compacted ruts were about one growth-year shorter and 29 percent less bole volume than the other trees. Since both absolute and percentage differences in total height decreased with time and the trend is expected to continue, BLM concludes that the overall stand productivity loss would be too small to measure at rotation age.

The Heninger study also noted that "tilling skid trails fully ameliorated growth losses [but also that] planting tree seedlings beside skid trails (in soil berms) instead of in ruts proved to be a practical means to avoid growth losses" (p. 244). This study on eight sites was done in the western Oregon Cascades near Springfield, within approximately 50 miles south of the SMBT project.

[31] 258 pounds/acre of sediment yield is equivalent to a "layer" of soil approximately 1/5 the thickness of a sheet of copier paper. A cubic foot of soil weighs approximately 85 (75-100) pounds. 258 lbs./acre of sediment (comprised of soil and ash) = 3 cubic feet/acre. 3 cu. ft./acre ÷ 43,560 sq. ft./acre = a depth of 0.00007 feet, or 0.0008 inches. A sheet of 20 lb. copier paper is 0.0038 in. thick.

3.7.2.3 No Action Alternative

With no management actions, there would be no changes to natural processes affecting soil conditions and characteristics.

3.8 Wildlife

Sources incorporated by reference: England and Murphy 2014, Cascades Resource Area EA Wildlife Report, Belly Twister/Sunday Morning Project, (Wildlife Report); England and Murphy 2014, Regeneration Harvest Alt. – Belly Twister/Sunday Morning (Bent Beekman) EA (Supplemental Wildlife Report)(Together, the preceding two reports are referred to as the "Wildlife Reports') ; Foster, C., 2013, Belly Twister and Sunday Morning Thinning and Silvicultural Prescriptions (2 documents) (Silviculture Reports), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.;USDI, Bureau of Land Management, Salem District, Cascades Resource Area. 2001, Crabtree Creek Watershed Analysis (CCWA 2001); USDI, Bureau of Land Management; Fish and Wildlife Service; USDI, Bureau of Land Management, Salem District, Cascades Resource Area. 1996. Thomas Creek Watershed Analysis (TCWA 1996)

3.8.1 Affected Environment and Desired Conditions

Descriptions of stand conditions as they relate to wildlife habitat are based on stand exam data, aerial photo interpretation, field review by BLM resource specialists in wildlife biology (wildlife biologist) and silviculture (silviculturist), and previous analyses including Watershed Analyses and Late-Successional Reserve Assessment. See also EA section 3.2.

Watershed Analysis and Late Successional Reserve Assessment

The SMBT project is located in the Crabtree and Thomas Creek 5th field watersheds in Linn County, Oregon.

BLM manages approximately 18 percent of the 100,022 acres Crabtree Creek watershed. Late seral forests comprise 36 percent of the federal ownership (CCWA p. 5-4). BLM lands have generally been heavily managed in the past for timber and are generally lacking desirable late seral characteristics. The CCWA (p. 7-4) identifies desirable stand characteristics including: larger trees for a large green tree component and recruitment of large standing dead/down coarse woody debris in future stands; multi-layered stands with well-developed understories; and multiple species that include hardwoods and other minor species. The WA recommends implementing density management prescriptions to develop and maintain late seral forest stand characteristics.

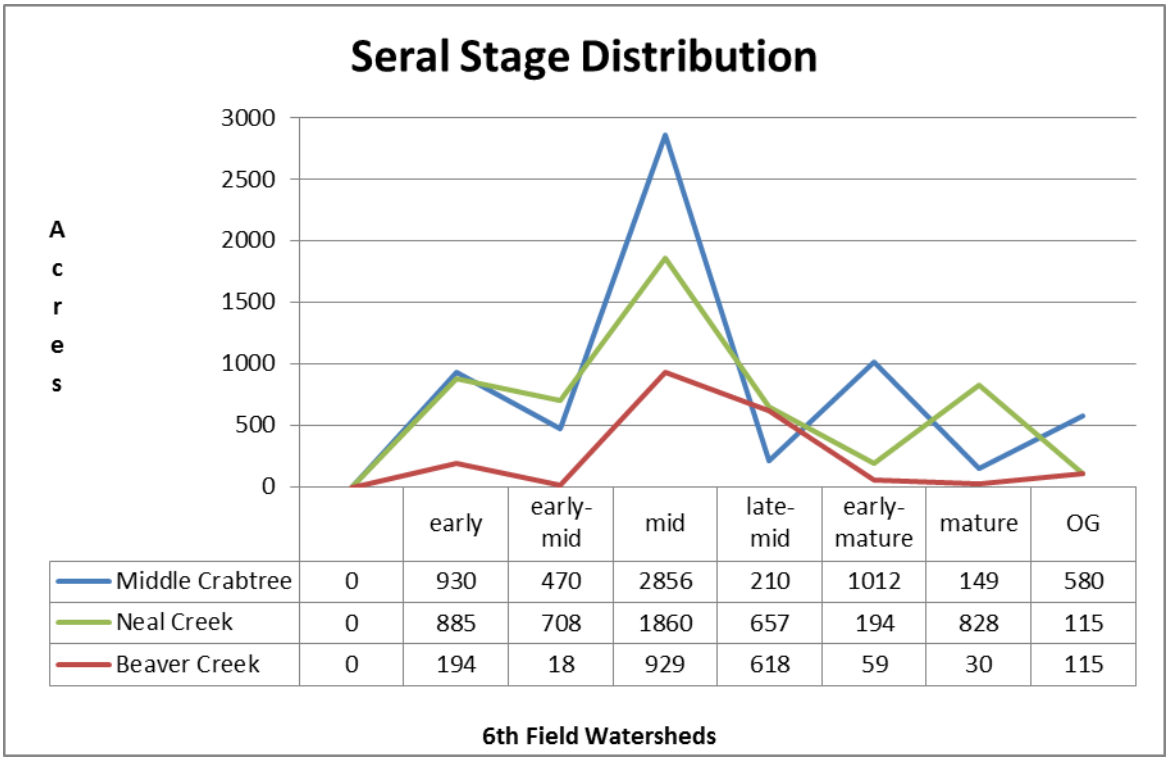
BLM manages approximately 17 percent of the 75,066 acres Thomas Creek watershed. Late seral forests comprise 33 percent of the federal ownership (TCWA p. 5-29). Terrestial Recommendation #1 recommends implementing density management prescriptions to develop and maintain late seral forest stand characteristics. Desirable sand characteristics include: larger green trees; recruitment of large standing/down dead and cull material for future stands; and multi-layered stands with well-developed understories and multiple species, including hardwoods and other minor species such as noble fir (TCWA p. 7-99). Hardwood dominated forest types are relatively uncommon in Thomas Creek Watershed at five percent (TCWA p. 7-99).

Habitat Condition

General stand development and condition in the project area are described in the Vegetation section of this EA (section 3.4). The specific conditions relevant to wildlife habitat at stand scale and watershed scale are discussed in this section.

When the forest stands on both BLM and private lands were established and treated to promote timber production, little or no consideration was given to habitat issues. Many desirable habitat features are generally lacking in the managed conifer stands proposed for thinning and in other public and private forest stands throughout these watersheds. 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). Figure 29 illustrates variation of seral stages across the landscape at the sixth field watershed level. 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. Specific aspects of these habitat features will be discussed in more detail in the following sections.

Figure 29: BLM Acres in Seven Seral Stages in the Relevant Sixth Field Watersheds



		early	early-mid	mid	late-mid	early-mature	mature	OG
Middle Crabtree	0	930	470	2856	210	1012	149	580
Neal Creek	0	885	708	1860	657	194	828	115
Beaver Creek	0	194	18	929	618	59	30	115

Sources: 2013 BLM Forest Operational Inventory (FOI) Data for BLM lands; analysis of 2012 BLM Aerial Imagery for private lands.

Early-Successional Stands and Early-Seral Habitat

Analysis of BLM data and field observations show that early-successional/early-seral habitat is lacking on BLM lands in the watershed, particularly early seral stands in the 0-10 year age class.

Early-seral stage stands are abundant on private industrial timber lands in the Crabtree Creek and Thomas Creek Watersheds, but they do not provide high quality early seral habitat. On private industrial forest lands intensive silvicultural practices are used to improve economic return and the early-seral habitat provided by these practices is generally low quality, lacking in the species diversity, structural elements and spatial diversity associated with high quality early-seral habitat. BLM has observed these trends on private lands intermingled with the project area:

- Harvest is usually done as clearcuts of large tracts based on property lines, road systems, timber volume, stand age and logging feasibility. These large clearcuts are typically not broadcast burned following harvest, so post-harvest vegetation growth does not benefit from the nutrients released by broadcast burning which encourage post-burn vegetation growth and diversity.
- Vegetation which would provide forage and understory development are actively suppressed with herbicides and/or cutting to reduce competition with conifer seedlings.
- Private industrial plantations are conifer monocultures or limited species of mixed commercial conifers.
- Conifer density is managed to fully utilize growing space, which restricts light reaching the understory as the canopy closes.

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

Snags, down logs, and special habitats provide important ecological functions for many wildlife species. Special habitats consist of wet and dry meadows, wetlands, talus, cliffs & rock outcrops. The presence of remnant trees and special habitats, and the amounts of snags and down logs present were based on stand exam data, aerial photos, and field review by specialists and are summarized in Table 18.

Table 18: Summary of special habitats, remnants, and down logs by project unit.

Unit	Location	Seral Stage*	Remnant trees	Special Habitats**	Down Logs***
Belly Twister Project Area					
1A	11S-1E-1	Mid	No	No	0’/456’
1B	11S-1E-1	Mid	No	No	34’/143’
1C	11S-1E-1	Mid	No	No	0’/580’
1D	11S-1E-1	Early Mid	No	No	0’/99’
1E	11S-1E-1	Mid	No	No	0’/85’
3A	11S-1E-3	Mid	No	No	12’/265’
5A	11S-2E-6	Mid	No	No	0’/228’
35A	10S-1E-35	Mid	No	No	0’/115’
35B	10S-1E-35	Late Mid	Yes	No	132’/605’
Bent Beekman					
8A/8C	11S-2E-5,6,7,8	Early Mature	Yes	Yes, Rock Outcrop, Pond#	17’/112’

Unit	Location	Seral Stage*	Remnant trees	Special Habitats**	Down Logs***
Sunday Morning Project Area					
15A	11S-1E-15	Mid	No	No	90'/0'
15B	11S-1E-15	Early Mid	No	No	0'/137'
15C	11S-1E-15,16	Mid	No	No	0'/138'
15D	11S-1E-15	Mid	No	No	0'/380'
15E	11S-1E-15	Mid	No	No	0'/255'
16A	11S-1E-16	Mid	No	No	23'/154'
17A	11S-1E-16	Mid	No	No	31'/44'
27A	11S-1E-27	Late Mid	Yes	No	49'/226'
27B	11S-1E-27	Late Mid	No	No	0'/58'

* 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+. See Table 11.

** Special habitats within the units include: wet and dry meadows, talus, cliffs & rock outcrops.

*** Linear ft./acre ≥20" diameter and ≥20' long, hard (decay classes 1-2)/soft (decay classes 3-5) logs.

Presence of adjacent special habitat, wetland, pond adequately protected with no treatment buffer.

Coarse Woody Debris and Other Down Logs

BLM's management direction for large down logs (generally referred to as coarse woody debris, or CWD in this document) 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 pp. 21, 25, 46).

Existing hard down logs in the project areas are generally less than 20 inches in diameter. Units 8A and 35 B have average diameters of 19.3 and 20.3 inches respectively (quadratic mean diameter (QMD)). Live trees are small in diameter and the project area has limited recruitment of hard down logs over 20 inches in diameter. Numerous hard logs in smaller size classes are the result of recent suppression mortality. These small logs are much less useful than larger logs for forest floor-associated wildlife species because they have less volume, persist for shorter periods of time (usually less than two decades), and are less thermally stable than larger material.

Existing soft down logs (decay classes 3-5) are usually remnants of unmerchantable trees and existing CWD that were not removed from the previous stand when it was harvested. There is an abundance of this type of material in most of the proposed units and in adjacent stands. These logs provide valuable habitat for a whole host of 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.

Snags

In unmanaged forests, the presence of cavity nesting birds has been linked to the presence of snags, particularly those larger than 50 cm (19.26") diameter (DBH) (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).

Table 19 summarizes the number of snags necessary for five cavity-excavating woodpecker species to maintain 40 percent of potential population levels (Neitro et al. 1985). These quantities are used as management direction for snag retention in the Matrix (RMP p. 21, 25, 46) at the time of regeneration harvest. Table 20 summarizes the snags currently present in the project area. A diameter of 15+ inches 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 material.

Table 19: Minimum number of snags per 100 acres necessary to support species of cavity nesting birds at 40 percent of potential population levels (RMP p. 21, as per Neitro et al, 1985).

Diameter class (inches DBH)	Cubic Feet of Wood in Snag 20 Feet Tall	Snag Decay Stage (number needed)		Total by diameter class (per 100 acres)
		Hard 2-3	Soft 4-5	
11+	13+		Downy woodpecker (6)	6
15+	25+	Red-breasted sapsucker (18)	Hairy woodpecker (77)	95
17+	32+		Northern flicker (19)	19
25+	68+	Pileated woodpecker (2)		2
Subtotals – all diameters by decay class		20	102	
Total – all diameter and decay classes				**122**

Table 20: Summary of existing snags by project unit.

Sunday Morning Belly Twister Project Area: Snags at least 15' tall/ 100 acres						
Unit #	Snags 15-25"		Snags greater than 25"		Total snags (15"+)	
	Hard	Soft	Hard	Soft	Hard	Soft
Belly Twister						
1A	0	0	0	0	0	0
1B	0	0	0	0	0	0
1C	270	0	0	40	270	40
1D	80	170	0	0	80	170
1E	0	0	0	0	0	0
3A	0	0	0	20	0	20
5A	0	0	0	60	0	60
35A	0	0	0	0	0	0
35B	0	0	0	120	0	120
Bent Beekman						
8A/8C	130	130	60	150	200	290
Sunday Morning						
15A	0	0	0	0	0	0
15B	0	0	0	0	0	0
15C	0	0	0	0	0	0
15D	0	240	0	20	0	260
15E	0	0	0	50	0	50
16A	0	60	0	30	0	90
17A	0	0	0	0	0	0
27A	0	120	0	80	0	200
27B	0	0	0	0	0	0

The use of 0+ in the table denotes trace numbers of snags present that did not appear in the stand exam. Some of this information is duplicated in Table 13.

The snag habitat within the proposed units consists mainly of small diameter hard snags and large diameter soft snags. Trees that could have developed into large snags and down logs were removed by past timber harvest and stand replacement fire. There are a few scattered residual large remnant trees in units 8A, 27A and 35B. Most of the existing snags are small (less than 15" diameter).

High quality old-growth trees, large cull material, down CWD and large snags are abundant in the mature/old-growth stands adjacent to or near most SMBT units. There are old-growth stands adjacent to portions of Units 1A, 1B, 1C, 8A, 15C, 15B, 15C, 27A, 35A, and 35B. Approximately 20 percent of the thinning boundaries are adjacent to old-growth stands. All of these edges were created as high contrast edge when adjacent stands were clear-cut, and have been exposed for 40 to 60 years. Understory layers and conifer reproduction is now much thicker along these edges as a result and they are now low contrast edges.

Special Habitats

There are rock outcroppings and rock gardens adjacent to 8C unit. These features are outside of the proposed unit would be buffered and posted outside of the unit boundaries.

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

Vegetation surveys (stand exam data) indicate that most of the stands proposed for thinning are lacking in habitat elements that support diverse populations of wildlife species, especially snags, down logs, deciduous understory and ground cover vegetation, or deep accumulation of leaf litter. BLM wildlife biologists developed a list of BLM Special Status/Species of Concern which are documented or suspected to occur in the Belly Twister/ Sunday Morning Project Area based on field inventories of the habitats present and a review of the existing literature (Wildlife Report Table 6). The following species in the project vicinity are of management concern.

Federally Listed Species

Threatened - Northern Spotted Owls

None of the proposed project units are located in 2012 Critical Habitat or unmapped Late Successional Reserves (LSRs), which are 100 acre core areas for known spotted owl sites as of January 1994. 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 proposed thinning units provide 1397 acres of dispersal and 103 acres of suitable habitat in the Thomas and Crabtree Watersheds.

There are two known spotted owl sites within the provincial home range (PHR) radius (1.2 miles) of the SMBT Project, known as the Snow Peak and Burmester Creek known spotted owl sites (KOS).

The Snow Peak KOS was occupied by a pair during 2006, and by a male from 2007 to 2010. There were no spotted owl responses from 2011 through 2014. The Snow Peak site is considered viable with a sufficient amount of suitable habitat available. However nesting has never been confirmed at this owl site. Unit 8A is not within the PHR of the site, but it is within the contiguous habitat patch. There are no units or activities planned within 0.5 miles or within disturbance range (0.25 miles) of the site.

The Burmester Creek KOS was occupied by a pair during 2010 and by a male in 2011. There were no spotted owl responses from 2012 through 2014. The Burmester Creek KOS is not considered a viable site because it lacks a sufficient amount of suitable available habitat. Units 35A and 35B are within the PHR of the Burmester Creek Site. There are no units or activities planned within 0.5 miles or within disturbance range (0.25 miles) of the site.

In addition, two historical sites have had no known occupancy during the last five years or more. Church Creek was located in the vicinity of unit 15A, 15B, 15C, and 16A; and Hammond Camp was located in the vicinity of units 27A and 27B. Both sites are non-viable due to a lack of suitable habitat. There is a long history of barred owl presence in the lower Crabtree basin. Barred owls are common and have been detected in all these spotted owl sites.

Bureau Sensitive

Johnson's Hairstreak

Johnson's hairstreak (*Callophrys johnsoni*) is an obligate old-growth, forest canopy species of butterfly typically found between 2,000 and 3,500 feet elevation. Larvae feed on dwarf mistletoe (*Arceuthobium* spp.) high in tree canopies (Davis and Weaver 2011) between April and October and adults fly from mid-May to early September with peaks in May and August (Andrews 2010b). No surveys for this species were conducted because ground surveys are limited in their ability to detect its presence due to the butterflies' preference for dwarf mistletoe high in tree canopies (Davis and Weaver 2011), which may also account for the rarity of sightings and its low detection rate.

Units 8A and 8C are the two late-successional stands proposed for treatment in the SMBT project and are between 2,000 and 3,500 feet elevation. Douglas-fir dominates the species composition with minor components of noble fir and western hemlock in units 8A&C. Dwarf mistletoe (*Arceuthobium tsugense*) is present but uncommon and not pervasive in these units.

The younger forests proposed for thinning that contain dwarf mistletoe may have the potential to support populations of the Johnson's hairstreak (Hoffman and Lauvray 2005). There are low amounts of Western hemlock dwarf mistletoe in the Belly Twister/ Sunday Morning area. The currently known geographical distribution of the Johnson's hairstreak indicates that it could be present in the Belly Twister/ Sunday Morning area.

Cascades axe tailed slug (Carinacauda stormi)

The Cascades axe tailed slug is a Bureau Sensitive species. Its current known distribution is in montane forests of the Western Cascades ecoregion of Oregon between about 1,700 to 4,000 feet elevation (Leonard et al. 2011). The Cascades axe tail slug is associated with conifer and leaf litter debris in Douglas-fir, western hemlock and vine maple woodlands. The slug is usually detected in the layer between the most recent leaf litter and the previous year's litter. Forest age class does not seem to be an important element of this species' habitat as it has been found in forests 25 years to over 200 years in age (Leonard et al. 2011). Habitat conditions for the slug are poor due to a lack of understory vegetation characteristic of the slug's habitat. The Cascades Resource Area has 15 sightings, and the adjacent Mount Hood and Willamette National Forest have over 300 records of its occurrence, indicating that it may be more common than previously thought. No Cascades axe tailed slugs where found during two protocol surveys of units 8A&C.

Survey and Manage

Units 8A and C were surveyed for Survey and Manage (S&M) species. All of the other units in the SMBT project are under 80 years of age. Commercial thinning in forest stands younger than 80 years old is exempted from the S&M survey standard under Exemption A of the 2006 Pechman Exemptions.

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 and units 8A and C meet the stand-level criteria for habitat as described in the Red Tree Vole Protocol (Huff et al. 2012).

Surveys for red tree voles were conducted in all of the stands proposed for treatment that are 80 years of age and older (IM-OR-2011-063, "2006 Pechman Exemptions," 2011) during the spring of 2013. Red tree voles were found in two locations in the area initially proposed for units 8A and 8B (See note in Table 13). Two habitat areas, 10 and 14 acres, were established and removed from the proposed units. "Habitat areas" are delineated to maintain habitat where red tree voles are known or assumed to occur, in accordance with the ROD direction to "manage habitat for the species on sites where they are located" (USDA, USDI 1994a, p. C-5). These habitat areas are designed to protect the physical integrity of the nests from both management activities and natural disturbances such as wind throw, and to provide a short-term approach to maintaining habitat at red tree vole sites until a stand-scale, landscape strategy is devised (USDA, Forest Service; USDI Bureau of Land Management. App. J-2. 1993).

Mollusks and amphibians

No Bureau Sensitive mollusks or amphibians are likely to be present in the proposed thinning units based on habitat, range data, and previous surveys for mollusks and amphibians conducted over 9,000 acres on the Cascades Resource Area since 1991.

No Bureau Sensitive or Survey and Manage species were found during two surveys in units 8A&C, which are older than 80 years. The first survey for Bureau Sensitive and Survey and Manage mollusks was conducted in units 8A and C during the fall of 2013, and the second mollusk survey was conducted in the spring of 2014.

Other species of management concern

Migratory and Resident Bird Species

There are no Bureau Sensitive bird species documented or suspected to occur in the SMBT project area. The proposed thinning is located in the Western Oregon Cascades Physiographic region. About 125 bird species are documented or suspected to nest on BLM lands in the Cascades Resource Area (Altman and Hagar 2007; Altman 2012; Marshall et al. 2003), of which 47 species are priority bird species of conservation concern (PIF 2012). 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 2008).

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. 2003). 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. These species are also common or more abundant in mature conifer stands (Hansen et al. 1995).

The proposed thinning areas are in mid-seral stands in the stem exclusion stage. These forest conditions are structurally simple and characterized by an even-aged, single-layered, closed-canopy with poor understory development (EA section 3.4, Vegetation) and are low in land bird species richness. The light-limited understory of unthinned stands 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 that rely on living deciduous trees, shrubs, and leaf litter (Hagar 2004). Abundance of arthropod prey species has been correlated with understory and midstory vegetation, particularly tall shrubs and hardwoods. These habitat elements are lacking or poorly developed in the stands proposed for thinning.

Bats

There are no Bureau Sensitive bat species suspected to occur in the SMBT project area.

Four bat species of concern are suspected to occur in the SMBT project area (silver-haired bat, long-eared myotis, long-legged myotis, and Yuma myotis). These species are primarily associated with caves and mines, bridges, buildings, and cliff habitat, none of which are present in the SMBT vicinity. Decadent live trees (old-growth) and large snags, particularly with bark attached that extend above the tree canopy, are used variously as solitary roosts, maternity roosts, and hibernacula by these species and other bat species associated with Douglas-fir forests, so they may be present (Christy and West 1993; Weller and Zabel 2001; Waldien et al. 2000). Although roost sites are poorly characterized in Pacific Northwest forests, existing information indicates that old-growth forests provide higher quality roost sites than younger forests and that many species prefer older forests (Thomas and West 1991, Perkins and Cross 1988), so any bats in the project vicinity are most likely to be found in the old-growth forest stands in the vicinity, which are not proposed for harvest.

The different bat species prefer different forest stand structure and use habitat features differently. Bats appear to be active and use both regeneration units and intact forest for foraging depending on the specific habitat of each species. Many bat species prefer late-successional forests, using decadent live trees and large snags as roost sites. Late-successional forests provide higher quality roost sites than younger forests (Thomas and West 1991, Perkins and Cross 1988). Smaller, more maneuverable species (*Myotis* spp.) are less affected by tree density than the larger, less maneuverable species. Two *Myotis* spp. differed in their habitat use. Little brown bat, an aerial insectivore, prefers to forage along the edge of clear-cuts, while the northern long-eared bat, a species that gleans prey from surfaces, doesn't forage in clear-cuts but prefers intact forest. The silver-haired bat prefers to forage in clearcuts and avoided intact habitat patches (Patriquin et al. 2003).

Big Game

Big game species found in the project areas include Roosevelt elk (*Cervus elaphus roosevelti*) and black-tailed deer (*Odocoileus hemionus*). The project areas are in mid-seral stands, which provide hiding and low quality thermal cover. There is big game use throughout the year in most

units due to being below the seasonal snow zone, except in 8A/C which are higher elevation than the rest of the project area. The Salem District Record of Decision and Resource Management Plan (RMP), approved May 1995, identified no critical winter or summer range in the project areas (RMP p.26).

Early to mid-seral stage stands are abundant in the Crabtree Creek and Thomas Creek Watersheds, especially on private industrial timber lands in the project vicinity, but do not provide high quality early seral habitat. BLM observations of practices on private industrial timber lands indicate that these stands are typically managed 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 provides browse, species diversity and understory development are actively suppressed with herbicides and/or cutting because they compete 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 early and mid-seral habitat provided by these practices is generally low quality, lacking in the species diversity, structural elements and spatial diversity associated with high quality early and mid-seral habitat.

3.8.2 Environmental Effects

3.8.2.1 Proposed Action

Stand Structure

All Land Use Allocations

The proposed treatments will have both short (less than five years) and long term (more than five years) effects. These effects involve trade-offs of effects.

In the short term, thinning these structurally simple mid-seral stands would result in:

- A reduction of suppression mortality since most of the trees which would otherwise die in the next five years would be harvested;
- Canopy cover which would be opened up by removing some of the trees which comprise the canopy; and
- Understory and ground vegetation which would be partially disturbed, broken and crushed during logging operations.

In the longer term thinning these mid-seral stands would result in 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 in both the short and long term, stand conditions and structural complexity would improve as canopies close and thus improve habitat quality for mid to late successional wildlife species. The effects of thinning are described in EA section 3.4.2.1

Research that has been completed 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 produces what has been described as “cascading ecological effects” (Hayes, Weikel and Huso 2003) that result from reduced competition between overstory trees and increased availability of solar radiation to the forest floor. Growth, size, branch diameter, and crown ratio of the remaining trees is increased,

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. These changes are considered to be beneficial since there is an abundance of simplified mid-seral stands in these watersheds (CCWA Chp. 7 pp. 5).

Proposed road construction and renovation, skid trails and skyline corridors under the proposed action would create narrow (approximately 12-28 feet at ground level) 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 avian predators and larger mammals such as big game and coyotes. In the long-term, ground vegetation would become re-established due to increased light to the forest floor. Eventually breaks in the canopy would close and the vigor of the understory would begin to decline as less light reached the forest floor in two to three decades.

The proposed action includes low density thinning patches of up to one acre each on up to one percent of the total treatment acreage. These openings could occur in Matrix or RR to increase understory layering, structural diversity and ground cover, adding complexity at both the forest stand and landscape levels. Species expected to benefit from low density thinning patches are ruffed grouse, Wilson's warbler, warbling vireo, song sparrow and big game species.

Riparian Reserves

Thinning would improve habitat conditions in the RR for wildlife by accelerating development of some desirable late-seral forest stand characteristics which are under-represented in the project watersheds. Desirable late seral forest stand characteristics include larger trees for a large green tree component and recruitment of large standing dead and down wood (snags and CWD) in future stands, multi-layered stands with well-developed understories, and multiple species that include hardwoods and other minor species. The age classes proposed for thinning generally provide the greatest opportunities for acceleration of tree diameter growth and understory development through thinning (CCWA p. 7-5). Untreated stands in both RR and Matrix would provide for continued presence of dense uniform stands which would continue to provide abundant small diameter snags and dead/down wood for the next several decades.

At the landscape level, connectivity for species such as the spotted owl would improve as late successional conditions develop in both treated and untreated stands in the RR. Other species would benefit from the development of older forests in the RR, including many species of mollusks, amphibians, bats, the red tree vole, blue grouse, red-breasted sapsucker, pileated woodpecker, Cooper's hawk, Pacific-slope flycatcher, Swainson's thrush, black-throated gray warbler, black-headed grosbeak, olive-sided flycatcher, brown creeper, and hermit warbler.

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

All Land Use Allocations

The younger project area units are not expected to meet RMP management direction for snags and CWD until enough live trees become large enough (at least 20 inches diameter) to provide

for recruitment of large snags and down logs. As a result of increased growth rates of retained trees, the RMP guidelines for snags (40 percent maximum population densities = approximately 1.2 snags per acre total of all diameters and condition classes) 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) could be met in one to four decades through natural processes and/or management action. EA Table 13 shows stand ages and average diameters now and in 20 years for treated and non-treated scenarios.

Throughout the project area, approximately 50 to 140 green trees per acre would be retained for green trees and be available for recruiting snags and down logs in the future stands (RMP pp. 21, 25, 48). 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. Future snags and down logs may be recruited by natural processes or by management actions.

Thinning these stands would reduce the number of small diameter (less than 15 inches DBH) snags over the next 20 to 40 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 15 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; see EA Table 19). Small dead wood created through suppression mortality would be abundant in adjacent and nearby untreated stands.

Within thinning units, approximately 90 percent or more of existing snags over 15 inches diameter and 15 feet tall would remain standing after treatment, based on BLM experience with similar projects. Retaining the largest snags to the extent feasible would retain the best available habitat. The remaining ten percent or less of these large snags may need to be felled to facilitate safe and efficient project operations.

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

BLM anticipates that at least 90 percent of existing CWD would be retained intact and in place, based on experience with similar projects. Less than ten percent of existing CWD would be directly impacted by logging because 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. BLM oversight of skyline corridor and skid trail locations would avoid impact to high value CWD wherever feasible. A high proportion of dead wood which is too small to meet management direction for CWD may be impacted by logging operations. 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.

There would be no effects to large, old (>200 years) remnant trees since most of the proposed units lack these structures and the few such trees which are within project units would be specifically protected by timber sale contract provisions and administration. The few scattered old-growth remnants located in units 8A, 27A, and 35B would be reserved, and it is feasible to leave these remnants standing and undamaged.

The conifer reproduction and understory which now form part of the low-contrast edge for old-growth stands adjacent to project units would remain intact. Because these low contrast edges remain intact they would buffer any potential impacts of thinning on adjacent old-growth stands.

Matrix

In the Matrix, the treatment units are not generally expected to meet RMP management direction (RMP pp. 21, 25, 46) for snags to support species of cavity-nesting birds at 40 percent of potential populations levels (EA Table 19) and at least 240 linear feet of logs per acre (average) which are ≥20 inches diameter (large end) and ≥20 feet long within the next two decades. Commercial thinning designed to meet Matrix/Timber Resources objectives generally retains the largest, healthiest trees in the stand which are the least likely to die and become snags or down wood and there is no direction to recruit snags/down wood as part of commercial thinning operations. As described for "all land use allocations" above, approximately 50-140 trees per acre would be retained, providing more than the 6-8 green conifer trees per acre plus additional green trees for snag (and CWD) recruitment that management direction calls for at regeneration harvest to provide snags, CWD and legacy (green) trees to bridge past and future forests (RMP pp. 21, 25, 48).

There would be no impacts to the rock garden and out crops in unit 8A due to buffers.

Riparian Reserves

In the short term, where there are trees of sufficient size to meet management direction for snags and CWD, logging operations would create some additional snags, CWD and broken/damaged trees. BLM would require that up to four per acre (2 standing, 2 down, and of sufficient size) of the trees damaged or felled during logging operations be left in place as snags and CWD (EA Table 4). If post-harvest surveys indicate that there are still insufficient snags and/or CWD to meet management direction and that there are source-material trees of sufficient size to meet management direction, up to two trees per acre may be felled or girdled to make up the deficit.

In the long term, snags and CWD would be recruited in RR throughout the project vicinity over the next four decades as surveys indicate the need for additional material and the availability of trees of sufficient size.

Federally Listed Species

Threatened - Northern Spotted Owl

The proposed thinning in the Sunday Morning and Belly Twister blocks may affect, but would not be likely to adversely affect (NLAA) the northern spotted owl due to modification of dispersal habitat.

The proposed thinning in the Bent Beekman block(units 8A/8C), would be likely to adversely affect (LAA) the northern spotted owl due to downgrading existing suitable habitat to dispersal habitat.

The SMBT Proposal is consistent with the Revised Northern Spotted Owl Recovery Plan (NSO 2011) and conforms with Recovery Actions 6 and 32.

- Recovery Action 6 recommends implementation of silviculture treatments (such as the proposed thinning) in plantations, overstocked stands, and modified young stands to

accelerate the development of structural complexity and biological diversity (NSO 2011 p. III-19).

- Recovery Action 32 recommends maintaining high quality suitable habitat. The proposed thinning would not alter Recovery Action 32 Habitat (NSO p. III-67) since the proposed units do not meet the stand level conditions characteristic of this habitat.

The short-term effect of thinning will be alteration of 1,397 acres of dispersal habitat, and downgrading 103 acres of suitable habitat to dispersal habitat. Forest stands can be altered in a manner that is not necessarily expected to change the habitat function for spotted owls (Forsman et al. 1984; USFWS 2007c). Current habitat function for the spotted owl would be maintained after treatment for the dispersal habitat and downgraded for the suitable habitat to be thinned. "Maintain" habitat means light to moderate 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 (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods) will be maintained post treatment to adequately provide for spotted owl dispersal. As a result, the functionality of the habitat used by spotted owls remains intact post treatment in dispersal habitat. Habitat "downgraded" refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat.

Thinning treatments in dispersal habitat can have long-term benefits to spotted owls by encouraging late-successional characteristics to occur more rapidly (BA p.19; LOC p.20). Thinning would accelerate the development of suitable habitat characteristics, especially in Riparian Reserves. As thinned stands mature, habitat conditions would improve. Canopy closures would increase and the stands that are currently dispersal would attain suitable habitat conditions within 20 to 40 years. These stands would develop foraging and nesting structure, and residual trees will increase in size and be available for recruitment of snags, culls and down logs for prey species and nesting opportunities for spotted owls. Subsequent treatments to create snags and down logs in the Riparian Reserve to meet LSRA CWD objectives would help move these stands toward suitable habitat conditions.

Disturbance associated with thinning (logging, road building, etc.) may have temporary effects on the presence or movement of spotted owls. However, thinning would maintain dispersal habitat, therefore maintaining the ability of the habitat to accommodate movement of birds after thinning is completed.

Seasonal restrictions on all activities in units 10S-1E-35B, and 11S-2E-8A & C during the critical nesting season would minimize the risk of disturbance to spotted owls (BA pp. 8-9, 10-11; LOC pp. 15, 16-17).

Table 21: Spotted Owl Habitat Modification by Treatment Type[1], Land Use Allocation, Pre/Post Treatment Habitat Type[2], Habitat Modification Type[3], and Effect[4].

5th. Field Watershed	Project	Township-Range-Section#	Proposed Treatment[1]	Acres	Land Use Allocation	Pre/Post Treatment Habitat Type[2]	Habitat Modification[3]	Effect[4]
Thomas Creek	Belly Twister	10S-1E-35	moderate thin	160	Matrix/ RR	Dispersal/ Dispersal	Maintain	NLAA
Crabtree Creek	Bent Beekman	11S-2E-5,6,7,8	moderate thin	103	Matrix	Suitable/ Dispersal	Downgrade	LAA
Crabtree Creek	Belly Twister	11S-1E-1,3	moderate thin	756	Matrix/ RR	Dispersal/ Dispersal	Maintain	NLAA
Crabtree Creek	Sunday Morning	11S-1E-15,16,17, 27	moderate thin	481	Matrix/ RR	Dispersal/ Dispersal	Maintain	NLAA
TOTAL	**SMBT**			**1,500**				

Notes and definitions for Tables 21 and 23 (BA 2014, pp. 7-8, 18-19; LOC 2014, pp. 13-15, 20-21, 28).

1 Treatment Type: Moderate thinning in dispersal or suitable habitat can be for forest health, to improve the structural characteristics of a stand, or to provide commodity. Such treatments may be described as commercial thinning, density management, selective cut, partial cut, or mortality (standing) salvage. Such thinnings maintain a minimum of 40 percent average canopy cover. Light to moderate thinnings can have long-term benefits to spotted owls by encouraging late-successional characteristics to occur more rapidly.

2 Habitat Types: Suitable habitat is conifer-dominated, 80 years old or older and multi-storied in structure, and has sufficient snags and down wood to provide opportunities for owl nesting, roosting and foraging. Canopy cover generally exceeds 60 percent. **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 habitat lacks the optimal structural characteristics needed for nesting.

3 Habitat Modifications: Maintain habitat means to alter forest stand characteristics but maintain the components of spotted owl habitat within the stand such that spotted owl life history requirements are supported (i.e. the functionality of the habitat used by spotted owls remains intact post treatment). For spotted owl dispersal-only habitat a canopy cover of >40 percent along with other habitat elements (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods) will be maintained post treatment to adequately provide for spotted owl dispersal. **Downgrade habitat** refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat.

4 Effect: NE=No effect; NLAA=May affect, but not likely to adversely affect; LAA=May affect and likely to adversely affect.

Bureau Sensitive

Johnson's Hairstreak

Potential impacts to Johnson's hairstreak would be limited to reduction of individual trees with dwarf mistletoe in stands which are marginal habitat. The primary habitat for Johnson's hairstreak is old-growth forest with dwarf mistletoe. The two oldest stands in the proposed project (8A&C) are early-mature stands with a small component of western hemlock infected with dwarf mistletoe, some of which may be removed. Johnson's hairstreak is more likely to be present in adjacent old-growth stands that have a high incidence of dwarf mistletoe in the Western hemlock. Hemlock dwarf mistletoe is very persistent and virtually impossible to eliminate without aggressive clear-cutting (Hawksworth and Wiens 1996) and would persist after treatment.

Cascades axe tailed slug (Carinacauda stormi)

Some individual slugs may be killed or disturbed by project operations, but there would be no known effects at a population or species level. Only two units (8A&C) are old enough (80+ years, Pechman Exemption) to require surveys and no Cascades axe tailed slugs where found during two protocol surveys of those units. Habitat conditions for the slug are poor in most units

due to a lack of understory vegetation characteristic of the slug's habitat and heavy ground disturbance from previous clear-cut harvests. Due to seasonal restrictions on ground-based logging, activity would occur during the drier seasons when mollusks are less active. Habitat conditions in adjacent old-growth stands are more favorable, with undisturbed ground and abundant vine maple in well-developed understories.

Survey and Manage

Red Tree Vole

The effects to red tree voles (RTV) are expected to be minimal due to poor quality of the mid seral habitat in most of the sale area. No suitable RTV habitat would be removed as a result of this proposal.

The two areas where RTV nests were found in the originally evaluated unit 8A are now protected by 10 and 14 acre RTV habitat reserve areas where no treatment is proposed and would not be impacted by project operations. 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, project area stands would acquire some older forest characteristics sooner than without thinning as described earlier in this section and in EA section 3.4 (Vegetation). Habitat conditions for red tree voles would gradually become more suitable after thinning as the stands continue to mature and develop older forest characteristics. Optimal habitat is available in old-growth stands near the units.

Other Species of Management Concern

Migratory and Resident Birds

Habitat modification activities that disturb vegetation may result in the unintentional take of nests, eggs, nestlings and nesting failure if harvest operations occur during active nesting periods. However, the impacts would be short term, involving loss of nests and unintentional take during one nesting season and would not reduce the persistence of any bird species in the watershed or populations at the regional scale. In the western Oregon Cascades there is temporal variability of breeding bird species and individuals of the same species in forested habitats. For example, some owls and woodpeckers begin breeding in February or March, while some flycatchers do not finish breeding until August. The majority of birds in the Pacific Northwest complete their breeding cycle within the April 15 to July 31 time period (Altman and Hagar 2007). The seasonal restriction for spotted owls from March 1 to July 15 would help reduce unintentional take of nesting birds in those units.

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 and nesting habitat, which would minimize short-term disturbance.

Changes in habitat structure would have immediate effects on bird communities in thinned stands. Thinning densely stocked conifer stands would be expected to immediately enhance habitat suitability for species which prefer a less dense conifer canopy, and reduce habitat suitability for species that prefer 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; however, these

species are also common or more abundant in mature conifer stands as well (Hansen et al. 1995). 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 for up to 20 years 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 density thinning patches would encourage the development of hardwood/deciduous tree/shrub components and canopy layers more rapidly and would further benefit this same set of species. Bird species that utilize snags and down logs would benefit as stands begin to achieve long-term CWD objectives in the Riparian Reserves.

Bats

Adverse impacts to bat species are expected to be low because very little habitat would be affected by the project. Most of the habitat for bats in the project vicinity is provided by old-growth forests which provide higher quality roost sites than younger forests, and many species prefer older forests (Thomas and West 1991, Perkins and Cross 1988). No older forests are proposed for thinning. The snags and large trees which extend above the canopy are structures which exist in the surrounding old-growth stands, some of which are adjacent to the proposed units, but are rare in units proposed for thinning.

There are few snags within the units proposed for thinning and even fewer large snags with sloughing bark. There are a few large trees which extend above the canopy in and adjacent to units 8A, 8C, 27A, 35B (Tables 18, 20). Unit boundaries would be located to exclude these structures where possible and any of these structures inside of units would be reserved from harvest and protected from damage as much as is feasible.

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 and Collopy 1999). Bat species are also associated with buildings, bridges, mines, cliff crevices and caves, none of which are present in the SMBT Project Area.

Big Game

Big game species would be temporarily 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 during times of operation. Thermal and hiding cover would be maintained after harvest but its quality would decrease in the short-term as a result of thinning, opening new roads, renovating 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 density thinning areas.

In the long term (≥five years), thermal and hiding cover quality would increase and vegetative forage would gradually decrease as a result of canopy closure over the next two to three decades, decreasing the amount of light reaching the forest floor. Vegetative forage would persist longer in low density thinning areas.

Cummumlative Effects

Seral Stages

Analysis shows that there are about 2,856 total acres of mid-seral stands of similar age as the proposed units in the Middle Crabtree 6th field watershed that are located on BLM lands. A total of 1,133 acres would be thinned, plus 235 acres treated by past projects, leaving 52 percent of these mid seral stands untreated. Areas proposed for treatment in Neal Creek and Beaver Creek comprise 29 and 13 percent respectively of mid- aged stands within their boundaries. The treated areas would develop some late-seral characteristics faster than untreated areas while untreated areas would continue developing along their current trajectories. These differing development trajectories would increase variation across the landscape which BLM considers to be a positive cumulative effect for wildlife habitat and species richness as described in this EA for the individual elements of habitat.

Table 22: Summary of BLM Acres in Seven Seral Stages in the Relevant 6th Field Watersheds, Then With Past, Current and Future Commercial Thinning in the SWB.

Seral Stage (acres)							
6th field watershed		Mid-Seral			Late Seral		
	early	early-mid	Mid	late-mid	early-mature	mature	OG
Middle Crabtree	930	470	2856	210	1012	149	580
Proposed	0	40	1133	0	103	0	0
Past projects	0	0	235	0	0	0	0
Future projects	0	0	0	0	0	0	0
Neal Creek	885	708	1860	657	194	828	115
Proposed	0	0	124	36	0	0	0
Past thinnings	0	0	410	0	0	0	0
Future projects	0	0	0	0	0	0	0
Beaver Creek	194	18	929	618	59	30	115
Proposed	0	0	0	64	0	0	0
Past thinnings	0	0	120	0	0	0	0
Future projects	0	0	0	0	0	0	0

Snags and Down Wood

Thinning these stands would reduce the number of small diameter (less than 15 inches DBH) snags over the next 20 to 40 years that would otherwise die from suppression mortality and become snags. Since approximately half of the stands of similar age on BLM lands in the Middle Crabtree 6th field watershed would not be treated, small dead wood would still be present and available throughout the watershed in untreated stands. The other 6th field watersheds in the project vicinity would have proportionally less reduction in small diameter dead wood.

No more than ten percent of large snags and CWD would be directly impacted within treated units based on BLM experience that yarding corridors, skid trails and landings are the areas where snags and CWD are most likely to be impacted and that PDF limits these features to less than ten percent of the treatment unit area. In practice, yarding corridors, skid trails, landings and other logging operations are planned and conducted as much as possible to avoid impacts to large snags and CWD and retain at least 90 percent of these features. By extension, no more than approximately 5 percent (10 percent on half the acres) of all large snags and CWD in stands of similar age would be impacted in the Middle Crabtree, 2.9 percent in Neal Creek, and 1.3 percent in Beaver Creek 6th field watersheds. Across all age classes, the percentage of large snags and CWD impacted is proportionally lower.

Within treated areas where there is source material of suitable size, additional large snags and CWD would be recruited as previously described both as a result of logging and post-logging management actions. As larger trees develop in the residual stands, they would provide source material for girdling and topping and the creation of snags and down logs would be beneficial. This would result in a lesser net degree of impacts to large snags and CWD in the short term (<5 years) than described above and may increase the cumulative level of large snags and CWD over the next 20-40 years compared to the no action alternative. Beneficial long term (20 to 40 years) cumulative effects to large snags and CWD and associated wildlife species would occur as a result of implementing the projects, since larger trees would be available sooner than without thinning to contribute additional large snags and CWD recruitment in future stands.

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).

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

Thinning in the project area would not be expected to contribute to the need to list any Bureau Sensitive or species of concern under the Endangered Species Act (BLM 6840). Habitat for the species that are known to occur in the project area 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. Specifically:

Northern Spotted Owl

The proposed action would not contribute to cumulative effects to spotted owls. The scale for cumulative effects for the northern spotted owl is the provincial 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) for conservation and recovery for spotted owls 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.

Other federal projects in the watershed include thinning and LSR habitat enhancement in the Crabtree watershed. Each of these projects intends to promote late-successional habitat via thinning young to mid-seral stands, setting a trajectory to a multi-structural and multi-species composition. This proposal, likewise, would establish forest conditions favorable to large high quality snag and CWD recruitment, multi-structural stand conditions, and greater species diversity. Currently, the project areas support dispersal habitat for spotted owls; however, in the

long-term, late-successional habitat conditions would improve within stands and across the landscape. Further, the proposed action would maintain dispersal habitat within and between known owl sites and LSR. Therefore, the proposed action would not contribute to cumulative effects to spotted owls.

BLM Special Status Species and Survey and Manage Species

The proposed action would not contribute to cumulative effects to any Special Status or Survey and Manage Wildlife species. Habitat within the project areas is low quality due to young age classes, dense stands, and a lack of important habitat elements required for suitable Special Status/Survey and Manage wildlife species habitat. A high percentage of similar habitat in the vicinity 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 proposed units or adjacent untreated stands under BLM management. Stand conditions and structural complexity would improve as canopies close and thus improve habitat quality for mid to late successional wildlife species.

Migratory and Resident Birds

No cumulative effects to birds are expected. The proposed action would not reduce the persistence of any bird species in the watershed or populations at the regional scale. Habitat changes resulting from the proposed action 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 would have the potential to improve habitat for bird species as these stands reach maturity, resulting in greater bird species diversity.

Big Game

No adverse cumulative effects to big game species populations are expected. The proposed action 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. Variable density thinning, including low density thinning areas, is expected to improve the quality of forage and cover both in the short and long term.

3.8.2.2 Action Alternative – Regeneration Harvest

The forest stands which include the 65 acres of regeneration harvest comprise the Bent Beekman block (see Table 1) of the SMBT project.

Habitat Structure, Snags and Coarse Woody Debris:

Regeneration harvest would convert 65 acres of mature forested habitat in the Crabtree Creek Watershed to open early-seral stage habitat. This conversion would adversely affect late-successional associated wildlife species such as the spotted owl. Late-successional habitat conditions in the regeneration harvest units would not be achieved again until the stands developed in size, (estimated to be 70 to 80 years). The adverse effects of regeneration harvest on wildlife habitat include:

- Removal of canopy cover;
- Loss of standing snags;
- Reduction of understory and ground cover vegetation;

- Fragmentation of remaining late-successional habitat; and
- An overall loss of habitat diversity and complexity.

The conversion of this habitat would positively affect early-successional associated species including some Neotropical Migratory birds and foraging big game species such as deer and elk. In the short term, there would be an increase in herbaceous vegetation, deciduous shrubs and early-seral habitat.

Snag densities and CWD levels would approach NWFP standards in one to three decades, with snag and CWD creation. Management direction for the Matrix LUA is to provide a renewable supply of snags and down logs well-distributed across the landscape (RMP pp. 21, 25, 47). Additional green trees over and above the six to eight required would be left to compensate for snag deficit conditions and loss of up to 90 percent of snags in the harvest units. Some (up to four per acre anticipated) of these retained green trees may be killed and/or knocked over incidental to logging operations and prescribed fire or windthrown during the first years after harvest. In the long term, green tree retention, followed by incidental and intentional snag and CWD recruitment, would introduce snag and CWD features and increase stand structure for the future life of these stands.

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 strength and likelihood of remaining standing after operations are complete increases geometrically with increasing diameter. Shorter snags with less decay also remain intact in higher percentages than tall, unstable and/or decaying snags. Overall, based on casual observations of regeneration harvest units completed 10-20 years ago it is likely that a relatively high percentage of sound snags larger than 15 inches diameter would remain standing, but BLM has no data or recent experience with regeneration harvest on which to base precise estimates.

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. Loss of snags would be a loss of existing habitat features for primary excavators (woodpeckers), and secondary cavity users, such as some songbirds, bats and small mammals within the harvest units. Since most of the vegetation would be cut around the remaining snags, they would be more exposed in an open environment.

Broadcast burning for site preparation could result in the loss of additional snags, depending upon the timing and intensity of the burn. Decayed wood is receptive to embers during prescribed fire so some snags may need to be felled to prevent holding fire into the dry season. Some damage to green trees left for recruitment of snags and down CWD would occur. Some trees (up to four per acre anticipated) may die as a result of broadcast burning, which would contribute to snags and CWD in the future life of the stand.

Any snag felled or that falls incidental to operations would be retained on site as down wood. Smaller diameter down logs would generally be partly or completely burned up during site preparation. Down wood which is larger than 20 inches diameter at the large end and longer than 20 feet would meet management direction for coarse woody debris (CWD) and would

generally remain intact and in place following site preparation but with some degree of charring. 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).

Microhabitat drying and direct impacts to existing snags and CWD due to logging and site preparation activities would be anticipated within and, to a lesser extent, around the perimeter edge 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 3 to 5) would persist as the canopy closes and contribute to forest-floor wildlife habitat conditions for many decades before becoming unrecognizable as down logs.

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

Northern Spotted Owl - Federally Listed Species

Refer to Table 23 for a summary of the regeneration harvest alternative (Bent Beekman) and its effects on spotted owl habitat. In the long term, 65 acres of suitable habitat in the Crabtree Creek Watershed would be removed as a result of regeneration harvest and converted to young early-seral stage capable habitat (Table 4 definitions).

No Incidental Take of spotted owls associated with the site is anticipated to occur and the regeneration harvest alternative is in compliance with the new Final Recovery Plan for the Northern Spotted Owl (USFWS, 2011). The alternative action May Affect and is Likely to Adversely Affect (LAA) spotted owls.

Overall habitat conditions within 1.2 miles of the Snow Peak spotted owl site center would not change as a result of regeneration harvest, because units 8A/C are outside the provincial home range radius. The Snow Peak known spotted owl site was analyzed and found to have approximately 1,541 acres (53 percent) of suitable habitat on BLM lands within 1.2 miles of the site center. This exceeds the 40 percent threshold for suitable habitat coverage within the 1.2 miles provincial home range radius which research suggests is likely necessary for maintaining spotted owl life history functions (Bart and Forsman 1992; Bart 1995; Forsman et al. 2005). These levels of suitable habitat coverage suggest that the Snow Peak site is viable for nesting spotted owls (CCWA, p. 7 – 4). It is probable that the contiguous habitat in this area is used, which includes Unit 8A, but spotted owls have never been confirmed to be nesting and no nest tree has been found for this site.

In the short term, seasonal restrictions on habitat modification activities (felling, yarding, burning, and road building) would minimize the risk of disturbance to any unknown spotted owls during the critical nesting season. This would delay habitat modification activities later in the nesting season when spotted owls are less sensitive to disturbance. When logging does occur, disturbance may have temporary effects on the presence or movement of spotted owls. Suitable spotted owl habitat conditions in the regeneration harvest units would not be achieved again for 70 to 80 years.

Table 23: Spotted Owl Habitat Modification by Treatment Type, Land Use Allocation, Pre/Post Treatment Habitat Type, Habitat Modification Type, and Effect Determination.

5th Field Watershed	Project	Twp., Rge., Sec.	Proposed Treatment[1]	Acres	LUA[2]	Pre/Post Treatment Habitat Type[3]	Habitat Modification[4]	Effect[5]
Crabtree Creek	Action Alt., Bent Beekman	11S-2E-7,8	Regeneration Harvest	65 ac	Matrix, GFMA	Suitable/Capable	Remove	LAA

See Table 21 for notes and definitions.

Johnson's Hairstreak - Bureau Sensitive Species

Potential effects on Johnson's hairstreak are anticipated to be very slight because the species is more likely to be present in adjacent old-growth stands that have a high incidence of dwarf mistletoe in the western hemlock than to be present in these stands which have only a minor component of western hemlock. The proposed regeneration harvest would reduce the amount of hemlock dwarf mistletoe in the stand, limited to individual Western hemlock trees. Hemlock dwarf mistletoe is very persistent and virtually impossible to eliminate without aggressive clear-cutting (Hawksworth and Wiens 1996), would persist in nearby stands after treatment and would return to these units within about 60 years as western hemlock becomes established in the understory and becomes infected with mistletoe.

Cascade Axe Tail Slug - Bureau Sensitive Species

Presumably, changes in microclimate caused by canopy removal would result in microhabitat drying within and around the perimeter of the proposed units, resulting in adverse effects. BLM anticipates that these potential adverse effects would be very slight because no Cascades axe tailed slugs were located during two protocol surveys conducted during the fall of 2013 and the spring of 2014 and because green tree retention and down wood would provide some refuge for this species and increase the probability of its persistence if it is currently present in these stands.

Red Tree Vole - Survey and Manage Species

The two known red tree vole nests found in the vicinity would be protected from logging and site preparation operations by the habitat reserves established around their nests. There would be a loss of 65 acres of suitable red tree vole habitat in the Crabtree Creek Watershed as a result of regeneration harvest. Suitable habitat is defined as late-successional forests, but red tree voles are found in younger stands. In the short term, undetected nest sites within the project area units could be damaged or destroyed during logging activities. Green tree retention, concentrated on leaving old growth remnants and large diameter trees, would provide refugia.

Bats - Species of management concern

There would be a loss of 65 acres of early-mature seral habitat preferred by some bat species, and a loss of up to 90 percent of the existing snags within the proposed units 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. Regeneration harvest and aggregated green tree retention would create open areas and edges.

Bats appear to be active and foraging in both regeneration units and intact forest depending on the specific habitat requirements of each species, so some species would be negatively affected

by the loss of mature forest habitat and snags while other species would benefit from the edges and open areas created by regeneration harvest.

Migratory and Resident Birds - Species of management concern

There would be some unintentional take of birds, eggs and nestlings and some nesting failure due to falling and yarding operations. BLM expects this unintentional take to be minimal because the seasonal restrictions (March 1 – July 15 for owls and April 15 – July 31 for migratory birds) would prevent habitat modification during the season when >90 percent of individuals and >90 percent of bird species complete their breeding cycle in the Pacific Northwest (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 be expected to 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. In the long term, 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. Edge species are likely to increase in abundance in forest leave patches because of the increase in edge habitat (Beese and Bryant, 1999; Chambers et al. 1999).

Bird diversity in the Pacific Northwest conifer forest 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.

Big Game

There would be a loss of 65 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. An increased vegetative response would be anticipated as a result of burning. This initial flush of vegetation would last up to three years and would be expected to further increase the quantity and quality of the forage. 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 BLM lands in the watershed and that the early successional habitat on private industrial timberlands in the watershed is generally poor quality.

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 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 stand.

Cumulative Effects

Late-Successional Habitat

The alternative action, including regeneration harvest and other planned projects in the foreseeable future, would retain more than 15 percent of late-successional habitat on federal lands after implementation (NWFP p. C-44; RMP p. 25). The proposed regeneration harvest is located in the Crabtree Creek 5th field watershed (CCW) where approximately 36 percent of the federal lands are late-successional forest habitat (CCWA, p. 5 - 7). 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 amount of late-successional forest habitat on federal lands in the Crabtree Creek 5th Field Watershed (CCW) after completion of the proposed 65 acres of regeneration harvest would be 35 percent, which is above the 15 percent management direction (NWFP p. C-44; RMP p. 25). Regeneration harvest of 65 acres of the 6,409 total federal acres of late-successional forest in the watershed would leave 99 percent of the existing late-successional habitat for the foreseeable future (5 years timber sale planning cycle). 290 acres of regeneration harvest have been implemented on BLM land in CCW since the inception of the NWFP in 1995. Approximately 2000 acres of thinning planned on federal lands in the project vicinity in the foreseeable future would occur in younger age classes and would not affect the amount or distribution of late-successional habitat in the watersheds.

Non-federal lands in the CCW would not contribute to late-successional habitat in the future. Most of the non-federal lands in the watershed are private industrial forest lands managed under the Oregon Forest Practices Act and are expected to be managed on a rotation which would never reach stand ages necessary to attain late-successional conditions. BLM anticipates that most or all non-federal late-successional forest stands in the watershed will be harvested within 20 years.

Within the Crabtree Creek 5th field watershed, the regeneration harvest included in the alternative action is located in the 25,128 acre Middle Crabtree Creek 6th field subwatershed basin (SWB). 6,207 acres of the SWB (25 percent) are managed by the BLM, including 1,817 acres of late-successional habitat (29 percent of BLM lands, 7 percent of the SWB). 65 acres of regeneration harvest would reduce the late-successional forest on federal lands in the SWB by four percent, to 21 percent of federal land in the SWB. All 290 acres of regeneration harvest in the CCW since 1995 were in this SWB.

Within the Middle Crabtree 6th field SWB, the 65 acres of proposed regeneration harvest is located in the 3,766 acres Rock Creek 7th field sub-basin. 1, 212 acres (32 percent) of the Rock Creek sub-basin are federal lands managed by the BLM, including 800 acres (66 percent of federal lands) of late-seral forest stands. 15 percent of federal lands in Rock Creek are mid-seral and 19 percent are early-seral. 65 acres of regeneration harvest would reduce the late-successional forest on federal lands in this sub-basin by eight percent, to 62 percent of federal land in the sub-basin. 141 acres of regeneration harvest have been done in this sub-basin since 1995.

There would not be any additional increases in open road densities due to the regeneration harvest alternative compared to the proposed action.

Remnant Trees, Snags and CWD

No discernable impacts to populations of species which use remnant trees, snags and CWD would be expected from additional cumulative impacts to these habitat components from the action alternative. These habitat components are most abundant in late-successional habitat, so cumulative effects to these components closely follow the cumulative effects to late-successional habitat. Since approximately 99 percent of the late-successional habitat on federal lands in CCW would remain intact, potential negative cumulative effects to these components would be expected to be most impacting at smaller scales. In the Rock Creek sub-basin where the regeneration harvest alternative is proposed, >65 percent of the remnant trees, snags and CWD would remain intact in section 7 and >83 percent in section 8, the two sections containing proposed regeneration harvest units.

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

The action alternative, including regeneration harvest of 65 acres in the Bent Beekman block of the Sunday Morning Belly Twister 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 sufficient late-successional habitat would remain at the site-specific scale, SWB scale, the watershed level, the provincial scale, and the regional scale to support populations of these species.

Northern Spotted Owl - Federally Listed Species

The removal of 65 acres of suitable habitat contiguous with the Snow Peak owl site could contribute to cumulative effects to spotted owls because it is likely that the suitable habitat in the project area has been used by the spotted owls associated with the Snow Peak site. BLM expects the degree of impact to be low because the 1.2 miles provincial home range radius is the standard scale for analyzing cumulative effects to the spotted owl (2014 BA pp. 7-8; 2014 LOC pp. 13-14) and the project is outside of this radius for the Snow Peak site.

The proposed project would have minimal effects on spotted owl dispersal because the area is not critical and offers limited value dispersal habitat due to scattered federal ownership (CCWA p. 7 – 4). East of the project area the North Fork Crabtree SWB directly connects to the large LSR/wilderness network; this is where the majority of dispersal between KOSs in the Cascades Range takes place (CCWA p. 7 – 4). To the West is the Willamette Valley margin with patchy federal ownership and the valley itself which creates a barrier to dispersal.

The Bent Beekman Project Area is not located in Recovery Action (RA) 10 or RA 32 habitat according to the Revised Recovery Plan (RRP 2011).

Bureau Sensitive/ Survey and Manage/Species of Concern

The action alternative would not contribute to cumulative effects to Bureau Sensitive species, Survey and Manage species or species of concern. Local effects and potential cumulative effects correspond to the effects analyzed above for late-successional habitat since late-successional forests are their primary habitat. After harvest the CCW would have approximately 35 percent of federal lands in late-successional forest, which is above the late-successional habitat management direction of 15 percent after implementation (NWFP p. C-44; RMP p. 25). Therefore the proposed regeneration harvest would occur in compliance with the NWFP and RMP.

Migratory and Resident Birds

At the various watershed levels analyzed and at the regional scale, the action alternative would not reduce the persistence of any priority bird species so there would be no discernable cumulative effects to those species**.** At the local level, limited to the Bent Beekman block, habitat fragmentation would occur and priority species which prefer closed canopy forested habitat would be affected. At the same local level, other priority species which prefer early successional habitat and open areas and edges would benefit from regeneration harvest of mature forest. Analysis shows that early successional habitat is lacking on BLM lands in the watershed and that early seral habitat on non-federal lands in the watershed is typically not of high quality.

Big Game

At the various watershed levels analyzed, the proposed action would result in minimal cumulative effects. As a result of the regeneration harvest of 65 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 85 percent of the mature forest cover would remain intact.

3.8.2.3 No Action Alternative

Habitat Structure, Snags and Coarse Woody Debris:

The majority of the stands in the project area have low vigor and small crowns. Self-thinning would occur, but snags and down logs created by suppression mortality would not be large enough to meet RMP management direction until later in the life of the stand (approximately 20 to 60 years) when suppressed co-dominates achieve these diameters before dying. No CWD creation would occur, and CWD development would occur over a longer period through self-thinning. Understory and ground cover development would establish more slowly as self-thinning occurs, or until a disturbance such as fire or wind throw removes over story trees, allowing light to reach the forest floor. Late successional habitat conditions would develop slowly; these stands would maintain low species and vertical diversity for 20-60 years.

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

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 Affected Environment and would develop slowly for the reasons stated above. In unthinned areas that are currently dispersal habitat, it would take approximately 30 to 60 years to develop suitable habitat conditions if left untreated. Currently units 8A and 8C are marginally suitable and these units would not be downgraded, and they would slowly improve under the no action alternative.

BLM Special Status Species and Survey and Manage:

In the short term, there would be no immediate change in current habitat conditions for Survey and Manage and BLM 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. The amount of dwarf mistletoe in these stands would steadily increase, and marginal habitat for Johnson's hairstreak would remain unaffected. Since no new disturbance to the conifer canopy would occur, no undetected red tree vole nests would be affected. Optimal habitat for Johnson's hairstreak and the red tree vole would develop more slowly without thinning, and stands would remain as closed mid seral stands until self-thinning or disturbance such as fire occurs.

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 reflect the simple single storied mid seral stages 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.

Big Game

In the short term, there would be no disturbance effects due to the proposed action. 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 gradually decrease as overstocked stands mature, hindering mobility. Forage quantity would continue to decrease as less light reaches the forest floor.

3.9 Air Quality and Fire Hazard/Risk

Source Incorporated by Reference: Mortensen 2014, Cascade Resource Area Fuels Specialist Report, Sunday Morning Belly Twister Project (Fuels Report)

3.9.1 Affected Environment

Air Quality

The major source of air pollutants within the SMBT analysis area is smoke associated with resource management activities including prescribed burning (broadcast, hand, machine, and landing piles), fossil fuel combustion and dust from the use of natural-surfaced roads.

The State of Oregon has designated the Willamette Valley as a Smoke Sensitive Receptor Area. The Willamette Valley experiences periods of air stagnation where cold air often becomes trapped near the valley floor with slightly warmer air aloft, creating conditions known as temperature inversions. These conditions result in trapping and concentrating air pollutants near the ground. Wintertime temperature inversions contribute to high particulate levels, often due to wood burning for home heating and fossil fuel combustion. Stagnant periods contribute to increases in ozone levels, causing the local air quality to deteriorate.

Fire Hazard/Risk

The climate in Northwest Oregon is considered mild and wet in late fall, winter and early spring. In the Oregon Cascade Mountains, snowfall accumulation remains at higher elevations (~2,500^{+} feet) for an extended period of time, but does not persist for long periods at lower elevations. Summers are warm with periods of dry weather during the months of July, August, and September. Summer mean temperatures during this period average approximately 55°- 60°F for lows and highs of 75° - 80° F. Extreme high temperatures reaching into the mid to upper 90's, and occasionally topping 100° F are common, but infrequent and occur for short durations. During average weather years, the conditions under the forest canopy remain relatively moist.

Fire is a natural disturbance process in the analysis area, especially on the southern slopes located within the Crabtree Creek and Thomas Creek watersheds. Fire effects are influenced by habitat type, fire frequency, fire duration, and fire intensity (Van Wagner 1965). These effects vary with forest type, depending on fuel type, structure, topography, and weather. Fire can influence; vegetation composition, age, and structure, successional pathways; nutrient cycling; fish and wildlife habitat and insect and disease vulnerability.

Wildfires within the project area have been primarily human-caused. Wildfire risk from humans within the project area is higher than compared to lightning. Dry lightning (lightning that that has no accompanying moisture) is uncommon in Northwest Oregon. The project area is located within two different Oregon Department of Forestry management areas. Approximately 60 percent of the project area is located within the Oregon Department of Forestry's Northwest Oregon Area - North Cascades District - Santiam Unit. Over the last ten years an average of four fires per year are attributed to lightning while twenty fires per year are human caused. The average size of lightning fires is approximately three quarters of an acre while the average size of human caused fires is approximately forty acres in size. The rest of the project area is located within the Oregon Department of Forestry's Southwest Oregon Area - South Cascades District - Sweet Home Unit. Over the last ten years an average of one fire per year is attributed to lightning while twenty fires per year are human caused. The average size of lightning fires is approximately one hundred seventeen acres. The average size of human caused fires is approximately nineteen acres in size (ODF, 2013). The difference in the size of the lightning fires between the two ODF Districts over the last ten years is attributable to the occurrence of several large fires that burned in the South Cascades District in 2006.

The overstocked stands in the project area could sustain a high intensity crown fire because of the amount of potential ladder fuels and the available fuel density in the canopy (canopy bulk density). Relative density above 35-45 percent is associated with a canopy bulk density which could sustain a high intensity crown fire (Agee, 1996). The average relative density of the forest stands within the project area is approximately 63 percent (see EA section 3.4, Vegetation).

Fire Regime and Condition Class (FRCC)

The SMBT project vicinity occurs within the Pacific Northwest Forested landscape and potential natural vegetation groups in the area are Douglas-fir-western hemlock (dry mesic), and Douglas-fir-western hemlock (wet mesic). The Fire Regime classifies the role fire would play across the landscape in the absence of recent human intervention. The area falls within two different Fire Regimes:

- Fire Regime III is characterized by a moderate to low fire return interval with a mixed severity and is associated with south and west facing slopes. More than 75 percent of fires are characterized as mixed or low severity.
- Fire Regime V is characterized by a low fire return interval with a high severity and is associated with north facing slopes. More than 70 percent of fires are characterized as stand replacement.

The Condition Class classifies the degree of departure from the natural fire regime. The timber stands in the analysis area generally fall within Condition Class 2 or 3. Forest management on both public and private lands in the SMBT area has altered the natural forest composition and structure and created large tracts of even-aged, overstocked stands, young plantations and clearcuts.

- Condition Class 2 indicates that fire regimes have been moderately altered from their historical range.
- Condition Class 3 indicates that fire regimes have been substantially[32] altered from their historical range.

Timber Stand and Fire History

Fire does play a major role as a natural disturbance agent, as do people. The pre-settlement fire history of the SMBT analysis area is not well documented, although it is known that Native Americans burned within the Willamette Valley, to what extent this burning extended into the Cascade foothills and up the river corridors is not specifically known. Post-settlement fire history in the analysis area does not document any wildfire occurrence. In Section 35 of the analysis area the 1955 aerial photo shows a very irregular disturbance pattern with many larger trees, and with scattered clumps and individual remnant trees, buckskin logs, and snags. The area was harvested in the late 1930's and early 1940's but the amount of Decay Class 4 & 5 wood on the ground could indicate that a wildfire might have occurred during the early 1900's.

In late August, 2006, lightning storms tracked a line from the south and ran north up the divide between Quartzville Creek and the Middle Santiam. The storm started 17 fires all of which were contained quickly except for two blazes. The Boulder Creek and Rocky Top # 5 fires grew in size and complexity in old growth timber on steep inaccessible terrain. On BLM managed land the Boulder Creek Fire burned 63 acres and the Rocky Top # 5 fire burned 28 acres. Later the same year, in September, 2006, the Middle Fork Fire burned approximately 1170 acres of which approximately 280 acres were located on BLM managed land. These fires were within fifteen miles of the SMBT project area.

[32] The original description for condition class 3 uses "significantly", which has a specific meaning in NEPA that is not intended in the context of the model.

Past forest management has shaped the analysis area. Many of the proposed harvest units were previously harvested between the 1940's and 1980's. In addition, many areas adjacent to the analysis area on private timber land have also been harvested during this time to the present. Harvest areas on BLM managed land during this period often had been broadcast burned or had spot burning associated with them. Burning primarily occurred for site preparation prior to tree planting but also to reduce the fuel load and limit the potential of a future wildfire.

The average fire return interval has increased following the advent of fire suppression in 1910. It has been decades since the most recent man-caused disturbance (logging) occurred within the analysis area. Although fire has been excluded from the landscape by aggressive fire suppression the analysis area is still within the range of a normal fire return.

3.9.2 Environmental Effects

3.9.2.1 Proposed Action

Air Quality

An increase in vehicle traffic would occur over access roads during the implementation of this project. The increases would be considered short-term while the project is implemented. Fossil fuel combustion and dust created from vehicle traffic from proposed project activities on gravel or natural-surface roads would contribute short-term (during project work) effects to air quality. These effects would be localized to the immediate vicinity of the operations.

The overall effects of smoke on air quality is predicted to be local and of short duration. Activities associated with the proposed action would comply with the provisions of the Clean Air Act. All prescribed fire burning would be done in accordance with the Oregon State Implementation Plan and Oregon Smoke Management Plan. The potential for smoke from prescribed fire to intrude into Smoke Sensitive Receptor Areas (SSRA) is low because burning would be done when the prevailing winds are blowing away from SSRA and under atmospheric conditions that favor good vertical mixing so that smoke and particulate matter is dispersed by upper level atmospheric winds.

Approximately 150 acres could be treated with prescribed fire, removing and burning approximately 40 tons of slash per acre, or 6,000 total tons. Prescribed burning would cause short-term impacts to air quality that would persist for one to three days within one-quarter to one mile of the project units. None of the proposed treatment units are close enough to public highways to affect motorist safety.

Fire Hazard and Risk

All treatment areas would see a short-term (0-5 year) increase in fire ignition potential because of the increase in fine dead fuels. Following thinning the fuel load and risk of a fire start would increase and would be greatest during the first year following treatment when needles dry but remain attached to tree limbs. The ability to control a fire would decrease during this period as a result of the proposed action. The modeling predictions for fire behavior (Anderson, April 1982) based on the National Fire Danger Rating System (NFDRS) fuel models would move the commercial thinning and low density thinning areas from a Fuel Model 8 (Closed timber litter) to Fuel Model 11 (Light logging slash), or Fuel Model 12 (Medium logging slash).

Thinning trees would decrease both the amount of potential ladder fuels and the canopy bulk density in the project area because the silvicultural prescription would lower the relative density

to approximately 34 percent. A relative density of 35 - 45 percent or lower has been identified as the point where canopy bulk density is unlikely to sustain a high intensity crown fire (Agee, 1996). The silvicultural prescription for all of the units in the analysis area falls within or below this range.

Following treatment containment of wildfires at less than 10 acres in size should continue to be attainable and the ability to successfully control wildfires in the fuels treatment areas would remain high. For the short-term (0-5 years), the fire risk would increase in all of the thinned areas, however due to decreased crown density and reduction in ladder fuels fires would be expected to remain as ground fires which can be successfully controlled. Decreasing fuel loading in strategic locations such as along roads and property lines would reduce the potential for human caused fire starts and would provide fuel breaks with lower fire intensity, rates of spread and flame lengths where fire can be successfully controlled by initial attack resources. The Oregon Department of Forestry has responsibility for fire protection on BLM managed land in western Oregon.

Cumulative Effects

There would be no cumulative effects to air resources, as the direct and indirect effects from the projects would be local and of short duration. No other effects in the project areas affecting this resource are anticipated. Based on past experience with broadcast burning, and pile burning within this habitat type and adherence to smoke management plans, there are no expected cumulative effects on air quality from the planned fuels treatment under this proposal.

There would be an increase in fuel loading and resultant fire hazard in the short-term (0-5 years). In the commercial thinning area, density management area, regeneration harvest area, along roads and property lines, and in gaps, the hazard and risk of fire would be minimized by the use of fuels reduction treatments. The localized increase in fire risk would diminish over time as slash decomposes. There would be positive benefits to the thinned stands in the longer term due to the wider spacing between tree crowns and the removal of most of the ladder fuels that are conducive to the spread of fire into the tree canopy. At a watershed scale, the commercial thinning, density management, and regeneration treatment of approximately 1500 acres of forest habitat would have very little effect on fire intensity or starts. However, due to reduced canopy density and ladder fuels, the potential for the stand to carry a crown fire would be reduced in the long term (>5 years).

3.9.2.2 Action Alternative – Regeneration Harvest of 65 Acres

The air quality and fire hazard/risk effects and cumulative effects of 1435 acres of commercial thinning and fuel reduction within those units would be identical to the same acres in the proposed action.

Approximately 210 acres could be treated with prescribed fire: approximately 145 acres in commercial thinning units and 65 acres of broadcast burning in the regeneration harvest units. This would remove approximately 40 tons of slash per acre or approximately 8,400 total tons from the highest risk areas within the project.

Regeneration stands would move from a Fuel Model 8 (Closed timber litter) to Fuel Model 12 (medium logging slash) immediately after logging. Ignition potential would increase in the short-term (0-5 year) because of the increase in fine dead fuels and then would drop to very low

potential when broadcast burned and remain low for many years until growing vegetation creates a new fuel load.

There would be no cumulative effects to air resources from broadcast burning because the direct and indirect effects would be local and of short duration. There would be no cumulative effects to fire hazard and risk because the reduced potential for ignition and wildfire after burning on 65 acres would have no discernable effect on fire intensity or starts at a watershed scale.

3.9.2.3 No Action Alternative

Air Quality

Effects of vehicle exhaust and dust from vehicle traffic on gravel and natural-surface roads in the SMBT area would continue at approximately the current levels since current traffic patterns would likely continue. These effects would be minor and localized to the immediate vicinity.

No regeneration harvest, commercial thinning, density management, road construction or road renovation, log hauling, or prescribed burning would occur so there would be no additional localized effects to air quality from management operations.

High stocking density would cause these forest stands to become more susceptible to a stand replacement fire event due to fuel loading and ladder fuels. In the event of a wildfire, poor air quality would be expected due to the high volume of smoke produced, potentially for several days to weeks.

Fire Risk

Vegetation growth in the analysis area would continue on its current trajectory. The current risk of a fire start would remain low. There would be a slow increase in the coarse woody fuel load (1000 hour fuel class) and in the smaller size fuel classes, (1, 10, and 100 hour fuels) in these timber stands as mortality within the stands increases. Ladder fuel densities would increase as additional trees become suppressed and die in the understory, shade tolerant species become established, and dominant trees increase in size. 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.

3.10 Recreation, Visual Resources and Rural Interface

Source incorporated by reference: Meredith 2014, Sunday Morning-Belly Twister Rec/Rural/Visual Resources Specialist Report (Recreation Report).

3.10.1 Affected Environment

Access

Access to most of the Belly Twister and Bent Beekman blocks is open to the public via the Neal Creek Access Road (Road 10-1E-23). Access to most of the Sunday Morning block is via gated private roads, which are generally closed to the public.

Recreation

The project area is within a forest setting accessed by gravel roads. Evidence of man-made modifications (roads, timber harvest activities, utilities, buildings, houses) is visible from both private and public lands within or in the vicinity of the project areas. No developed or

designated recreation sites, trails, or trailheads are within or within 8 miles of the project area on BLM-administered lands. Any trail is unauthorized with no protection from implementation of the proposed action. A hiking trail, apparently user-created, utilizes the 11-2E-5.2 road terminating at the top of Snow Peak and provides views from the peak.

Dispersed recreation activities that occur in the area include off-highway vehicle (OHV) riding, equestrian riding, hiking, hunting and associated camping, target shooting, driving for pleasure, and special forest products harvest.

Designations

There are no eligible, designated, or suitable Wild and Scenic Rivers (WSR) within or near the project area. The North Santiam eligible WSR is nearly 9 miles north of the project area. Quartzville Creek WSR is just over 9 miles to the southeast in Township 11 South, Range 3 East; Quartzville Creek Back Country Byway parallels the WSR. There is no designated wilderness or lands containing wilderness characteristics within the project area.

Visual Resources

Ninety-one percent of the project area is in Visual Resource Management (VRM) class 4, which allows high levels of change to the landscape. Nine percent is in VRM class 3, which allows moderate levels of change to the landscape. Timber management operations near or adjacent to the project areas are observable from private and public lands and major roads; various age classes of trees are visible. The intermixed land ownership pattern between public and private lands greatly limits the BLM's ability to manage the project areas as a contiguous view shed.

Project units, which are not adjacent to major roads, are in the distance when looking from public travel routes, and may not be observable since the rolling mountains, remaining trees, and vegetation block the view. Using viewshed analysis, which calculates if a raster cell's visibility from a point on the earth's surface; approximately 404 acres of the proposed project is visible from points used in the analysis (see map 1). Units 8B, 15B, 35A, and 35 B are not visible from viewshed points. Although a portion of unit 8A shows as visible, no portion of the regeneration harvest portion is visible from those same points (see map 2).

For the most part BLM-administered lands are unidentifiable from other lands when looking at the landscape from any vantage point, except when private forest land owners have clearcut their holdings to BLM property line. Traffic speeds reduce the time any unit is visible from a distance while slower forest road speeds allow units to remain in view. No special visual features or specific concerns were identified in scoping.

Rural Interface Areas (RIAs)

Units 17B, a portion of 17 A, and 27A totaling approximately 65 acres, are located within a rural interface zone as defined in the Salem District Resource Management Plan (p. 39).

The haul route would pass homes in Township 10 and 11 South, Range 1 East along the Snow Peak Road, Island Inn Drive, Fish Hatchery Drive, Tree Farm Road, O K Howard Road, Lulay Road, and various county roads leading to State highways and mill sites. These roads have historically experienced log truck traffic.

In general, the concerns of property owners near timber harvest and hauling activities tend to be associated with noise, traffic, and dust from logging and hauling activities, effect to scenic, water

and wildlife values, increased public access that may lead to problems with fire hazard, garbage, dumping, and vandalism.

OHV Designation and Use

Off-highway vehicle (OHV) usage of the project area is restricted to existing roads and designated trails. The primary OHV classification of this area is Limited to Designated Roads. No designated OHV trails are within the project area. The majority of BLM side roads in the area are closed by gates or earthen berms to block vehicle access and private roads are closed by gates. The Snow Peak area, specifically in section 5 adjacent to the Neal Creek Access Road, has a history of unauthorized OHV use and abuse and there have been several BLM actions to close and rehabilitate unauthorized roads and OHV trails over the last two decades.

3.10.2 Environmental Effects

3.10.2.1 Proposed Action

Access

The proposed action would not change access to the area except for road occasionally being blocked by operations for short periods and increased log truck traffic during the three year contract period.

Recreation

Dispersed recreation use within the proposed units would be moderately restricted for a few weeks at each location within approximately three to five years during timber harvest and associated management activities such as final road maintenance and prescribed burning. Access would be restricted primarily for safety and affect only units with active operations and only for the time when operations are ongoing. Recreation visitation should return to prior usage upon completion of activities. Other BLM lands nearby would remain available for recreational opportunities. Recreational users in the vicinity would hear the noises of the timber operations and may experience traffic delays of minutes to hours or lack of access for safety reasons. Tree removal from the proposed units would leave the undergrowth vegetation crushed. Most undergrowth vegetation would return within five years.

The first quarter mile of the 11-2E-5.2 road, used for a hiking trail to Snow Peak would be renovated and rocked for use during logging operations. That portion of the 11-2E-5.2 road would be closed to vehicle traffic after operations, but foot access to the non-designated hiking trail would continue to be available. The existing trail from the end of the logging spur road to the Snow Peak summit would generally remain in its current condition, although some disturbance from logging operations may occur near the end of the road.

Areas where public access is restricted by private gates would still be unavailable for recreation and the project would not change recreational use.

Visual Resources

The proposed action of commercial thinning would comply with VRM Class 3 and 4 Management Objectives. Commercial thinning would not significantly alter the visual character of the project area. Some short-term disturbance would be observable in the foreground, but a forested setting would be maintained. The disturbance to the stand would be less observable within five years as vegetation returns to the site and the remaining stand continues to mature.

Visual disturbance of the project area would be associated with modifications to vegetation and other ground disturbing activities from timber harvest and road decommissioning operations. Evidence of harvest activities would fade as understory vegetation returns to a more natural appearance and the remaining stand continues to mature. A forest setting and most of the canopy would remain. Harvest activities would remove a portion 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 treatments would comply with State of Oregon smoke management regulations thus reducing the affect to visual quality to a few days, however leaving blackened burned blotchy areas where piles were located. Understory vegetation and the remaining trees would rebound, grow, and continue to green up covering logging debris and burn pile scars.

Rural Interface Areas (RIAs)

Rural interface areas present within the project area and residences along the haul route or in close proximity to timber harvest activities may hear equipment harvesting trees, noise from log truck traffic, experience dust from gravel road traffic, and experience delays for safety. Disturbance from this proposed timber harvest would be short-term lasting a few weeks to months. The proposed action would have no effect on rural interface zones other than increased log truck traffic and potential to hear harvest operations.

OHV Designation and Use

Harvest operations would obliterate any existing unauthorized OHV trails. Project design features for this project, including slash and logging debris on the ground and blocking potential access points for OHV, are expected to minimize the potential for off-road vehicle travel within the project area. No reconstruction of unauthorized trails would be planned or allowed. Where OHV trails circumvent prevention measures taken as part of this project soil damage and increased potential for human caused fire starts would be expected. In the future OHV trails would continue to be obliterated and restored under BLM's ongoing damaged lands restoration projects.

Cumulative Effects

This project would have minimal to no cumulative impact on recreational uses due to the availability of other dispersed recreation opportunities and that closures would be local and of short duration. The changes to the visual and recreational environment are unlikely to change the availability or nature of recreational opportunities in the vicinity in the long term (more than 3-5 years) on BLM lands.

Large scale timber harvest and road closures on the private industrial forest land intermixed with BLM lands in the project vicinity are likely to reduce the aesthetic values associated with dispersed recreation in the vicinity.

Where public access is limited by privately controlled gates, there would be no change to recreational opportunities.

3.10.2.2 Alternative Action – Regeneration Harvest of 65 Acres

Visual Resources

Regeneration harvest would comply with VRM Class 4 management objectives. The proposed regeneration harvest units, 8A & C, are not geometric shapes and conform to irregular

boundaries. The units are also not visible from viewshed points used in the visual analysis. The forested setting would be changed to open area with clumps of trees and individual trees scattered throughout the units. The area would be blackened immediately after burning with some dead trees serving as snags. Growing vegetation, including planted seedlings, would grow and hide most of the blackened ground and debris within approximately three years and would grow into a forested appearance again over the next three decades.

3.10.2.3 No Action Alternative

With the exception of unexpected changes (i.e. wildfire or disease), the proposed units would continue to provide a forest setting for dispersed recreation opportunities. Timber management activities and log truck traffic would continue on both private and public lands in the vicinity. No modifications to the landscape character of the project area would be expected to occur. Modifications to the landscape character in the area around the projects would still be expected, as a result of activities on other ownerships.

3.11 Cultural Resources

Sources incorporated by reference: Greatorex, F. Sunday Morning / Belly Twister Preliminary Culture Resource Report, 2014.

3.11.1 Affected Environment

One historic cabin site was located adjacent to unit 5A in SE¼SE¼ Sec. 5, T. 11 S., R. 2 E. This is the approximate location described by a local resident as "Cold Spring", a horse camp (personal communication, K. Walton and Len Neal). The site is in a highly degraded condition, with no standing walls. The remains of a stone hearth, notched logs, milled lumber with wire nails and non-diagnostic cans and broken bottles are associated with the site. The site has been recorded and photographed. Other previously recorded cultural properties were degraded to the point of being unlocatable.

3.11.2 Environmental Effects

3.11.2.1 Proposed and Alternative Actions

Since the site is outside of the proposed unit boundaries, no additional protection is needed. Cultural resources found in the future would be evaluated and protected as needed.

3.11.3 Cumulative Effects

No direct effects to cultural resources would be expected, therefore no cumulative effects would be expected.

3.11.3.1 No Action Alternative

Current status and trends would continue. The remaining wood would continue to decay and tin cans would continue to rust.

3.12 Review of Elements of the Environment Based On Authorities and Management Direction

Table 24: Elements of the Environment Review based on Authorities and Management Direction

Element of the Environment /Authority	Remarks/Effects
Aquatic Conservation Strategy	In compliance with PCFFA IV (Civ. No. 04-1299RSM), this project complies with the Aquatic Conservation Strategy described in the Northwest Forest Plan and RMP. This project also complies with the PCFFA II (265 F.3d 1028 (9th Cir. 2001)) by analyzing the site scale effects on the Aquatic Conservation Strategy. EA section 3.12.1 shows how the SMBT project meets the Aquatic Conservation Strategy in the context of the PCFFA cases. EA chapter 3 analyzes specific effects of the proposed actions.
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 (one burn period during implementation of prescribed fire). Addressed in Text (EA Section 3.9).
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 on this element because cultural resource inventories of the affected area have been conducted and management actions will avoid damage to cultural resources.
Ecologically critical areas [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because there are no ecologically critical areas present within the project areas. Addressed throughout the EA, see table of contents.
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 project 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 No fish species with Bureau Status are found within the project area. Timber harvest and connected actions in the project area effects on Essential Fish Habitat (EFH) as designated under Magnuson-Stevens Fishery Management Act are discussed in the text.
Farm Lands, Prime [40 CFR	The project would have no effect on this element because

Element of the Environment /Authority	Remarks/Effects
1508.27(b)(3)]	no prime farm lands are present on BLM land within the Cascades RA.
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 BLM lands as a result of this project.
Healthy Forests Restoration Act (Healthy Forests Restoration Act of 2003 (P.L. 108-148)	This project is in compliance with this direction because treatments would decrease the risk of stand replacement fire and help restore forests to healthy functioning condition (EA Section 3.4, 3.9)
Migratory Birds (Migratory Bird Act of 1918, as amended (16 USC 703 et seq)	This project is in compliance with this direction because treatments would restore natural resources that could degrade habitat for migratory birds. Addressed in text (EA Section 3.4, 3.8).
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 (EA section 1.8).
Noxious weed or non-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 decline in both number and vigor of invasive plant populations in the project area. Addressed in text (EA Sections 2.3, 3.4)
Park lands [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because there are no parks within or adjacent to the project area.
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 active parts of the project area during operations, and the projects would not create hazards lasting beyond project operations. (EA section 2.3, 3.10)
Threatened or Endangered	This project is in compliance with this direction because

Element of the Environment /Authority	Remarks/Effects
Species (Endangered Species Act of 1983, as amended (16 USC 1531)	there would be no adverse effects on Threatened or Endangered Species (EA Section 3.4, 3.8, 5.1).
Water Quality –Drinking, Ground (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. Addressed in text (EA Sections 3.5)
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 no wetlands are within the project area and adjacent wetlands would be protected by buffers except for less than two acres where cutting and removing selected trees would be done to retard conifer encroachment into meadows. (EA Sections 1.4.6, 2.3, 3.4, 3.8)
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 Wild and Scenic Rivers within or adjacent to the project area.
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 there are no Wilderness Areas or areas being considered for Wilderness Area status in or adjacent to the project area.

3.12.1 Compliance with the Aquatic Conservation Strategy

The Four Components of the ACS

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 ACS on the project (site) scale. The project complies with the four components of the Aquatic Conservation Strategy, as follows:

ACS Component 1 - Riparian Reserves: The project would comply with Component 1 by maintaining canopy cover along all streams and wetlands, which protect stream bank stability and water temperature. Stream Protection Zones (SPZ) would protect streams from direct disturbance from logging. Road and landing locations have been minimized in Riparian Reserves. Timber management proposed in the Riparian Reserves complies with the third exception: "Apply silvicultural practices for Riparian Reserves to control stocking…and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives." Addressed in text (EA sections 3.3.2-3.3.3)

ACS Component 2 - Key Watershed: The project would comply with Component 2 by establishing that the SMBT project is not within a Key watershed. (RMP p. 7).

ACS Component 3 - Watershed Analysis: The project would comply with Component 3 by implementing practices that contribute to meeting the following Terrestrial Recommendations (TR), Aquatic Recommendations (AR) and Social Recommendations (SR) from the CCWA, Chapter 7 and parallel recommendations from the TCWA (*EA sections 1.1, 1.3, 1.4, 2.3, 3.3, 3.4, 3.5, 3.6, 3.8*):

- TR1. Timber harvest should emphasize enhancement and restoration opportunities…Implement density management prescriptions to develop and maintain late seral forest stand characteristics…include larger trees for a large green tree component and recruitment of [snags and CWD] in future stands, multi-layered stands…
- TR2. …green tree retention for the recruitment and development of standing dead/down CWD and to contribute to the development of late seral forest stand characteristics.
- TR6. Coordinate management and protection around KOSs…
- AR1. Plan and implement riparian silvicultural project designed to accelerate growth of riparian conifers… (Note: AR1 focus is actually on stands closer to streams than allowed for this project since part of the purpose is to "improve potential for LWD recruitment". The project applies this principle to other portions of the Riparian Reserve.)
- AR2. …promote large conifer development in riparian areas through density management and thinnings. (See note above.)
- AR5. …replace culverts that do not meet 100 year flood standards…
- AR6. Comply with the Water Quality Restoration Plan for stream temperature (TMDL), which was not yet developed when the CCWA was written.
- AR7. Improve shade – project was designed to not reduce shade.

ACS Component 4 - Watershed Restoration: The project would comply with Component 4 by the combination of thinning and retaining unthinned areas in Riparian Reserves, so that the increased variety would further enhance terrestrial habitat complexity in the long and short term. Thinning would also be expected to result in long-term restoration of large conifers and the potential for material that would contribute to in-stream habitat complexity in the long-term.

The Nine Objectives of the ACS

Cascades Resource Area Staff have reviewed this project against the ACS objectives at the project or site scale with the following results. The No Action alternative does not retard or prevent the attainment of any of the nine ACS objectives because this alternative would maintain current conditions. The proposed action does not retard or prevent the attainment of any of the nine ACS objectives for the following reasons.

The Riparian Reserve treatments for proposed action and alternative action are identical, so the following analysis of the proposed action applies also to the alternative action unless specifically stated otherwise.

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.* Addressed in text (*EA sections 3.4, 3.5, 3.6*). In summary:

No Action Alternative: The No Action alternative would maintain the current trajectory of stand growth, understory growth, crown and canopy development, and natural recruitment of snags and woody debris (some portion of which may be large diameter) on all Riparian Reserve acres.

The extensive uniform stands would eventually develop diversity and complexity due to natural events and site factors over several decades. These natural events are not predictable and it is unknown how diversity and complexity would be distributed across the landscape within Riparian Reserves. There would be no management action to develop elements of diverse, complex watershed and landscape features faster than they develop naturally or to encourage wide distribution of these features across the landscape.

Proposed Action: The proposed combination of thinning from below in 18 percent of the Riparian Reserve stands in the project vicinity would result in forest stands that exhibit some desired attributes typically associated with stands of a more advanced age and stand structural development (larger trees, a more developed understory, and an increase in the number, size and quality of snags and down logs) sooner than would result from the No Action alternative. Maintaining unthinned areas in the other 82 percent (derived from data in EA Table 2) of the Riparian Reserve LUA would result in stands that continue to develop as described for the No Action alternative.

This mix of treated and untreated stands would immediately contribute to restoring watershed and landscape scale diversity and complex features by introducing some changes to the current uniformity. Several elements of complexity such as large tree crowns would continue developing faster than untreated areas for decades. Other elements of complexity such as understory development may or may not trend toward similarity after several decades. Treated stands, especially with follow-up treatment over the next few decades, would tend to develop fewer but larger snags and CWD during the next few decades and may tend toward similar characteristics as stands approach two centuries old.

The stream protection zones (SPZ) would provide undisturbed corridors for travel and provide resources for aquatic and riparian dependent plant and animal species.

The increased structural and plant diversity in Riparian Reserves across the landscape would provide resources for a wide variety of other late-successional associated plants and animals, and ensure protection of aquatic systems by maintaining and restoring the distribution, diversity and complexity of watershed and landscape features.

ACSO 2: *Maintain and restore spatial and temporal connectivity within and between watersheds.* Addressed in text (*EA sections 3.4, 3.5, 3.6, 3.8*). In summary:

No Action Alternative: The No Action alternative would have little effect on connectivity except that forest stands would continue to grow in the long term (several decades) within the affected watersheds.

Proposed Action: Both terrestrial and aquatic connectivity would be maintained, and over the long-term, as the Riparian Reserve LUA develops late successional characteristics, lateral, longitudinal and drainage connectivity would be restored. The proposed action would accelerate development of some types of stand structure in treated areas to increase habitat diversity across the watershed while maintaining connected forest stands throughout the Riparian Reserves.

ACSO 3: *Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.* Addressed in text (*EA sections 3.4, 3.5*). In summary:

No Action Alternative: The current condition of physical integrity would be maintained because there would be no management actions to change any of these features. The two culverts proposed for replacement would continue to be at risk for failure which could impact the physical integrity of the stream channels at those locations at an unpredictable time and to an unknown degree depending on whether the failure is gradual or catastrophic.

Proposed Action: The current condition of physical integrity would be maintained because there would be no timber harvest operations within SPZ which could change these features. The physical integrity of channels at existing stream crossings would be altered for one to several years following replacement of 36 culverts. In the long term, replacement of these culverts would prevent impacts to the physical integrity of these streams by eliminating almost all potential for failure. Within the road prism (estimated at 30 feet maximum width), the channel surface, banks and bed would be compacted (bulk density of soils increased by as much as 30 percent), vegetation would be disturbed or removed from the banks within the road prism, and the bed/banks would be reshaped and stabilized with woody debris and vegetation after use. Due to the stable nature of the channels and the low gradient and vegetation both up and downstream from the sites and that these stream crossings currently have culverts installed, little to no additional disturbance to channel morphology would be expected either upstream or downstream from the crossings. In addition, installing 11 new and replacing 15 cross drain culverts would reduce road-related inputs to streams.

ACSO 4: *Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.* Addressed in text (*EA sections 2.3, 3.5, 3.6*). In summary:

No Action Alternative: BLM expects that the current condition of the water quality would be maintained, unless an existing culvert fails, because no management actions would change things that currently contribute to water quality.

Proposed Action: Water quality would be maintained by retaining stream protection zones (SPZ) in the Riparian Reserve LUA to prevent measurable changes to sediment input from the slopes above the streams and prevent measurable effects on stream temperatures, pH or dissolved oxygen. Proposed new roads and road renovation would be done in places where there would be no increased hydrologic connection or sediment input into streams or riparian areas, except as described in the following paragraph.

Sediment transport and turbidity in the watershed is likely to increase in the short term as a direct result of replacing 36 culverts. Sediment increases would not be visible beyond 800 meters (0.5 mile) downstream from the culvert replacement sites, would be of low magnitude and short duration (hours to days), and would not be expected to affect fish, aquatic species or human uses. Over the long term (generally beyond the first season after culvert replacement, fully beyond 3-5 years), the risk of high level sediment inputs from catastrophic failure of the culvert would be reduced and current conditions/trends in turbidity and sediment yield would likely be maintained.

Log hauling would not be expected to visibly increase turbidity for more than a few hours, if at all, because project design features (PDF) to prevent sediment transport and to restrict use of unsuitable haul routes would prevent generating sediment would be implemented. Additional

PDF to immediately detect and correct any sediment transport that might occur would also be implemented. Any such sediment increases would be of low magnitude and short duration (hours), and would not be expected to affect fish, aquatic species or human uses.

ACSO 5: *Maintain and restore the sediment regime under which aquatic ecosystems evolved.* Addressed in Text (EA sections *2.3, 3.5, 3.6*). In summary:

No Action Alternative: BLM expects that the current levels of sediment inputs into streams would be maintained, except for the potential failure of the culverts proposed for replacement which would not be replaced under the No Action alternative.

Proposed Action: Increases in sediment delivery to streams would be of low magnitude and short duration that would maintain the sediment regime because: Stream protection Zones (SPZs) in RRs would be maintained (minimum of 60 feet on fish bearing streams and 30 feet on non-fish bearing streams in treatment areas, increased to 100 ft. and 50 ft. within one mile of listed fish habitat). Hauling restrictions and sediment control measures would minimize sediment delivery. Short-term localized increases in stream sediment can be expected after replacing 36 culverts and routine repair and maintenance of existing culverts, but BMPs and mitigation measures would be implemented to limit acceleration of sediment delivery to streams. Any such sediment increases would be of low magnitude (<800 meters below source) and short duration (hours), and would not be expected to have long-term effects to fish, aquatic species or human uses.

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 sections 2.3, 3.5, 3.6, 3.8*). In summary:

No Action Alternative: In-stream flows and related habitats and patterns would be maintained because there would be no management actions or predictable natural events that would change inputs to stream flows or sediment, nutrient and wood inputs.

Proposed Action: In-stream flows would be maintained because: the proposed actions would retain more than half of the forest canopy in treated Riparian Reserve areas; treated areas would comprise less than nine percent of RR in the project vicinity, which is 2.2 percent of the acres in the combined 6th field watersheds affected; only a small fraction of forest cover would be removed for new roads and landings; and the stream network would not be increased by road construction. A preliminary analysis for the risk of increased peak flow as a result of forest harvest, using the Oregon Watershed Assessment Manual watershed analysis methods for forest hydrology (OWEB, 1997) indicates that the proposed action would be unlikely to produce any measurable effect on stream flows.

Riparian, aquatic and wetland habitats and patterns of sediment, nutrient and wood routing would be maintained because the proposed action would maintain riparian microclimate conditions by maintaining intact stream protection zones (SPZ) that retain the primary shade zone and retain substantial portions of the canopy in the secondary shade zone. The SPZ would retain patterns of sediment and nutrient inputs and retain more than 90 percent of the trees that would potentially contribute to wood routing.

Alternative Action: In-stream flows would be maintained because: all treatments and expected effects within Riparian Reserves are identical to the proposed action; and 65 acres of

regeneration harvest would not increase openings enough to change the risk category for enhanced peak flows even at the smaller 7th field watershed level.

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 2.3, 3.5, 3.6*). In summary:

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 because no management actions or predictable natural events would occur to cause changes.

Proposed Action: The current condition of floodplain inundation and water tables would be maintained because there would be no alteration of any stream channel, wetland or pond morphological features. All operations, equipment and disturbances are kept a minimum of 60 feet from all wetlands and perennial stream channels, and 30 feet from all intermittent stream channels (increased to 100 ft. and 50 ft. within one mile of LFH).

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 2.3, 3.5, 3.6, 3.8*). In summary:

No Action Alternative: The current species composition and structural diversity of plant communities would be maintained by continuing along the current trajectory. Diversification would occur over a longer period of time compared to the proposed action alternatives. Current trends of recruiting dead wood primarily from suppression mortality of smaller trees would continue.

Proposed Action, Project 1: SPZs would maintain the current trajectory of species composition and structural diversity of plant communities in riparian areas and wetlands from 30 feet (intermittent streams) to 60 feet (perennial streams) (50 to 100 feet minimum within one mile of LFH) in the project area.

The proposed action would restore structural diversity in the upland portions of the Riparian Reserve by accelerating growth and development of some elements of structural diversity that are normally associated with late successional forests, such as shrub component, understory development, large diameter trees, and deep crowns with large limbs. It would accelerate development of large diameter snags and down wood by accelerating tree growth to provide potential source material for this dead wood. It would immediately recruit some snags and CWD by girdling or felling some trees larger than 21 inches diameter.

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 2.3, 3.5, 3.6, 3.8*). In summary:

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.

Proposed Action: The proposed action would maintain riparian habitat for dependent species by maintaining stream protection zones with minimum widths of 30 feet on intermittent streams

and 60 feet on perennial streams (increased to 50 and 100 feet on streams within one mile of LFH) where habitats and populations would not be disturbed.

The proposed action would restore the upland portions of these habitats in the long term by diversifying habitat characteristics across the landscape, accelerating development of some late successional characteristics to provide habitat for a wider variety of plant and animal species across the landscape at the 6th field watershed level. The proposed action would have no adverse effect on riparian dependent species. Although thinning activities may affect some invertebrates within the treatment areas, adjacent non-thinned areas should provide adequate refugia for the species. In the long term, the treatments would restore elements of structural diversity to treatment areas in the Riparian Reserve LUA. These attributes would help to provide resources currently lacking or of low quality, and over the long-term, would benefit both aquatic and terrestrial species.

3.12.2 Comparison of Alternatives with Regard to the Decision Factors

This section compares the alternatives with regard to the decision factors in EA section 1.4 which are reprinted here *in italics* for the reader's convenience, followed by the comparison of alternatives. The only differences between the proposed and alternative actions arise from the 65 acres in the Bent Beekman block which are proposed for thinning in the proposed action and for regeneration harvest in the alternative action. Therefore, the following discussions of the alternative action only address what would be different from the proposed action.

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 (objectives 4,7,8,12);

No Action: The No Action alternative would not contribute to meeting this objective because no timber sale would be implemented and no other uses of these lands are known to contribute measurably to local communities or industries or provide revenue.

Proposed Action: The proposed action would result in a timber sale that BLM experience shows would be successfully offered to the marketplace. Harvesting and processing the timber would support local communities by providing jobs and support local industries by providing raw materials for the wood products industry and demand for products in other sectors to supply other needs to log, transport and manufacture forest and wood products and care for the developing forest. The direct sale of the timber would provide revenue to the government and the O&C Counties and the taxes on payroll and corporate earnings would provide income to multiple levels of government. The project was designed to be environmentally sound, which is an essential element of the objectives which comprise this decision factor.

There are no clear indicators from scoping comments on the likelihood of protest or appeal of timber sales arising from the proposed action.

Alternative Action: In addition to the above description for the proposed action the alternative action would provide additional timber and revenue due to the higher volume per acre and the lower unit production (logging) cost for the timber in the Bent Beekman block. Timber sales from the Belly Twister and Sunday Morning blocks would be identical to the proposed action.

The alternative action timber sale proposed for the Bent Beekman block would have a higher probability of being protested and appealed than the proposed action, which could reduce the bid price compared to the bid price if the sale were not protested. The comparative bid prices between a non-protested sale from the proposed action and a protested sale from the alternative action in the Bent Beekman block are unknown.

Note: Timber supply from RR is a by-product of managing RR stands for other resource values. Treating these stands as a part of timber sales accomplishes the work efficiently and provides net revenue to the government and the O&C Counties rather than at a net cost to the government by implementing a separate project without logging. The proposed RR treatment would contribute to the objectives contained in this decision factor.

2. Provide for a sustainable supply of timber and other forest products on a predictable and long term basis (objectives 1,4,7,8,9,10,11,16,17);

No Action: The No Action alternative would not supply timber at this time, but would keep Matrix timber available for harvest at a future time, contributing to long term timber supplies. Overall long term productivity would be reduced compared to managing the stands because mortality would not be captured and the reduced growth rates which result from overstocking would reduce the long term productivity compared to a managed stand. In particular, objectives 10 and 16 would not be met because silvicultural prescriptions designed to accomplish the elements of these objectives would not be implemented.

Proposed Action: The proposed action would provide a current supply of timber and improve both quantity and quality of future sustainable timber supplies in stands which have not yet reached CMAI because the silvicultural prescriptions are designed to achieve these goals. In stands which have reached CMAI, the proposed action would provide some current timber supply and the remainder of the timber in the stand would be retained for potential future harvest. The thinning prescriptions were designed primarily to allow the retained trees to grow faster. In Matrix stands, this forms the basis for future timber harvest while retaining enough habitat benefits to meet other objectives. The proposed action would not change the current age class distribution on BLM lands. In particular, objectives 10 and 16 would be met because the silvicultural prescriptions for Matrix stands were specifically designed to accomplish the elements of these objectives.

Alternative Action: The alternative action would slightly alter the age class distribution on BLM lands by converting 65 acres of 110-120 year old age class to newly regenerated forest which would contribute to long term timber supply with a stand of fast growing, commercially valuable trees.

Note: RR lands within the proposed and alternative actions would be unlikely to contribute to long term sustainable timber supplies because timber is a by-product of managing these stands for ACS objectives. Therefore, RR are not anticipated to contribute to long-term timber supplies and are irrelevant to the long term and sustainable timber production objectives contained in this decision factor.

3. Contribute to a healthy forest ecosystem with habitat that will support populations of native plant and animal species (objectives 6,13,14,18,20);

No Action: The No Action alternative would partially meet the objectives in this decision factor by maintaining current conditions and trends. Stands would eventually develop into a healthy

forest ecosystem through natural processes which develop habitat diversity and late-successional characteristics over several decades. However, silvicultural practices to accelerate development of some of the currently underrepresented elements of a healthy forest ecosystem (e.g. large trees/snags/down wood, large limbs/crown, understory development) would not be done.

In particular, ACSO 8 and 9 embodied in objective 20 would be maintained, but the specific elements of the objective which were designed to more rapidly restore specific stand characteristics which are recognized to be components of a healthy forest ecosystem in the upland portions of RR would not be done. No Action would not manage habitat to enhance or accelerate development of additional habitat features to provide additional benefit to any species. It would passively contribute to achieving recovery of ESA listed and Bureau special status species.

No actions would be taken that could potentially reduce protection for riparian areas and waters and there are no known threats which suggest a need for immediate action. Undersized culverts potentially pose a threat to aquatic ecosystems if they fail, but the timing and magnitude of potential impacts cannot be reliably determined.

Proposed action: The proposed commercial thinning would immediately introduce an additional element of diversity by treating a portion of the relatively uniform stands that dominate these watersheds and accelerate development of some late-successional characteristics as described in the elements of objective 20. The thinning prescriptions were designed primarily to allow the retained trees to grow faster. In Matrix, this provides for developing some characteristics of late-successional habitat (e.g. larger diameter snags/CWD, larger limbs/crowns, understory development) before reaching rotation age, especially in CONN. In RR the basic prescription would be modified, typically after initial marking, to retain/develop additional habitat characteristics as part of a healthy forest ecosystem.

Thinning would provide forest stands which provide favorable habitat for species which prefer a more open stand, while leaving large tracts (75 percent of stands in the project vicinity, see Table 2) of unthinned forest to provide habitat for species which prefer the habitat provided by overstocked stands and other existing stand types which continue to develop naturally.

The proposed action would contribute to forest habitat diversity by providing up to 15 acres of early seral forest in low density thinning patches up to one acre in size. The proposed action would maintain adequate supplies of dead wood because at least 90 percent of all snags larger than 15 inches diameter and at least 90 percent of existing CWD would be retained within treated units and the status quo of conditions and trends in dead wood would be maintained in the 75 percent of the project vicinity which is not proposed for treatment.

BLM experience with similar projects shows that the projects would provide adequate protection for riparian areas and waters to maintain riparian/aquatic habitat and water quality which meets ODEQ standards. Upgrading undersized culverts would reduce the potential for failure and resultant impacts. The proposed action would partially meet this decision factor by maintaining the status quo of conditions and passive recovery on the other 75 percent of the project vicinity.

Alternative Action: The proposed alternative for 65 acres of regeneration harvest and reforestation in two units, and up to five acres of low density thinning patches in the remainder of the project area, would provide pockets of high quality early seral habitat to support populations of species which utilize early seral and edge habitat for a few decades, and

contribute to landscape level structural diversity and complexity for many decades. Within the watershed industrial forests provide large tracts of low quality early seral habitat which serves some of those 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 (objectives 2,3,6,19,20);

No Action: The No Action alternative meets this decision factor by maintaining current processes and trends. Undersized culverts would not be replaced, maintaining current trends toward potential failure.

Proposed Action and Alternative Action: The proposed and alternative actions meet this objective because project design features would be implemented to maintain water quality within ODEQ standards and to protect aquatic and riparian habitat from disturbance. Undersized culverts would be replaced causing short term, low intensity local impacts and reducing the potential for culvert failure.

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 (objectives 5,7,15,17,19).

No Action: The No Action alternative partially meets this objective because the current primary road system would remain in place and be maintained according to the District road maintenance program. It would not meet part of the objective because: it would not prevent or slow deterioration of unmaintained spur roads; replace the 36 under-sized or failing culverts proposed for replacement; or install or replace cross drains to relieve road-related inputs to streams.

Proposed Action and Alternative Action: The proposed and alternative actions would meet this objective by maintaining the current road system as part of the proposed timber sale as well as normal maintenance. They would maintain spur roads and replace 36 failing culverts to prevent deterioration and sedimentation, then stabilize and close spur roads to prevent erosion and unauthorized use. Both alternatives would install or replace 26 cross drains to reduce road-related inputs to streams.

Chapter 4: Preparers

Table 25: List of Preparers

Resource	Name	Reviewed By (Initials)	Date
Writer/Editor	Keith Walton		12/15/14
NEPA Review	David Simons	dls	12/11/2014
Botany	Terry Fennell		12/15/14
Cultural Resources	Heather Ulrich, Fred Greatorex		
Engineering	Dan Nevin, Amy Stammers		12/15/14
Fire/Fuels	Kent Mortensen		10/15/14
Fisheries	Bruce Zoellick		
Hydrology/ Water Quality	Patrick Hawe	WPH	12/10/14
Logging Systems	Seth Macalady		12/15/14
Recreation, Visual Resources and Rural Interface	Traci Meredith	TMM	12/15/14
Silviculture	Clint Foster	CPF	12/11/14
Soils	Patrick Hawe	WPH	12/10/14
Wildlife	Jim England, Corbin Murphy		12-11-14

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

Date: 12/15/2014

John Huston

Field Manager, Cascades Resource Area

Chapter 5: Contacts and Consultation

5.1 Consultation

5.1.1 US Fish and Wildlife Service (USFWS)

The Sunday Morning Belly Twister thinning proposal will be submitted for Informal 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 FY2015 consultation process.

The Belly Twister/ Sunday Morning proposal is similar to thinning proposals submitted during the most recent consultation process for 2014 not likely to adversely affect projects. The *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) was submitted in April 2013. Using effect determination guidelines, the BA concluded that thinning actions similar to the Belly Twister/ Sunday Morning proposal may affect, but are not likely to adversely affect the northern spotted owl due to modification of dispersal habitat (BA p. 40) and would have no effect on spotted owl Critical Habitat.

The Bent Beekman proposal is similar to proposals submitted during the most recent consultation process for 2014 likely to adversely affect projects. The *Biological Assessment of Likely to Adversely Affect Projects with the Potential to Modify the Habitat of Northern Spotted Owls, Willamette Planning Province – FY2014* (BA) was submitted in August 2013. Using effect determination guidelines, the BA concluded that actions similar to the Bent Beekman proposal may affect and are likely to adversely affect the northern spotted owl due to modification of suitable habitat (BA pp. 37) but would have no effect on spotted owl Critical Habitat.

All applicable General Standards described in the future Biological Opinion and Letter of Concurrence for FY2015 projects will be incorporated into each proposal. This may include a seasonal restriction within disruption distance of known spotted owl sites during the critical nesting season and monitoring/reporting on the implementation of this project to the U.S. Fish and Wildlife Service.

5.1.2 National Marine Fisheries Service (NMFS)

Consultation with the National Marine Fisheries Service (NMFS) on effects of the Sunday Morning Belly Twister 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. Most harvest units are located on 1st and 2nd order headwater tributaries ≥1 mile from listed fish habitat (LFH) in Crabtree Creek, E.F. Neal Creek, Rock Creek, and the Roaring River. Perennial streams would have minimum no-entry stream protections zones (SPZs) of 70 feet. To further ensure no impacts to LFH, SPZ's would be wider within 1 mile of LFH (>100 feet wide on perennial streams; 50 feet on intermittent streams), thereby ensuring no temperature changes to LFH downstream (Groom et al., 2011; U.S. Forest Service and Bureau of Land Management TMDL Implementation Strategy, 2005).

Of the Sunday Morning units that are about 1 mile from LFH, SPZ widths on perennial tributaries to Crabtree Creek would range from 120 to 675 feet in width. Two units in the Sunday Morning block are located on intermittent streams about 0.5 mile upstream of LFH in Crabtree Creek. The 50 feet wide SPZ's on these units would prevent sediment delivery and channel alteration, and stream temperatures during the summer would not be impacted because

no surface flows would be present. Perennial stream buffers would maintain large wood supplies, and stream shading and thus stream temperature, and intercept and infiltrate water carrying sediment preventing its delivery to LFH. The regeneration alternative would have no peak flow effect on listed fish habitat due to maintaining enough area with canopy closures ≥30 percent in the Rock Creek watershed (see hydrology discussion of peak flow effects). Log haul routes are all paved where they cross listed fish habitat, with no mechanism to deliver sediment to LFH. Graveled portions of haul routes are >0.5 mile upstream of LFH with the exception of the south haul route from the Sunday Morning block, which has two well-graveled stream crossings located about 0.5 mile upstream of Crabtree Creek. This haul route will be restricted to dry season and dry condition use to prevent any potential sediment from reaching LFH. Potential increased turbidity caused by 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 also would not impact listed fish habitat.

5.1.3 Cultural Resources: Section 106 Consultation with State Historical Preservation Office

Cultural resource surveys were conducted throughout the sale area during 2014 (Report # C13-05). Cultural resource inventories did not identify any pre-contact archaeological sites within the project area. Traces of historic structures were found outside of proposed unit boundaries, none would be impacted by proposed operations. A summary report of the cultural resource inventory will be sent to the State Historic Preservation Office.

5.2 Scoping

See EA section 1.8 for a description of scoping methods and the issues identified through scoping.

5.3 EA Public Comment Period

The EA and FONSI will be made available for public review and comment from December 17, 2014 to January 16, 2015. On or before the first day of the public review and comment period: Letters announcing the public review and comment period will be mailed to persons and organizations on the Scoping Letter mailing list, those who attended the Open House, and those who submitted Scoping Comments; the letter, the EA and the FONSI will be posted at the Salem District website at http://www.blm.gov/or/districts/salem/plans/index.php; and the notice for public comment will be published in a legal notice in the ***Albany Democrat Herald*** newspaper. Written comments should be addressed to John Huston, Field Manager, Cascades Resource Area, 1717 Fabry Road S., Salem, Oregon 97306. Emailed comments may be sent to OR_Salem_Mail@blm.gov. Attention: John Huston

Chapter 6: List of Interdisciplinary Team Reports Incorporated by Reference

The Interdisciplinary team reports can be found in the Sunday Morning Belly Twister EA project file and are available for review at the Salem District Office.

2014 Foster, Sunday Morning Silvicultural Prescription (Silvicultural Prescription) , Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

2014 Foster, Belly Twister Silvicultural Prescription (Silvicultural Prescription) , Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

England and Murphy 2013, Cascades Resource Area EA Wildlife Report, Belly Twister/Sunday Morning Project, (Wildlife Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

England 2014, Regeneration Harvest Alt. – Belly Twister/Sunday Morning (Bent Beekman) EA (Supplemental Wildlife Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR. (Together, the preceding two reports are referred to as the "Wildlife Reports')

Fennell, T., 2014. Cascades Resource Area Botanical Report Proposed Sunday Morning Timber Sale (Botany Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Fennell, T., 2014. Cascades Resource Area Botanical Report Proposed Belly Twister Timber Sale (Botany Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Greatorex, Fred and Heather Ulrich 2014. Cultural Resource Inventory Reports, Sunday Morning Belly Twister Pre-project Surveys. Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, 2013, Hydrology/Channels/Water Quality: Specialist Report for the Proposed Sunday Morning Belly Twister Project, etc. (Hydrology Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, 2014 Soils Specialist Report for the Proposed Sundae Belly Project (Soils Report) Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

King and Zoellick, 2014. Sunday Morning Fisheries Specialist Report (Fisheries Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Macalady and Bernards 2014, Sunday Morning/Belly Twister Logging Systems Report (Logging Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Meredith 2014, Sunday Morning-Belly Twister Rec/Rural/Visual Resources Specialist Report (Recreation Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Mortensen 2014, Cascade Resource Area Fuels Specialist Report, Sunday Morning Belly Twister Project (Fuels Report, Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

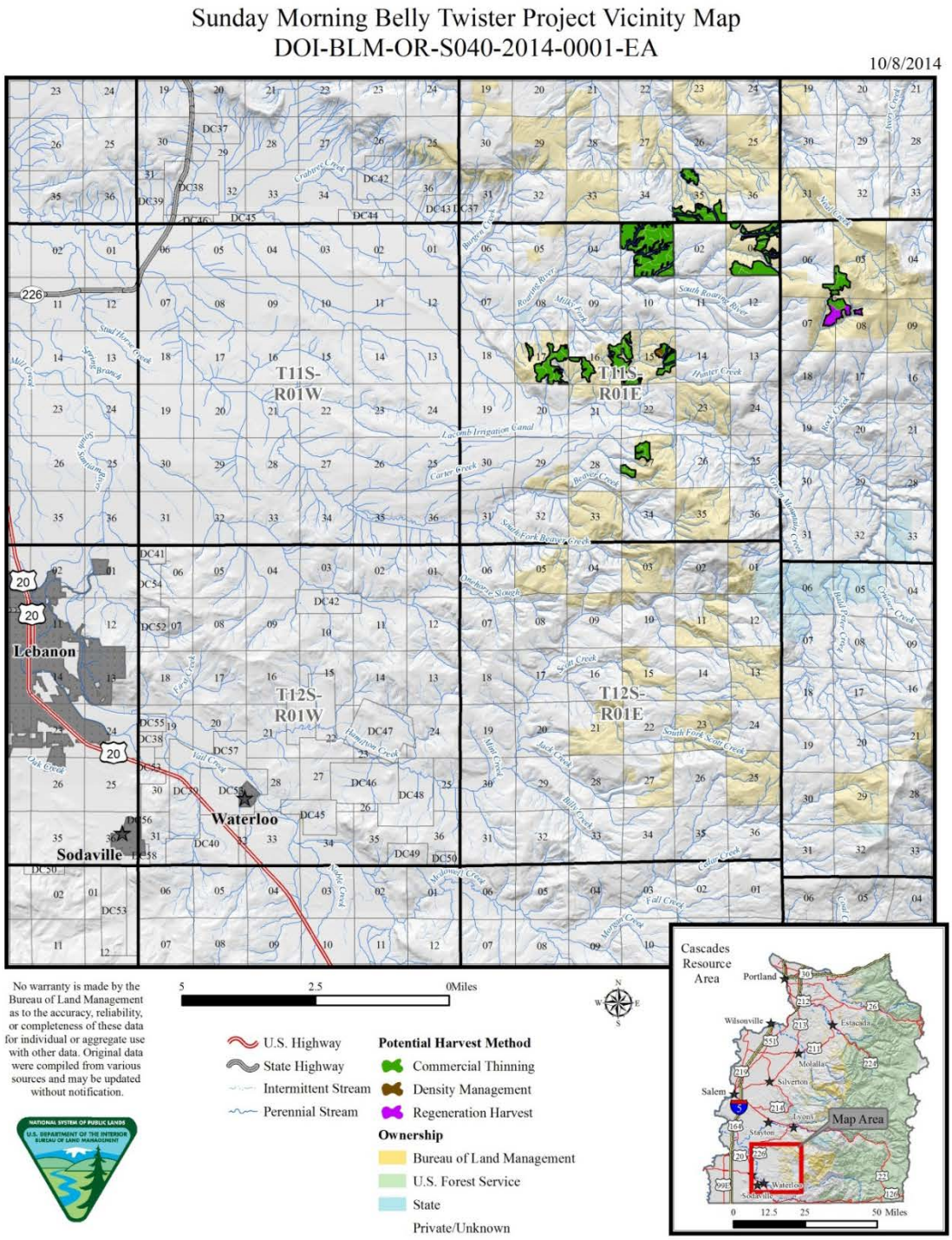
Walton 2014, Sunday Morning Belly Twister Analysis of Public Scoping Comments and Documentation of Responses, Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Zoellick, 2014, Belly Twister Fisheries Specialist Report (Fisheries Report) Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Chapter 7: Additional Tables, Project Maps, Glossary and Acronyms

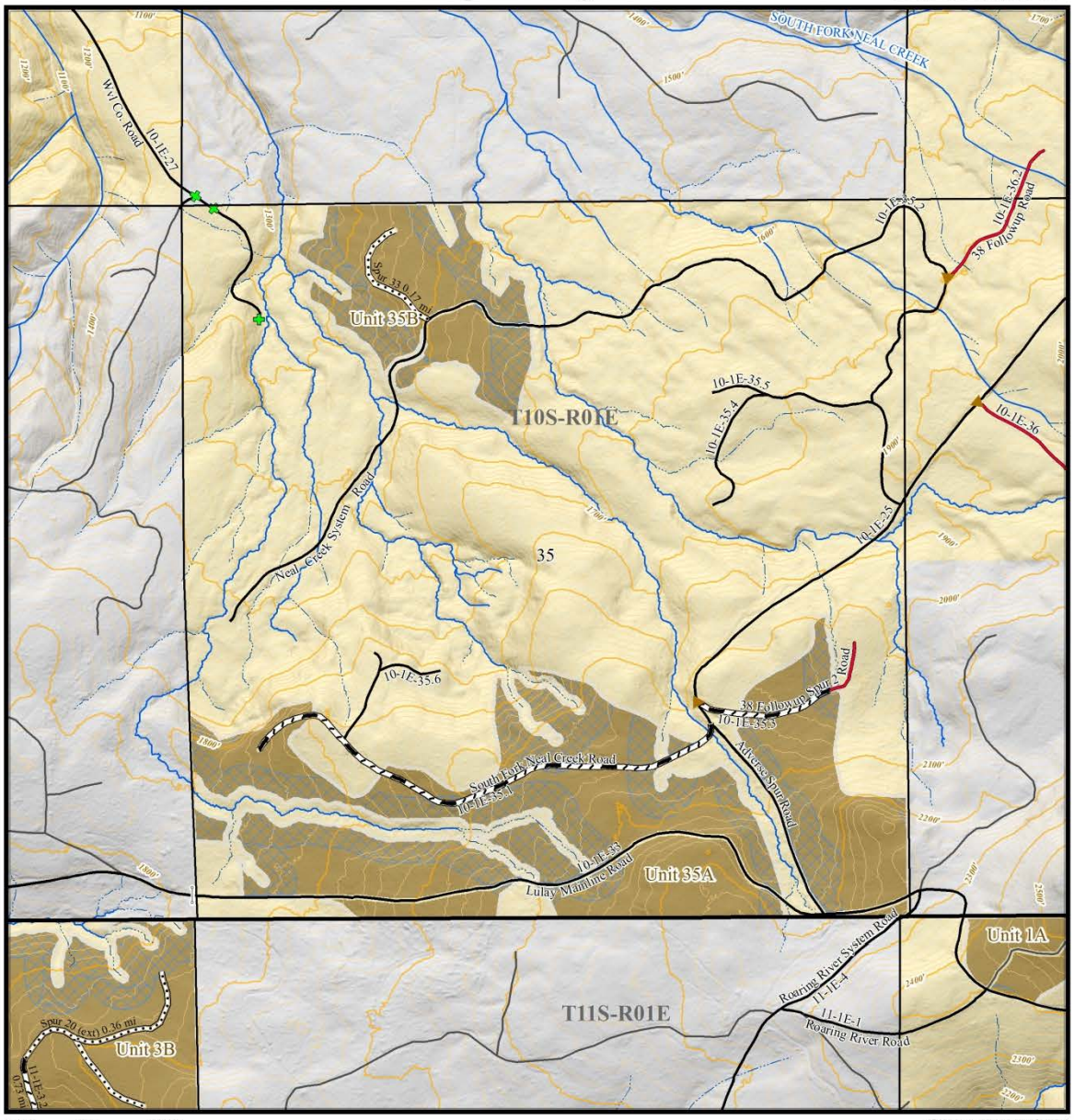
Maps of the Proposed Action

The following maps include an overview/vicinity map and separate maps for each section. Some of the units include land in multiple sections, so some of the maps overlap.



Sunday Morning & Belly Twister
Proposed Projects

T10S-R01E Sec 35



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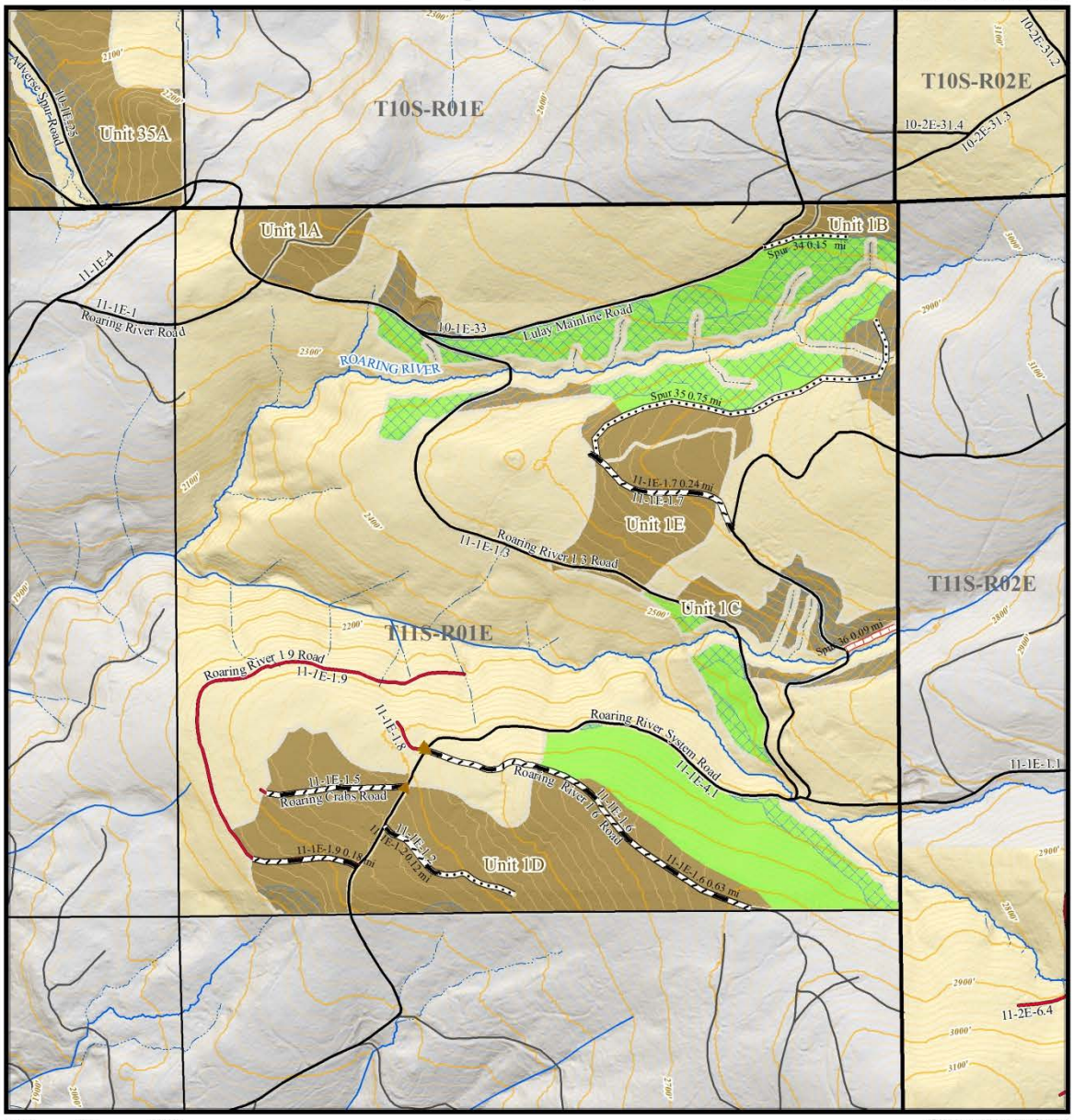
Contour Interval: 20'

Gate
Earth Berm
Vegetation Blockage
BLM decommissioned
BLM other
Non-system other
New Construction
Renovation
Riparian Reserves
EA Unit Boundary
Ground based Yarding/Thinning
Bureau of Land Management
Private/Unknown

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.

Sunday Morning & Belly Twister
Proposed Projects

T11S-R01E Sec 01



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Contour Interval: 20'

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- BLM other
- Non-system other
- Decommission
- New Construction
- Renovation
- Riparian Reserves
- EA Unit Boundary
- Ground based Yarding/Thinning
- Skyline Yarding/Thinning
- Bureau of Land Management
- Private/Unknown

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Sunday Morning & Belly Twister
Proposed Projects

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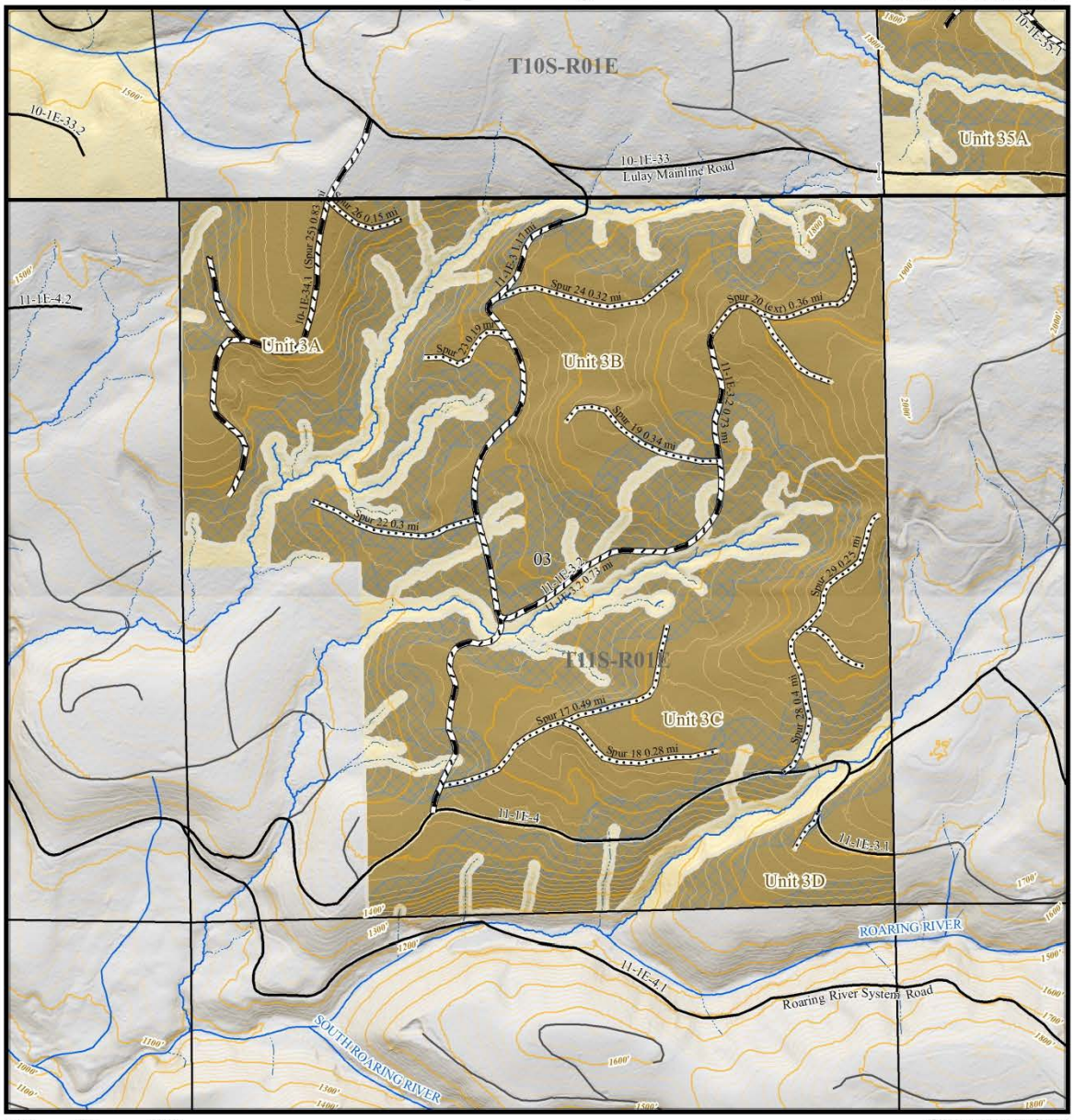

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Sunday Morning & Belly Twister
Proposed Projects

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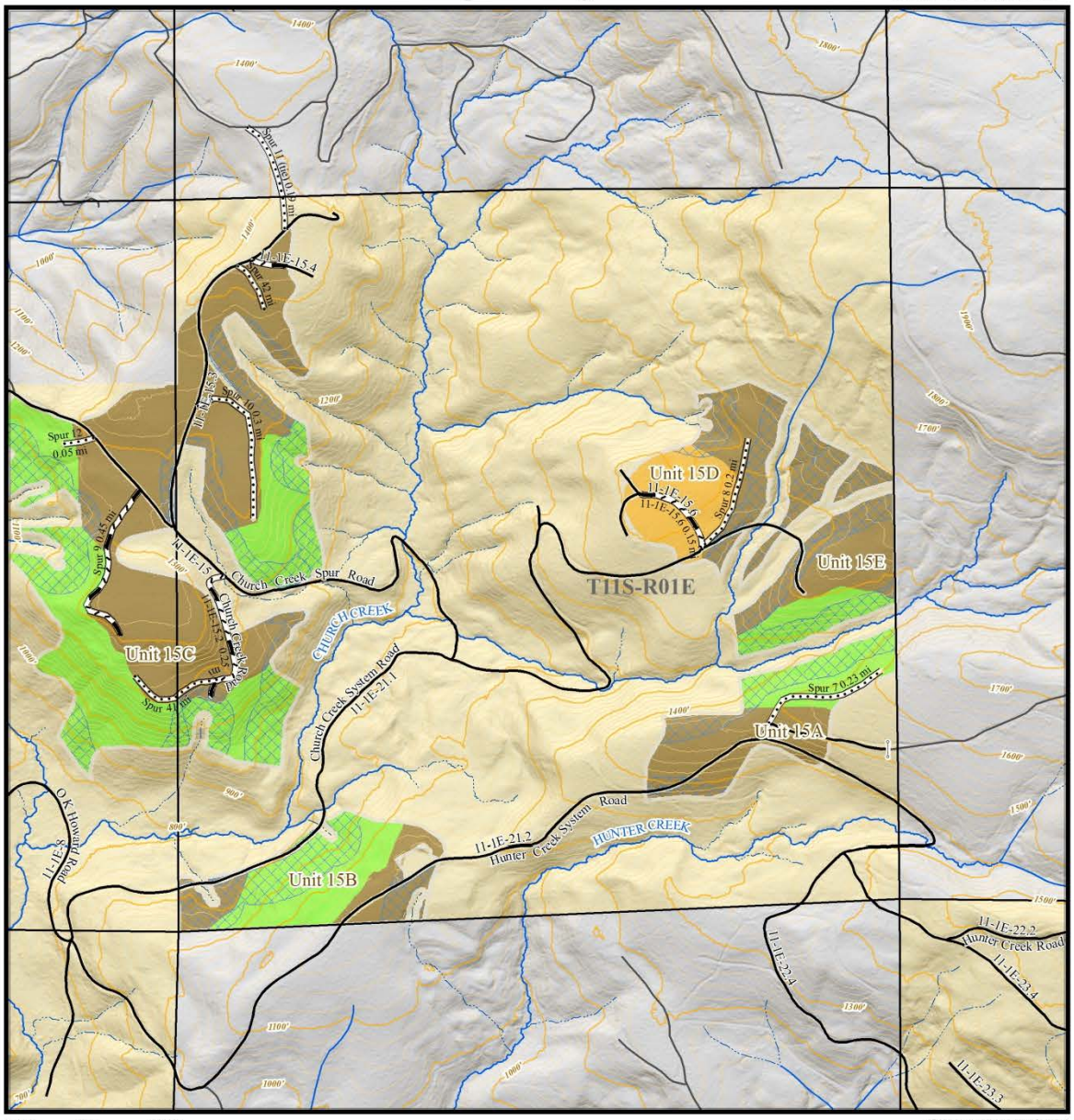

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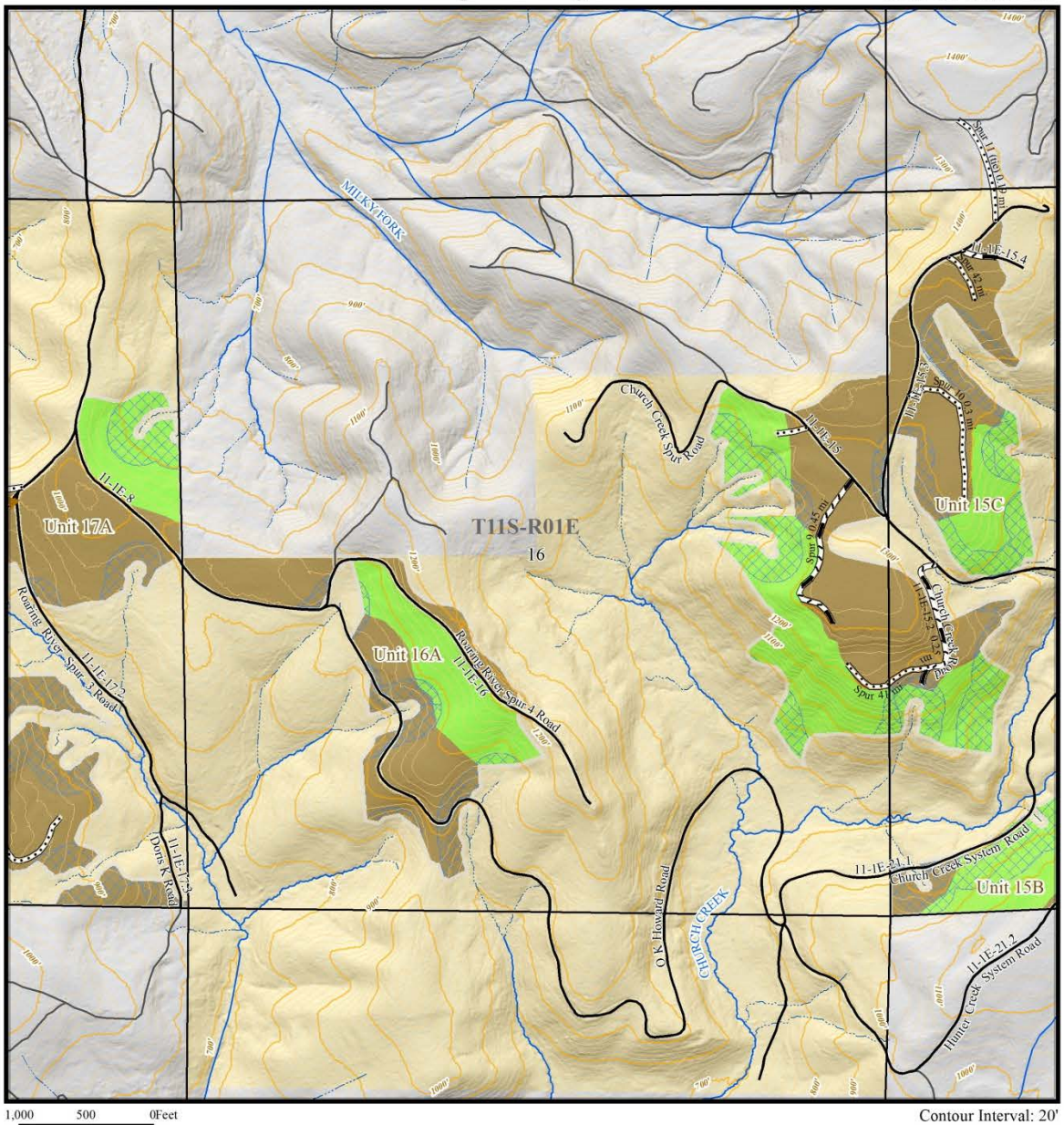
- Non-system other
- New Construction
- Renovation
- Riparian Reserves
- EA Unit Boundary
- Ground based Yarding/Thinning
- Ground based Yarding/DM
- Skyline Yarding/Thinning
- Bureau of Land Management
- Private/Unknown

Sunday Morning & Belly Twister
Proposed Projects

T11S-R01E Sec 16



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- BLM other
- Non-system other
- New Construction
- Renovation
- Riparian Reserves
- EA Unit Boundary
- Ground based Yarding/Thinning
- Skyline Yarding/Thinning
- Bureau of Land Management
- Private/Unknown

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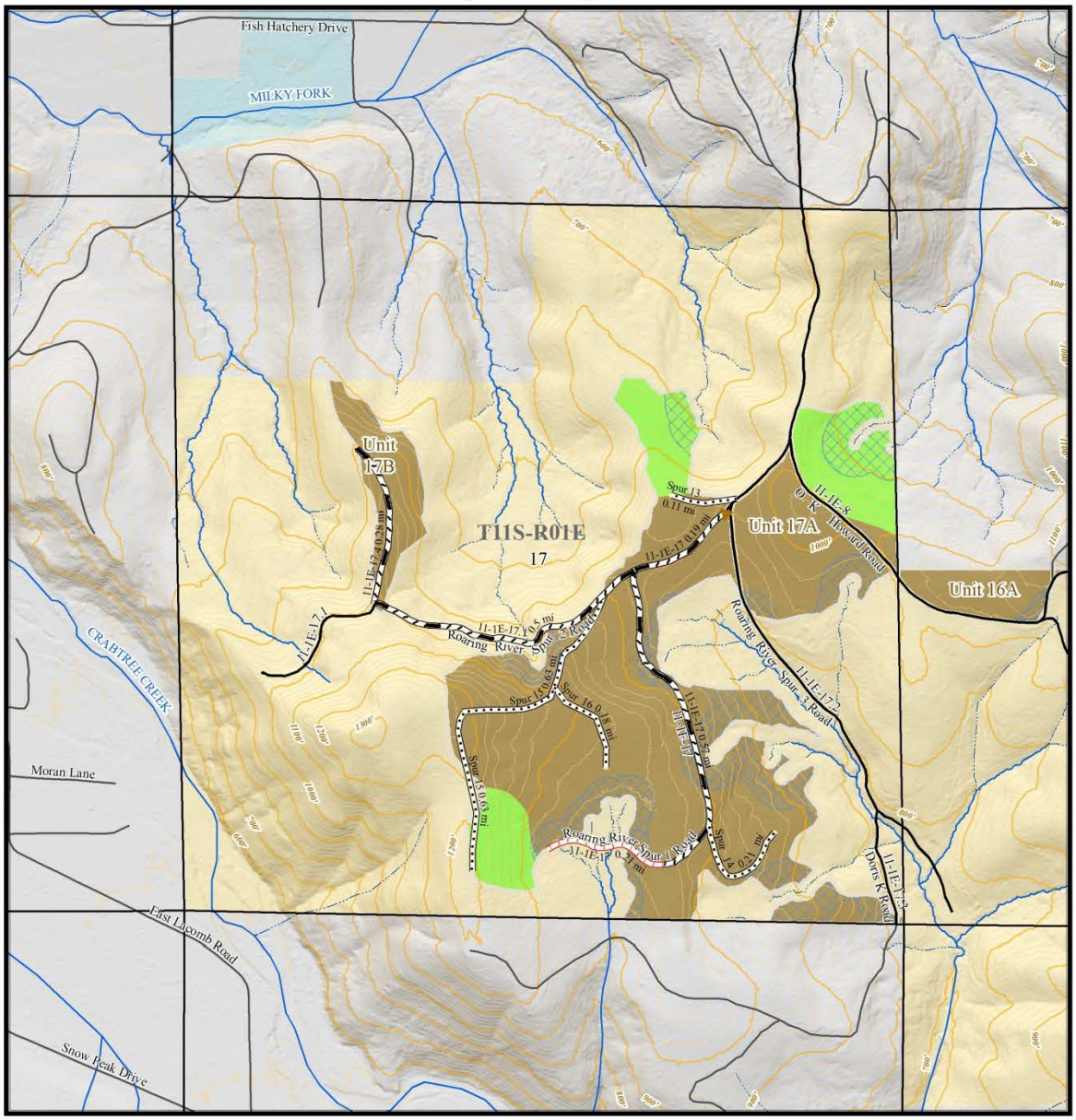
Sunday Morning & Belly Twister
Proposed Projects

T11S-R01E Sec 17



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Sunday Morning & Belly Twister
Proposed Projects

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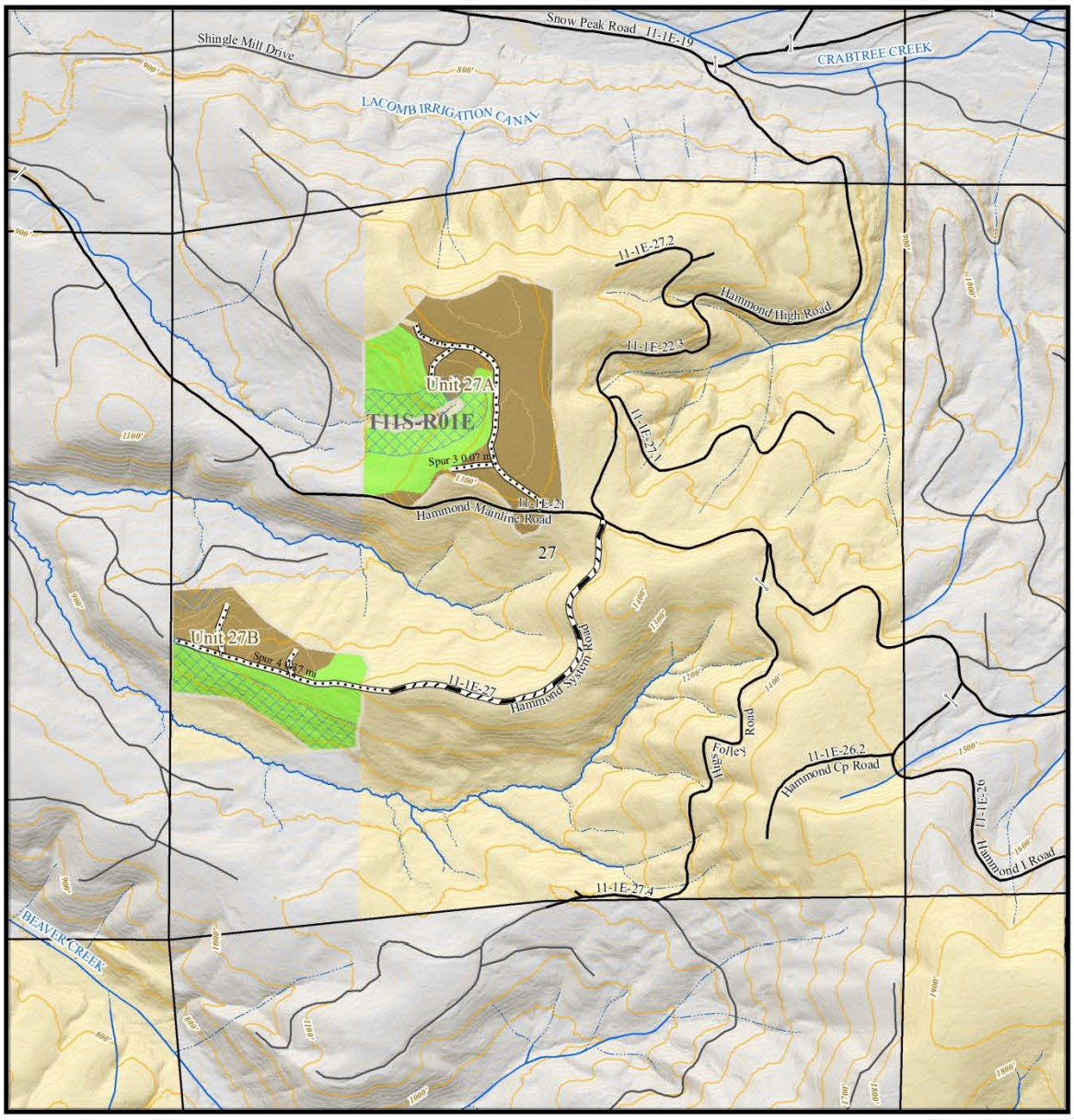

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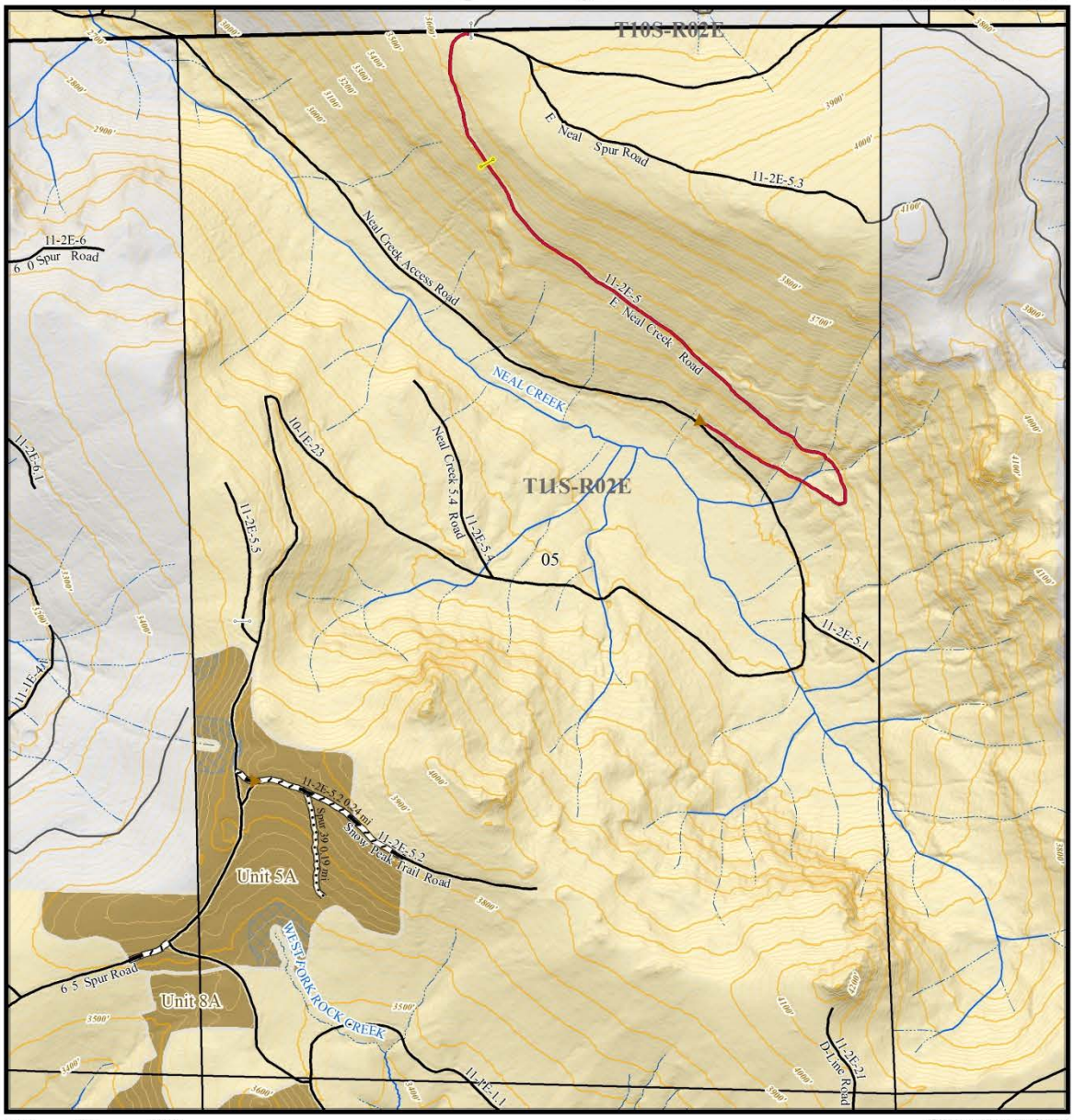
- Non-system other
- New Construction
- Renovation
- Riparian Reserves
- EA Unit Boundary
- Ground based Yarding/Thinning
- Skyline Yarding/Thinning
- Bureau of Land Management
- Private/Unknown

Sunday Morning & Belly Twister
Proposed Projects

T11S-R02E Sec 05



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Sunday Morning & Belly Twister
Proposed Projects

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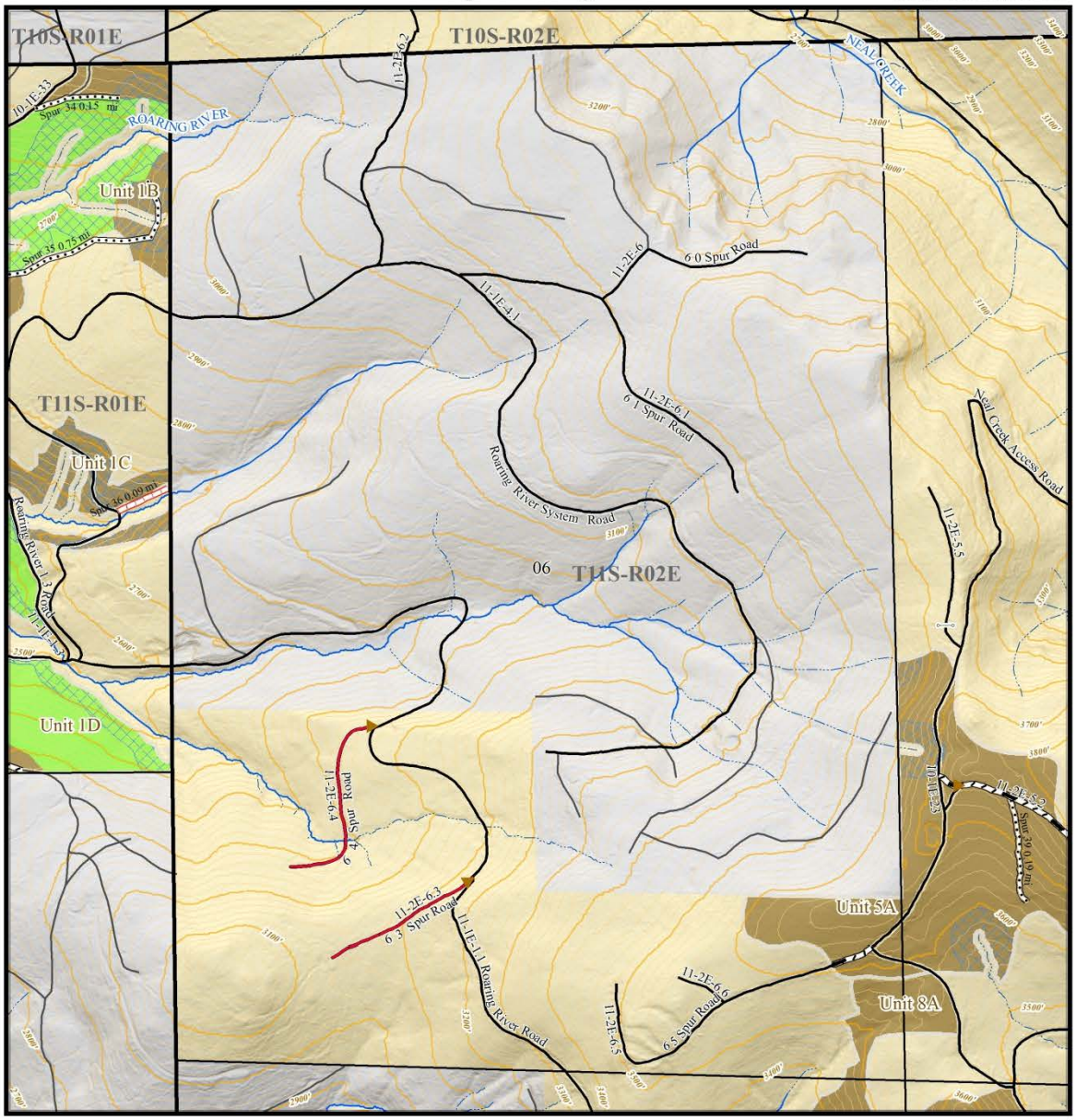

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Contour Interval: 20'

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BLM decommissioned
BLM other
Non-system other
Decommission
New Construction
Renovation
Riparian Reserves
EA Unit Boundary
Ground based Yarding/Thinning
Skyline Yarding/Thinning
Bureau of Land Management
Private/Unknown

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Sunday Morning & Belly Twister
Proposed Projects

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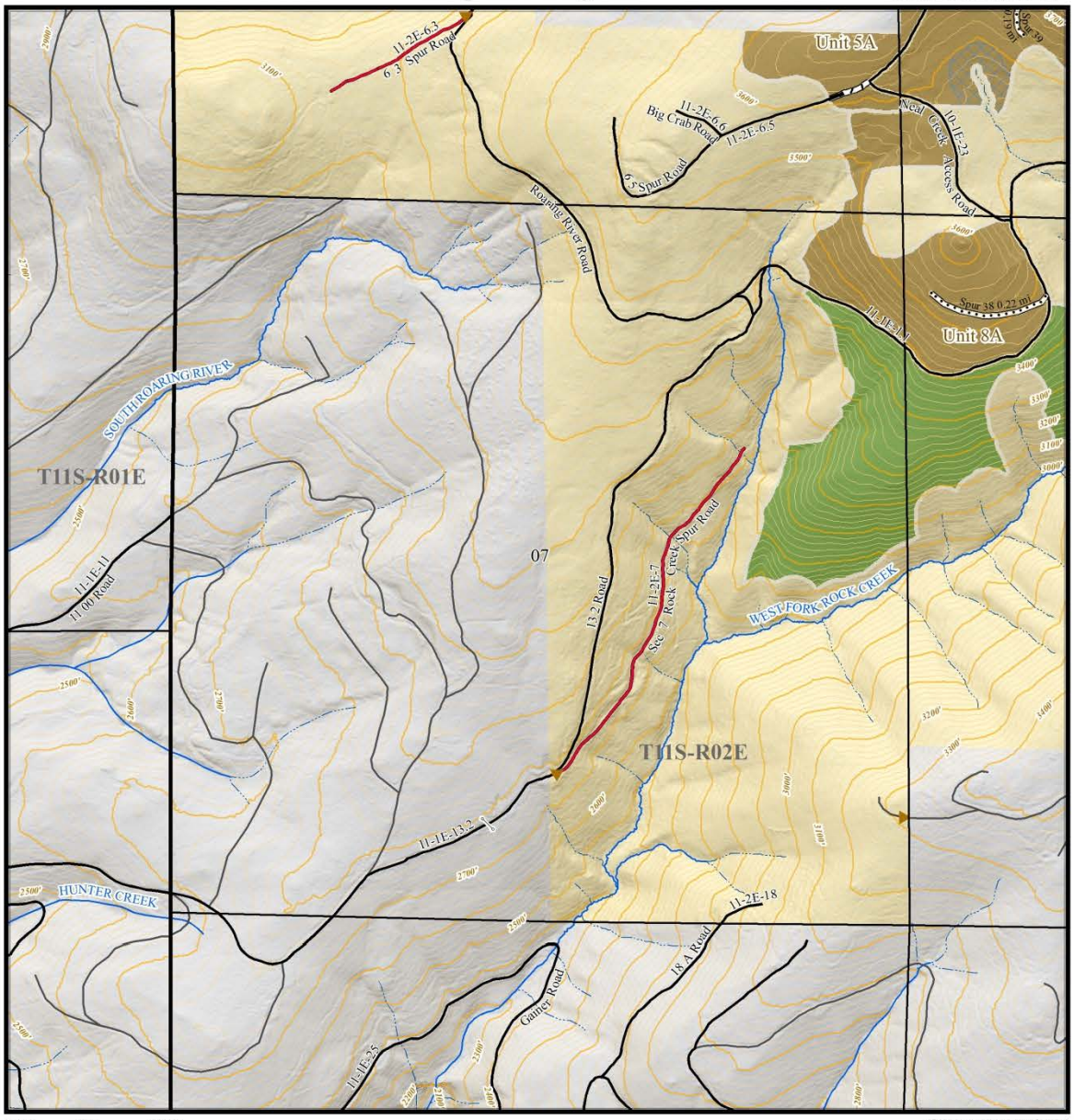

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Contour Interval: 20'

- Gate
- Earth Berm
- BLM decommissioned
- BLM other
- Non-system other
- New Construction
- Renovation
- Riparian Reserves
- EA Unit Boundary
- Ground based Yarding/Thinning
- Skyline Yarding/Regen
- Bureau of Land Management
- Private/Unknown

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Sunday Morning & Belly Twister
Proposed Projects

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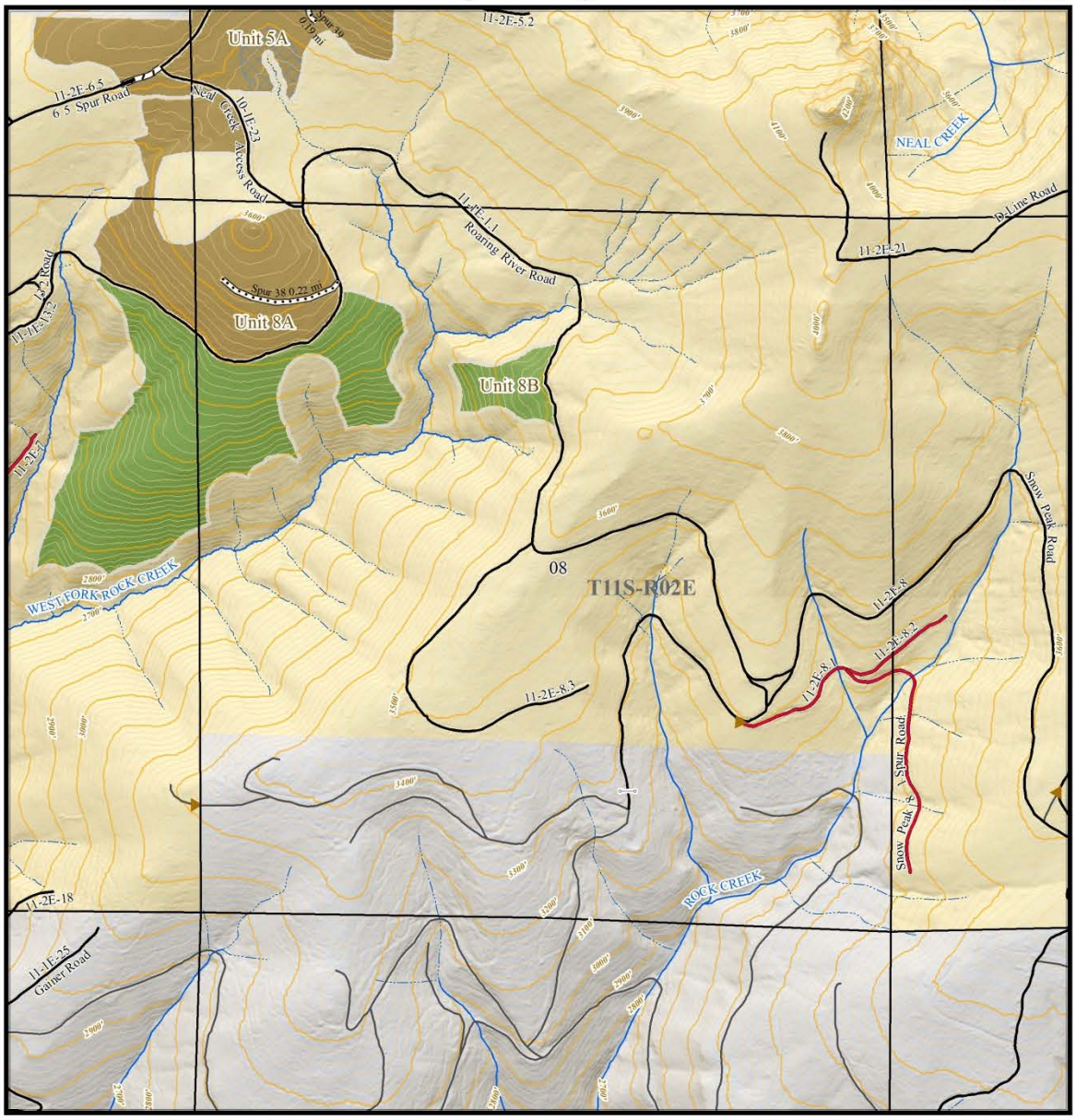

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Contour Interval: 20'

Gate
Earth Berm
BLM decommissioned
BLM other
Non-system other
New Construction
Renovation
Riparian Reserves
EA Unit Boundary
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Bureau of Land Management
Private/Unknown

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7.1 Glossary

activity fuel - Debris (wood chips, bark, branches, limbs, logs, or stumps) left on the ground after management actions, such as logging, pruning, thinning, or brush cutting, versus debris left after storms or fires.

age class - A management classification using the age of a stand of trees

alternative - One of several proposed management actions that have been studied and found to meet the goals and objectives of a project's purpose and need and, as a result, is suitable to aid decision-making.

anadromous fish - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Includes species such as salmon and steelhead. Also see salmonid.

(ACS) Aquatic Conservation Strategy - A Northwest Forest Plan methodology designed to restore and maintain the ecological health of watersheds and aquatic ecosystems, consisting of four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration.

baseline - The starting point for the analysis of environmental consequences, often referred to as the Affected Environment. This starting point may be the condition at a point in time (e.g., when inventory data is collected) or the average of a set of data collected over a specified number of years.

beneficial use - In water use law, such uses include, but are not limited to: instream, out of stream, and ground water uses; domestic, municipal, and industrial water supplies; mining, irrigation, and livestock watering; fish and aquatic life; wildlife watering; fishing and water contact recreation; aesthetics and scenic attraction; hydropower; and commercial navigation.

(BMPs) Best Management Practices, ***Broad Definition as Used by the IDT in this EA*** - BMPs are methods, measures or practices selected on the basis of site-specific conditions to protect the environment from significant adverse impacts potentially caused by the proposed project and to achieve resource management objectives.

(BMPs) Best Management Practices, ***Narrow Definition from EPA*** - BMPs are defined as methods, measures, or practices selected on the basis of site-specific conditions to ensure that water quality will be maintained at its highest practicable level. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation).

canopy cover - The ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeter and commonly expressed as a percent of total ground area.

(CWD) coarse woody debris - That portion of trees that has naturally fallen or been cut and left in the forest. Refers to pieces which meet RMP requirements of at least 20 inches in diameter (large end) and 20 feet long. Pieces which do not meet this size requirement are referred to

simply as woody debris. There are four classes used to describe coarse woody debris. The classes range from Class I (which has the least decay, intact bark, and a hard log) to Class IV (i.e., the coarse woody debris has decayed to the point of nearly being incorporated into the forest floor).

(CT) commercial thinning - Any type of thinning producing merchantable material at least equal to the value of the direct cost of harvesting. See thinning.

crown fire - Fire that moves through the upper part of a tree that has live branches and foliage (i.e. crown) independent of any surface fire. Crown fires can often move faster and ahead of ground fires.

cumulative effect - The impact on the environment that results from incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of which agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time which change the magnitude, duration, extent or likelihood of an impact.

(DBH) diameter at breast height - The diameter of the stem of a tree measured at 4.5 feet above the ground level on the uphill side of the stem.

dispersal habitat (spotted owl) - Forest habitat that allows northern spotted owls to move (disperse) across the landscape; typically characterized by forest stands with average tree diameters of greater than 11 inches, and conifer overstory trees having closed canopies (greater than 40 percent canopy closure) with open space beneath the canopy to allow owls to fly.

dropped - dropped from this proposed action. The actions may be considered in the future and would be documented in an environmental analysis with a new decision. Dropping these areas does not constitute a change in land use allocations.

effective shade - The proportion of direct beam solar radiation reaching a stream surface to total daily solar radiation.

environmental effects - The direct, indirect and cumulative effects of a proposed action or alternative on existing conditions in the environment in which the action(s) would occur. Also see baseline.

fine sediment - Fine-grained soil material, less than 2mm in size, normally deposited by water, but in some cases by wind (aeolian) or gravity (dry ravel).

fuel loading - The dry weight of all accumulated live and dead woody and herbaceous material on the forest floor that is available for combustion, and which poses a fire hazard.

green tree - A live tree.

(LWD) large woody debris - The portion of a down tree which is in the stream channel and is large enough to influence the hydrology of the stream by capturing gravel, creating pools, etc.

(LUA) land use allocation - A designation for a use that is allowed, restricted, or prohibited for a particular area of land, such as the Matrix, adaptive management, late-successional reserve, or critical habitat land use allocations.

late-successional forest - A forest that is in its mature stage and contains a diversity of structural characteristics, such as live trees, snags, woody debris, and a patchy, multi-layered canopy.

long term - A period of time used as an analytical timeframe; generally starts more than 10 years after implementation of a project, though it may be different depending on the resource being analyzed. Also see short term.

mass wasting - The sudden or slow dislodgement and downslope movement of rock, soil, and organic materials.

mature stage - Generally begins as tree growth rates stop increasing (after culmination of mean annual increment), and as tree mortality shifts from density-dependent mortality to density-independent mortality.

merchantable - Trees or stands having the size, quality and condition suitable for marketing under a given economic condition, even if not immediately accessible for logging

multi-layered canopy - Forest stands with two or more distinct tree layers in the canopy.

old-growth forest - A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

overstory - That portion of trees forming the uppermost canopy layer in a forest stand and that consists of more than one distinct layer.

Rural/Urban Interface – see WUI

short term - A period of time used as an analytical timeframe and that is within the first 10 years of the implementation of a resource management plan. Also see long term.

silvicultural prescription - A planned series of treatments designed to change current stand structure to one that meets management goals.

snag - Any standing (upright) dead tree.

thinning - A silvicultural treatment made to reduce the density of trees primarily to improve tree/stand growth and vigor, and/or recover potential mortality of trees, generally for commodity use. See commercial thinning.

timber - Forest crops or stands, or wood that is harvested from forests and is of a character and quality suitable for manufacture into lumber and other wood products rather than for use as fuel.

(USFWS) United States Fish and Wildlife Service - A federal agency under the United States Department of the Interior that is responsible for working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats.

watershed - All of the land and water within the boundaries of a drainage area that are separated by land ridges from other drainage areas. Larger watersheds can contain smaller watersheds that all ultimately flow their surface water to a common point.

wetland - land with presence and duration of water, sufficient to support wetland vegetation.

wildfire - Any nonstructural fire, other than prescribed burns, that occurs on wildland.

(WUI) wildland/urban interface - The area in which structures and other human development meet or intermingle with undeveloped wildland. The term used primarily for wildfire prevention

and suppression. Rural/Urban Interface is used primarily for other recreation and forest management activities.

windthrow - A tree or trees uprooted or felled by the wind.

7.2 Additional Acronyms

BLM – Bureau of Land Management

BS – Bureau Sensitive, a category of species under the Oregon/Washington Special Status Species Policy

DBH – diameter at breast height

EA - Environmental Assessment

ESA – Endangered Species Act

FONSI – Finding of No Significant Impact

GFMA – General Forest Management Area land use allocation (Matrix)

NEPA – National Environmental Policy Act (1969)

ODEQ – Oregon Department of Environmental Quality

RIA – Rural-Urban Interface (recreation, visual and sociological issues)

RMP/FEIS – Salem District Proposed Resource Management Plan / Final Environmental Impact Statement (1994)

ROW – right-of-way (roads)

RR – Riparian Reserve Land Use Allocation (Riparian Reserves)

SPZ – Stream Protection Zone (no-cut protection zone)

TMDL – total maximum daily load

USDI – United States Department of the Interior

USFS – United States Forest Service

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