Highland Fling Thinning

Environmental Assessment and
Finding of No Significant Impact

Environmental Assessment Number OR080-08-05
March 2010

Salem District
Clackamas County, Oregon

T. 3 S., R. 3 E. section 35; T. 4 S., R. 3 E. sections 1, 21, 27, 29;
T. 4 S., R. 4 E. sections 21, 27, 29, W.M.

Responsible Agency:	USDI - Bureau of Land Management
Responsible Official:	Cindy Enstrom, Field Manager Cascades Resource Area 1717 Fabry Road SE Salem, OR 97306 (503) 315-5969
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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-09/055+1792

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FINDING OF NO ADDITIONAL SIGNIFICANT IMPACT[1]

The Bureau of Land Management (BLM) has conducted an environmental analysis (Environmental Assessment Number OR080-08-05) for a proposal to thin approximately 720 acres located on BLM lands within the Cascades Resource Area in Clackamas County, Oregon. The *Highland Fling Thinning Environmental Assessment* documents the environmental analysis of the proposed commercial thinning activity. The EA is attached to and incorporated by reference in this Finding of No Significant Impact determination. 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 thinning 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*).

The project is located on BLM lands in T. 3 S., R. 3 E. section 35; T. 4 S., R. 3 E. sections 1, 21, 27, 29; T. 4 S., R. 4 E. sections 21, 27, 29, W.M. in Clackamas County, Oregon. The proposed action is to thin approximately 720 acres including the following age classes of timber stands: 91 acres of 28 to 35 years-old; 564 acres of 41 to 80 years-old; and 65 acres of 81 to 93 years-old. These acreages include 14 acres of right-of-way clearing. Approximately 550 of these acres are in the Matrix land use allocation (LUA), and 170 in the Riparian Reserve LUA.

The EA and FONSI will be made available for public review from March 24, 2010 to April 23, 2010. The notice for public comment will be published in a legal notice in the *Molalla Pioneer newspaper*. Written comments should be addressed to Cindy Enstrom, Field Manager, Cascades Resource Area, 1717 Fabry Road S., Salem, Oregon 97306. Emailed comments may be sent to OR_Salem_Mail@blm.gov. Attention: Cindy Enstrom

Finding of No Significant Impact

Based upon review of the *Highland Fling Thinning EA* and supporting documents, I have determined that 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 a new environmental impact statement is not needed. This finding is based on the following discussion:

Context: 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 Clear Creek (including Little Cedar Creek), Upper Clear Creek, Upper Milk Creek and Headwaters of Milk Creek. This project would affect approximately 0.6 percent of the 56,118 acre combined 6th field watersheds listed above. (*EA section 1.1,* Table 1) [40 CFR 1508.27(a)]

[1] This section of the Highland Fling Thinning EA is the Draft Finding of No Significant Impact (FONSI). The Cascades Field Manager will finalize the FONSI in the Decision Rationale document after the public comment period.

***Intensity**:*

1. The resources potentially affected by the proposed thinning activities are: vegetation and forest stand characteristics, hydrology, fisheries and aquatic habitat, soils, wildlife, air quality and fire hazard/risk, carbon storage, carbon emissions and climate change, recreation, visual resources and rural interface areas, and cultural resources.

   The effects of commercial thinning are unlikely to have significant adverse impacts on these resources [40 CFR 1508.27(b) (1)] for the following reasons:

   - *Project design features* described in *(EA section 2.3.4)* would reduce the risk of effects to affected resources to be within RMP standards and guidelines and to be within the effects described in the RMP/EIS.
   - *Vegetation and Forest Stand Characteristics (EA section 3.3.1):* 1/ No special status vascular plant species or bryophytes would be affected. 2/ Noxious Weeds – Increases in the number of invasive/non-native plants are expected to be short lived because all areas with ground disturbing activities be revegetated with native species (*EA section 2.3.4 – 3*); and native species would naturally revegetate after thinning activities (*EA section 3.3.1.1*). The proposed action would not result in adverse effects to BLM Special Status Species or former Bureau Assessment Species because no suitable habitat for any species known or likely to be present would be lost or altered to a degree that may impact existing populations. Therefore, the project would not contribute to the need to list any BLM Special Status Species.
   - *Hydrology; Fisheries and Aquatic Habitat; and Soils (EA sections 3.3.2-3.3.4)*: Road construction would occur on gentle slopes with stable, vegetated surfaces. Gentle to moderate slope gradients in this project area provide little opportunity for surface water to flow. Stream protection zones (60 feet on perennial streams, 30 feet on intermittent streams) would maintain current stream temperatures by retaining the current vegetation in the primary shade zone and most of the current levels of shading in the secondary shade zone. Stream protection zones are also expected to prevent sediment as a result of overland flow or surface erosion in logging units from reaching streams during storms of less than a 10 year return interval (*EA section 3.3.2*). Timber haul and road maintenance project design features would prevent sedimentation delivery to streams in quantities that would exceed Oregon DEQ requirements. In-stream work (standard culvert maintenance, temporary ford) would take place during the dry season/in-water work period to prevent water quality degradation for more than a few hours within a few days time period within ½ mile downstream of the work site. The proposed action will abide by and meet State of Oregon water quality standards.
   - *Soils*: Soil Compaction is limited to no more than 10 percent of each unit's acreage, with less than 2 percent potential loss of productivity.
   - *Wildlife* (*EA section 3.3.5*): 1/ Stands proposed for thinning are not presently functioning as late-successional old growth habitat. 2/ Existing snags, remnant old growth trees and coarse woody debris (CWD) would be retained. The few (fewer than 10 percent of existing) large (≥ 15 inches diameter and ≥ 15 feet tall) snags that would be felled for safety or knocked over by falling and yarding operations would be retained as CWD. 3/ No suitable habitat for BLM Special Status species known or likely to be present would be lost.

Therefore, the project would not contribute to the need to list any BLM Special Status species. 4/ Thinning 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. 5/ See # 2, for effects to northern spotted owl.

- *Air Quality and Fire Hazard/Risk (EA section 3.3.6):* 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. 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. For example, slash burning would take place when wind and air movement patterns would dissipate smoke within 12 hours, reducing the effect on air quality.

- *Carbon Storage, Carbon Emissions and Climate Change (EA section 3.3.7):*

    - 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.

    - The retained trees would sequester carbon equal to the amount of carbon from the live trees pool emitted during the first decade of the project within three years after thinning, so the direct impacts are of short duration as well as small magnitude.

    - An equal amount of wood would be harvested and processed from other lands within the region to meet market demand, resulting in zero net difference between the action and no action alternatives on regional carbon storage and global climate change scales.

- *Recreation, Visual Resources, and Rural Interface (EA section 3.3.7*): Changes to the landscape character would be low and would comply with Visual Resource Management guidelines because the project would maintain a forested setting. Some disturbance to vegetation would be observable after thinning activities and would be expected to develop an undisturbed appearance within five years.

2. The proposed thinning activities:
    - Would not affect:
        - unique characteristics of the geographic area [40 CFR 1508.27(b)(3)] - There are no parklands, prime farmlands, wild and scenic rivers, wilderness, or ecologically critical areas located within the project area (*EA Section 3.3.10);*

        - districts, sites, highways, structures, or other objects listed in or eligible for listing in the National Register of Historic Places, nor would the proposed action cause loss or destruction of significant scientific, cultural, or historical resources [40 CFR 1508.27(b)(8)] (*EA Section 3.3.10).*

- Are not unique or unusual. The BLM has experience implementing similar actions in similar areas without highly controversial [40 CFR 1508.27(b) (4)], highly uncertain, or unique or unknown risks [40 CFR 1508.27(b) (5)].
- Do not set a precedent for future actions that may have significant effects, nor does it represent a decision in principle about a future consideration [40 CFR 1508.27(b) (6)].
- Are not expected to adversely affect Endangered or Threatened Species listed under the Endangered Species Act (ESA) of 1973 [40 CFR 1508.27(b) (9)].
    - ESA Wildlife - Northern spotted owl (EA Section 3.3.5): 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, LCR coho salmon, and LCR steelhead trout (EA Sections 3.3.2, 3.3.3): Effects to ESA fish are not significant because thinning is not expected to affect these species for the reasons stated in the Hydrology section, above. The increased turbidity from the temporary ford on Randall Creek is unlikely to be visible or measurable beyond 0.5 mile downstream of the ford. The closest ESA listed fish are at least 3.7 miles downstream of this site (see Table 8), thus unlikely to be affected by turbidity produced from project actions. The log haul route from unit 3-3-35B crosses ESA fish habitat in Little Clear and Mosier Creeks. Effects of the log hauling are not significant because hauling would be conducted in summer when road surfaces are dry, and because approaches to the stream crossings drain water away from the streams, and ditches are densely vegetated with no sign of sediment movement from road surfaces. New road construction would be located in stable locations and would not contribute to degradation of aquatic habitat. ESA Consultation is described in EA section 5.1.2.
    - Do not violate any known Federal, State, or local law or requirement imposed for the protection of the environment [40 CFR 1508.27(b) (10)] ***(****EA Section 1.3****)***.

3. The Interdisciplinary Team (IDT) evaluated the project area in context of past, present and reasonably foreseeable actions [40 CFR 1508.27(b) (7)] and determined that there is a potential for cumulative effects on water quality and fisheries, and on carbon storage. 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 renovation, road maintenance, road use and log fill removal. There is a theoretical potential for increases in stream sediment and turbidity as a result of thinning and logging operations (*EA Sections 3.3.2 -3.3.4*). 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 (less than 0.3 percent of the total 6th field watershed sediment supply, an undetectable change) and duration (primarily major storm events during the first year following disturbance) 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 sixth or seventh field watershed scale and would be unlikely to have any effect on any designated beneficial uses, including fisheries. (EA Section 3.3.3.2)

o Carbon storage and carbon emissions *(EA section 3.3.7)*: 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 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 proposed thinning would contribute to cumulative effects to carbon storage and carbon emissions by emitting 5,052 tonnes of Carbon over the next 10 years (Table 17, Item 11) which is approximately 0.000007 percent of average global emissions (Table 18, Items E, E-1).
- Tables 17and 18 of the EA show that carbon emissions resulting from the proposed thinning over the next 10 years would total 5,052 tonnes of (0.000005 Gt) of carbon or 18,541 tonnes (0.000019 Gt) of carbon dioxide (tonnes C*3.67). Current annual global emissions of carbon dioxide total 25 Gt of carbon dioxide, (IPCC 2007, p. 513), and current annual U.S. emissions of carbon dioxide total 6 Gt (EPA 2007, p 2-3. Therefore, the short-term (1-10 years) emissions of carbon from the proposed thinning would constitute 0.00003 percent of current global emissions and 0.000007 percent of current U.S. emissions. 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..

In addition, the net carbon emissions would be of short duration. The remaining trees in the project area would sequester 2,255 tonnes of carbon per year, restoring the carbon loss from fuel burning, harvested wood, and harvest operations emissions within three years after thinning (Tables 17 and 18, EA section 3.3.7). Over the thirty years following the proposed thinning, the increase of 28,056 tonnes of live tree carbon would contribute to an annual average of 0.0012 percent of the U.S. annual accumulation of carbon from forest management of 0.191 Gt; or 0.13 percent of the annual accumulation of 0.00169 Gt of carbon as a result of current implementation on BLM-managed lands in western Oregon. (2008 FEIS, p. 4-537).

Approved by: Cindy Enstrom 3/23/2010

Cindy Enstrom, Cascades Resource Area Field Manager Date

HIGHLAND FLING THINNING ENVIRONMENTAL ASSESSMENT

1.0 INTRODUCTION

This EA will analyze the impacts of proposed commercial thinning operations and connected actions on the human environment. The EA will provide the decision-maker, the Cascades Resource Area Field Manager, with current information to aid in the decision-making process. It will also determine if there are significant impacts not already analyzed in the Environmental Impact Statement for the Salem District's Resource Management Plan (1995) and whether a supplement to that Environmental Impact Statement is needed or if a Finding of No Significant Impact is appropriate. Section 1 of this EA for the proposed Highland Fling Thinning project provides a context for what will be analyzed in the EA, describes the kinds of actions we will be considering, defines the project area, describes what the proposed action need to accomplish, and identifies the criteria that we will use for choosing the alternative that will best meet the purpose and need for this proposal.

1.1 Proposed Action

The Cascades Resource Area, Salem District Bureau of Land Management (BLM), proposes to implement forest management activities within the Clear Creek and Lower Molalla River 5th Field Watersheds. Proposed forest management activities are commercial thinning to maintain the health and growth of existing dense stands. Connected actions include such restoration activities as: fuels management; removal of a failing culvert; mulching, seeding, and fertilizing for roadway stability; and blocking, and improving roads (*EA Sections 2.0 and 3.0)*.

1.1.1 Project Area[2] Location and Vicinity

The Highland Fling Thinning Project area is within the Middle Clear Creek (including Little Cedar Creek), Upper Clear Creek, Upper Milk Creek, and the Headwaters of Milk Creek 6th field watersheds, near the City of Colton in Clackamas County, Oregon. BLM-administered land is intermixed with privately-owned land (agricultural, industrial timber and residential), creating an assortment of ownership patterns. The project is located within Township 3 South, Range 3 East, section 35; Township 4 South, Range 3 East, sections 1, 21, 27, 29; Township 4 South, Range 4 East, sections 21, 27, 29; Willamette Meridian. See EA Section 7.2.1 - Vicinity Map.

1.2 Purpose of and Need for Action

1.2.1 Need for the Action

Data analysis and field examinations by BLM staff have identified specific stands in which growth rates will soon decline or have already started to decline, and/or in which structural diversity is limited due to overstocking—that is, the stands contain more trees than the sites have water, nutrients, and growing space to sustain. These overstocked stands in the project area need immediate forest management activities to reduce the number of trees per site to allow remaining trees to have sufficient water, nutrients and space for additional growth to meet RMP objectives.

[2] Project Area is defined as that area that is directly affected by project operations (e.g. thinning units, area cleared for landings, roads and rights-of-way). The area around the Project Area, especially BLM managed lands in the same contiguous block of ownership, is referred to as the project area vicinity or similar term.

Table 1: Watershed and Proposed Treatment Acres

Watershed Name	6th Field Sub-Watershed Acres	Total 5th Field Watershed Acres	Proposed Project Acres within the Watershed	Percent of Watershed Treated
Lower Clackamas River Watershed, *Clear and Foster Creek Watershed Assessment* (2002)				
Middle Clear Creek (Incl. Little Cedar Creek)	21733	46,528	473	1.0
Upper Clear Creek	12433			
Milk Creek Watershed, *Lower Molalla River and Milk Creek Watershed Assessment* (2004)				
Upper Milk Creek	11753	65,791	247	0.4
Headwaters of Milk Creek	10199			
Total	56118	112,319	720	0.6

On Matrix lands designated for the sustained production of timber overstocked stands, with their declining growth rates, have resulted in reduced volume yield and value over the planned timber rotation. The proposed forest management activities are needed in the project area stands to reverse these trends so the stands will persist and contribute to future forest production and other goals of the NWFP.

On Riparian Reserve lands designated for restoring and maintaining the ecological health of watersheds and aquatic ecosystems (RMP p. 5), and for providing habitat for terrestrial species (RMP p. 9), overstocked conifer stands have resulted in simple stand structure and declining growth rates that result in delayed development of large diameter snags and other habitat characteristics associated with late-successional forests.

1.2.2 Purpose (Objectives) of the Project

This project has been designed under 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 (see EA Section 1.3).

The Highland Fling project area is within the Matrix (General Forest Management Area (GFMA)) and Riparian Reserve land use allocations (RMP p. 5; NWFP p. A-4, A-5; EA section 1.3). The following RMP and Northwest Forest Plan (NWFP) objectives would be applied to achieve the purpose of this project.

Within the Matrix (General Forest Management Area (GFMA)) land use allocation:

1. Manage developing stands on available lands to promote tree survival and growth and to achieve a balance between wood volume production, quality of wood, and timber value at harvest; (RMP p. 46) and increase the proportion of merchantable volume in the stand, to produce larger, more valuable logs, to anticipate mortality of small trees as the stand develops, to maintain good crown ratios and stable, wind-firm trees (RMP p. D-2) by applying commercial thinning treatments.
2. Supply a sustainable source of forest commodities from the Matrix land use allocation to provide jobs and contribute to community stability (RMP pp. 1, 46-48).

Select logging systems based on the suitability and economic efficiency of each system for the successful implementation of the silvicultural prescription, for protection of soil and water quality, and for meeting other land use objectives (RMP P. 47) by developing timber sales that can be successfully offered to the market place.

Within the Riparian Reserve land use allocation:

3. Maintain water quality standards (RMP p.2) and improve stream conditions by:
   - Maintaining effective shade for streams pursuant to BLM's TMDL agreement with the State of Oregon.
   - Designing new roads and using existing roads to avoid increasing the quantity of water and sediment transported to streams.
4. Develop large conifers and future large coarse woody debris, large snag habitat and in-stream large wood. Develop long-term structural and spatial diversity, and other elements of late-successional forest habitat, and to control stocking (stand density) to acquire desired vegetation characteristics and improve diversity of species composition within the Riparian Reserve LUA. These objectives would be accomplished by applying commercial thinning treatments within the Riparian Reserve LUA concurrent with treatments in the adjacent Matrix LUA, removing 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).

Within Both Land Use Allocations

5. 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).
6. 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 vehicles needed to meet the objectives above;
   - Perform road maintenance to prevent road deterioration or failure and to prevent road generated sedimentation that exceeds ODEQ standards.
7. Increase protection for the public, facilities and high-value resources from large, intense wildfires in the rural/urban interface (RMP, pp. 39, 43) in accordance with the National Fire Plan's Healthy Forest Initiative and Restoration Act by:
   - Reducing natural and activity-based fuel hazards on BLM-administered lands in rural interface areas,
   - Protecting resources on BLM-administered land from potential wildfires originating on adjacent private land by reducing fuel hazards,
   - Controlling access to limit potential human sources of wildfire ignition.

1.2.3 Decision Factors

In choosing the alternative that best meets the purpose and need, the Cascades Resource Area Field Manager will consider the extent to which each alternative would:

1. Provide timber resources and revenue to the government from the sale of those resources (objectives 1 and 2);
2. Reduce the costs both short-term and long-term of managing the lands in the project area objectives 1 and 2);
3. Provide safe, cost-effective access for logging operations, fuels management and fire suppression (objectives 2, 6, and 7) ;
4. Reduce competition-related mortality and wildfire risk, and increase tree vigor and growth (objective 1 and 7);
5. Reduce erosion and subsequent sedimentation from roads (objectives 3 and 6);
6. Provide for the establishment and growth of conifer species while retaining structural and habitat components, such as large trees, snags, and coarse woody debris (objectives 4 and 5);
7. Promote the development of healthy late-successional characteristics in the Riparian Reserve land use allocation (objective 4);
8. Establish a defensible area for use during extended fire suppression activities and possibly reduce the overall size of a wildfire (objective 7).
9. Reduce potential human sources of wildfire ignition by controlling access and by reducing activity fuels in the areas most accessible to humans (objective 7).

1.3 Conformance with Land Use Plan, Statutes, Regulations, and other Plans

On July 16, 2009 the U.S. Department of the Interior, withdrew the Records of Decision (2008 ROD) for the Western Oregon Plan Revision and directed the BLM to implement actions in conformance with the resource management plans for western Oregon that were in place prior to December 30, 2008. Since project planning and preparation of National Environmental Policy Act documentation for this project began prior to the effective date of the 2008 ROD, this project had been designed to comply to the land use allocations, management direction, and objectives of the 1995 Salem District resource management plan (1995 RMP), as amended.

The following documents direct and provide the legal framework for management of BLM lands within the Salem District and for this project:

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 (e.g. complies with management goals, objectives, direction, standards and guidelines) as required by 43 CFR 1610.5 (BLM Handbook H1790-1). Implementing the RMP is the reason for doing these activities (RMP p.1-3);
2. *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl*, April 1994 (the Northwest Forest Plan, or NWFP);

   Land Use Allocations: The area proposed for treatment falls within the following Land Use Allocations (LUA) as defined in the previously described in the (***1***) the Salem District RMP and (***2***) Northwest Forest Plan (NWFP):

- **Matrix (Matrix LUA).** The management objectives for this land use allocation include: to produce a sustainable supply of timber, provide connectivity between Late Successional Reserves, provide habitat associated with all age classes, and provide structural components such as down logs, snags and large trees (RMP p. 20). For this project, all matrix land is within the General Forest Management Area (GFMA), so the terms "Matrix" and "GFMA" may be used interchangeably in this document. See EA section 1.2.2 for management objectives associated with this land use allocations.
- **Riparian Reserves (Riparian Reserve LUA).** The primary management focus for the Riparian Reserve LUA is to meet the Aquatic Conservation Strategy Objectives described in the RMP (pp. 5-6) "to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands." This includes terrestrial habitat, water quality and quantity, and aquatic habitat. See EA section 1.2.2 for management objectives associated with this land use allocations. For the Highland Fling Thinning Project, the Riparian Reserve LUA includes the stream and the area extending from the edges of the stream channel (each side) to a distance equal to the height of:
  - For fish-bearing streams – a slope distance equal to the height of two site potential trees. For this project this is 440 feet each side of the stream channel.
  - For non-fish-bearing streams - a slope distance equal to the height of one site potential tree. For this project this is 220 feet each side of the stream channel.

  In addition, the NWFP/ROD (p.B-31) also 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) direct the BLM to apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives. 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 3.4 describes the project's compliance with the Aquatic Conservation Strategy, including the nine ACS objectives.

3. *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.

The analysis in the Highland Fling Thinning EA is site-specific, and supplements and tiers to analyses found in the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement*, September 1994 (RMP/FEIS). The RMP/FEIS includes the analysis from the *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl*, February 1994 (NWFP/FSEIS). The RMP/FEIS is amended by the *Final Supplemental Environmental Impact Statement for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, November 2000.

Information from the *Clear and Foster Creek Watershed Analysis, 2002 (CFCWA)* and the *Lower Molalla River and Milk Creek Watershed Assessment, 2004 (MCWA)* has been incorporated into the development of the proposed thinning activities, and into the description of the Highland Fling Thinning EA's affected environment and environmental effects (*EA section 3.0*) and is incorporated by reference. The Clear Creek and Milk Creek portions of these two watershed analyses include all of the proposed thinning areas analyzed for the Highland Fling Thinning.

The above documents are available for review in the Salem District Office. Additional information about the proposed activities is available in the *Highland Fling Thinning EA* Analysis File, also available at the Salem District Office.

1.3.1 Survey and Manage Species Review

Before issuing a decision, the Highland Fling thinning project will 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.

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in *Conservation Northwest, et al. v. Rey, et al.*, No. 08-1067 (W.D. Wash.) (Coughenour, J.), granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the BLM and USFS 2007 Record of Decision eliminating the Survey and Manage mitigation measure. Previously, in 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation had entered into a stipulation exempting certain categories of activities from the Survey and Manage standard (hereinafter "Pechman exemptions").

Judge Pechman's Order from October 11, 2006 directs: "Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

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

Following the Court's December 17, 2009 ruling, the Pechman exemptions are still in place. Judge Coughenour deferred issuing a remedy in his December 17, 2009 order until further proceedings, and did not enjoin the BLM from proceeding with projects. Nevertheless, I have reviewed the Highland Fling thinning project in consideration of both the December 17, 2009 and October 11, 2006 order.

I have made the determination that units 3S-3E- 35A-D, 4S-3E-1, 4S-3E-21A&C, 4S-3E-29A&B, 4S-4E-27A&C, 4S-4E-29A-C (655 acres) of the Highland Fling thinning project meets Exemption A of the Pechman Exemptions (October 11, 2006 Order) because these units entail thinning in stands less than 80 years old (Table 6).

Therefore these units of the Highland Fling Thinning project may still proceed even if the District Court sets aside or otherwise enjoins use of the 2007 Survey and Manage Record of Decision since the Pechman exemptions would remain valid in such case.

Sixty five (65) acres of the Highland Fling thinning project (Units 4S-3E-27A&B, 4S-4E-21, and 4S-4E-27B) will meet the December 17, 2009 order by surveying these units to the standards outlined in the 2001 Survey and Manage Record of Decision (2001 ROD without Annual Species Reviews (ASRs)). These surveys will take place prior to making a final decision on whether to implement these units.

1.3.2 Relevant Statutes/Authorities

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

- Oregon and California Act (O&C) 1937 – Requires the BLM to manage O&C lands for permanent forest production, in accord with sustained-yield principles. Management of O&C lands must also 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.

Additional authorities and management direction are described in EA section 3.3.10 Table 19.

1.4 Scoping and Identification of Relevant Issues

1.4.1 Scoping

External scoping (seeking input from people outside of the BLM) for this project was conducted by means of a scoping letter sent out to approximately 291 federal, state and municipal government agencies, nearby landowners, tribal authorities, and interested parties on the Cascades Resource Area mailing list on 20 February 2008. In addition, BLM representatives attended the Clarkes-Highland Community Planning Organization meeting on 05 March 2008 to answer questions about the Highland Fling Thinning proposal and solicit comments. Approximately thirty-eight (38) comment letters/emails/postcards were received during the scoping period. The scoping and EA comment letters/emails/postcards are available for review at the Salem District BLM Office, 1717 Fabry Rd SE, Salem, Oregon. *EA section 1.4.2* addresses the topics raised in the comments. Internal scoping was conducted by the Interdisciplinary Team (IDT) through record searches, field reviews and the project planning process.

1.4.2 Relevant Issues

Based on input from the public and the Interdisciplinary Team plus information contained in the RMP, the following issues were identified. These issues provide a basis for comparing the environmental effects of the proposed project and aid in the decision-making process. The major issues brought forward were used to formulate alternatives, identify appropriate design features, or analyze environmental effects. The following major issues were identified:

1.4.2.1 Issue 1: Urban Interface

Local residents have expressed concern about the project's impacts on: scenic and recreation values; noise, dust, hunter and OHV trespass onto neighboring private property; and OHV use on BLM land. This issue is addressed in the following sections of the EA: 2.3.1 – Proposed Treatments; 2.3.3 – Connected Actions, 2.3.4 – Project Design Features; 3.3.6 – Air Quality and Fire; 3.3.8 – Recreation, Visuals, and Rural Interface.

1.4.2.2 Issue 2: Cumulative Effects

Commenters expressed a concern about cumulative effects when added to operations on surrounding private lands. Cumulative effects are addressed in the following sections of this EA: 3.3.1.2 - Vegetation; 3.3.2.2 - Hydrology; 3.3.3.2 - Fisheries; 3.3.4.2 – Soils; 3.3.5.2 - Wildlife; 3.3.6.2 - Air Quality and Fire; 3.3.7.2 - Carbon Sequestration and Climate Change; 3.3.8.2.- Recreation, Visuals and Rural Interface.

1.4.2.3 Issue 3: Water Quality, Riparian management and Aquatic Conservation Strategy

Commenters expressed concerns about impacts to streams and riparian habitat and whether thinning in the Riparian Reserve supports the attainment of Aquatic Conservation Strategy objectives. This issue is addressed in the following sections of this EA: 1.2.2 - Purpose of the Project; 2.3.1 – Proposed Treatments; 2.3.3 – Connected Actions, 2.3.4 – Project Design Features; 2.5 – Alternatives Consider but not in Detail; 3.3.1 – Vegetation; 3.3.2 - Hydrology; 3.3.3- Fisheries; 3.3.5 - Wildlife; 3.4- Compliance with Aquatic Conservation Strategy.

1.4.2.4 Issue 4: Potential impacts to Special Status Species (includes ESA threatened/ endangered species)

Commenters expressed concerns about impacts to Special Status Species, including fish, plant and animal species. This issue is addressed in the following sections of this EA: 2.3.4-4 – Project Design Features; 3.3.1.1 - Vegetation; 3.3.3 - Fisheries; 3.3.5 - Wildlife, 5.1 – Consultation.

1.4.2.5 Issue 5: Economic viability of timber sale

Commenters have expressed concern that the proposed timber sale be economically viable and operable. This issue is addressed in the following sections of this EA: 1.2.2 - Purpose of the Project; 1.2.3 – Decision Factors.

1.4.2.6 Issue 6: Invasive Non-Native Plants

Commenters expressed concern about spreading invasive non-native plants because of logging activities. This issue is addressed in the following sections of this EA: 2.3.4-3 - Project Design Features; 3.3.1- Vegetation.

1.4.2.7 Issue 7: Recreation

Commenters have expressed concern about impacts to recreational uses within proposed thinning units, specifically user-created equestrian trails. This issue is addressed in the following sections of this EA: 2.3.4-1, 3 - Project Design Features; 2.5 – Alternatives Considered; 3.3.8 – Recreation, Visuals, Rural Interface.

1.4.2.8 Issue 8: Carbon Storage, Carbon Emissions, and Climate Change

Commenters expressed concern about the impacts of the project on Carbon Sequestration and Climate Change. This issue is addressed in the following sections of this EA: 2.5 - Alternatives Considered; 3.3.7 – Carbon Storage/Emissions, Climate Change..

1.5 Decisions to be Made

The following decisions will be made through this analysis:

- To determine if a Supplemental Environmental Impact Statement (SEIS) should be prepared based on whether the proposed action would result in significant impacts to the human environment not already analyzed in the EIS prepared for the Salem District RMP and its amendments.
- If there are any such additional impacts that are significant, we will determine whether the project proposals could be modified to mitigate the impacts so an SEIS would not be necessary. If we determine there is no need to prepare an SEIS, we will document this determination in a Finding of No Significant Impacts (FONSI).
- To determine at what level, where, and how to harvest trees on BLM-administered lands allocated to the programmed timber harvest base within the project area.
- To implement or not implement proposed fuels management projects on BLM-administered lands within the project area and/or outside of proposed project units.

2.0 ALTERNATIVES

2.1 Alternative Development

Pursuant to Section 102 (2) (E) of the National Environmental Policy Act (NEPA) of 1969, as amended, Federal agencies shall "…study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." There were no unresolved conflicts concerning alternative uses of available resources, therefore, this EA will analyze the effects of the current "proposed action" and "No Action alternative" (which provides the baseline to evaluate effects).

2.2 Planning and Implementation Process

The BLM would require the timber sale operator to accomplish the following actions as required in the timber sale contract written by the BLM. The BLM would develop the timber sale contract to implement the actions described below and the project design features (PDF) that follow (*EA Section 2.3.4*). These actions and the PDF, taken together, form the best management practices (BMP) that the IDT developed based on the principles of the BMP described in Appendix G of the RMP/FEIS and Appendix C of the RMP which the IDT adapted to the site specific conditions of the proposed Highland Fling Thinning project.

2.3 Alternative 1 (Proposed Action)

The proposed action is to commercially thin[3] (this summary includes right-of-way acres) approximately 720 acres including (See EA Table 6 and Section 7.2.2 for maps of the Proposed Action):

[3] In commercial thinning material from cut trees is used for wood products.

- 91 acres of 28 to 35 year-old Early and Early-Mid Seral Stage[4] timber stands;
- 564 acres of 41 to 80 year-old Mid and Late-Mid Seral Stage timber stands;
- 65 acres of 81 to 93 year-old Early Mature Seral Stage timber stands.

The proposed action would be implemented with two timber sales:

- The Highland Fling Thinning timber sale would include all units west of Highway 211. The anticipated offer date would be August 2010.
- The Highland Flung Thinning timber sale would include all units east of Highway 211. The anticipated offer date would be November 2010.

2.3.1 Proposed Treatments

In the Matrix LUA

The BLM proposes to commercially thin 545acres of overstocked 28-93 year old forest stands within the General Forest Management (GFMA) portion of the Matrix Land Use Allocation (LUA).

The objective of this treatment is to: promote timber volume growth and quality; develop a healthy forest that can resist windthrow, disease and wildfire; and provide habitat for a variety of wildlife species.

The proposed commercial thinning would reduce stand density by implementing a "thin from below" prescription in all units except 27-4S3E. The prescription generally designates trees to be retained based on a combination of tree size, crown position,[5] spacing, species mix, vigor and potential future log quality (see the Silvicultural Prescription for Highland Fling, 2009).

Specifically, the prescription proposes to:

- Retain trees that are larger than the average diameter for the stand, emphasizing the largest, healthiest and best formed dominant and co-dominant trees;
- Cut and remove suppressed and intermediate trees, and co-dominant trees directly competing with the trees selected for retention 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 stocking (number of trees per acre to be retained in each stand);
- 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.
- The proposal is to thin to a relative density of 35 on all units except 27-4S-3E, which would be thinned to a relative density of 40-45.

[4] Age ranges of stands proposed for treatment are based on 2008 Stand Exam data and are rounded for this presentation. Seral Stage Age Classes are: Early = 0-30; Early Mid = 31-40; Mid = 41-60; Late Mid = 61-80; Early Mature = 81-120; Mature = 121-200; Old Growth = 201+.

[5] Crown position indicates the relative position of the live crown (branches) of a tree relative to the crowns of other trees in the forest canopy. Dominant and co-dominant trees are generally the tallest trees, most exposed to sunlight – also called "overstory trees" or "the overstory". Intermediate tree crowns reach into the canopy enough to get some light from above but not from the sides and are generally small and crowded. Suppressed trees are shaded by all of the other crowns and have low growth rates and low vigor as a result of competition with overtopping trees.

- 27-4S-3E is a multilayered multi species stand with many shade tolerant trees. The prescription for this stand thins trees in all canopy positions and thins to a higher relative density that is, in the opinion of the BLM silviculturist, more appropriate for this stand.

In the Riparian Reserve LUA

The BLM proposes to commercially thin 175 acres of overstocked 28-93 year old forest stands as one part of a management prescription to increase forest stand structural diversity within the Riparian Reserve LUA.

This prescription would contribute to Aquatic Conservation Strategy (ACS) objectives; develop a healthy forest that can resist windthrow, disease and wildfire in order to protect watershed and aquatic resources; and provide habitat for a variety of wildlife species. The prescription contributes to developing a complex, variable stand structure across the landscape in the Riparian Reserve. Specifically the prescription proposes to apply the following treatments:

- Reserve (do not treat) approximately 76 percent of the Riparian Reserve within the BLM lands that contain the project area (in this context, the contiguous block of BLM managed land or the section containing proposed thinning, whichever is the smaller area), allowing these areas to develop naturally and provide the "dense" element of complex stand structure through "passive restoration". These no-treatment buffers in the Riparian Reserve include:
  - Stream protection zones (SPZ) - minimum width of 60 feet slope distance on each side of perennial streams[6] and 30 feet slope distance on each side of intermittent streams[7]. These SPZ would increase to 100 feet on perennial streams and 50 feet on intermittent streams within one mile upstream of ESA listed fish habitat. These SPZ are also designed to prevent sediment generated by logging operations from reaching the streams and prevent loss of shading on those streams to avoid increasing water temperature;
  - Potentially unstable slopes;
  - Areas where hardwood trees and brush species already provide desired levels of structural complexity;
  - Areas where logging is not feasible in conjunction with operations in the adjacent Matrix thinning: and
  - Areas where new road would be required specifically to treat stands within the Riparian Reserve.
- Commercially thin up to 24 percent of the Riparian Reserve acres in these blocks of BLM managed land and retain a minimum 50 percent canopy cover.

2.3.2 Logging Systems

Incorporated by reference: Highland Fling Logging Systems Report (M. Barger 2008) (Logging Report)

The BLM designed the project for basic logging systems to accomplish the proposed thinning project using Best Management Practices (BMP) identified by the IDT. Ground based and skyline logging is also described on pages 13-17 of the logging systems report. The elements of this plan are described below:

[6] Streams that flow all year.
[7] Streams that dry up at least part of the year.

- Approximately 86 percent (622 acres) of the thinned area (720 acres) would be harvested using conventional ground-based logging equipment. In ground based logging, the BLM requires the logging operators to propose a plan that best uses their particular combination of equipment and operating techniques to accomplish the project within the requirements of the contract, including stipulations to implement the proposed action and project design features described in this EA (*EA section 2.3.4*).
- Authorized BLM personnel review the written plan and examine skid trail and landing locations prior to approving the plan. The plan then becomes an enforceable part of the contract which is administered by trained and authorized BLM personnel.
- Approximately 14 percent (98 acres) of the thinned area would be harvested using a skyline yarding system. The process for approving and administering a logging plan for skyline yarding is similar to the one described above, designating the location of yarding corridors, landings, and trees to be used for attaching cables.

2.3.3 Connected Actions

1. Road Work (*EA Section 2.3.4; EA Section 7.2-Maps***):**

- ***New Road Construction: "***New Construction" is building a road where none existed before. In this project, for analysis purposes, "new construction" also includes reconstruction of deteriorated roads with trees growing in the road bed. The BLM would design and construct approximately 3.9 miles of new road on BLM land and 1.4 mile of new road on private land to provide access to the proposed thinning project area for logging and hauling. All of the new roads are needed to manage Matrix land under the proposed action. Approximately 3.7 miles of these new roads would be within the Matrix and approximately 0.2 mile would be in the upland portion of the Riparian Reserve. The BLM may rock new roads on Matrix depending on conditions and needs during operations. New roads in the Riparian Reserve LUA would not be rocked and would be used in the dry season (typically June through October) and with dry conditions. Approximately 14 acres on BLM and up to 5 acres on private land (approximately 3 percent of the 720[8] acre overall project area) would be logged and cleared for Rights-of-Way, and roads constructed on BLM, using conventional ground based equipment.
- ***Road Improvement*:** "Road Improvement" upgrades an existing road to a higher design standard than the design of the existing road. Upgrades may include widening the subgrade, changing the alignment so it can be used by modern trucks, upgrading from natural surface to rock surface, and removing substantial vegetation and some trees from the roadbed. No road improvement is proposed in the Highland Fling Thinning project. Some new construction does coincide with segments of deteriorated remnants of abandoned railroad or truck road routes.
- ***Road Renovation and Maintenance Renovation:*** Some of these roads have been blocked or gated and maintenance has been deferred so that vegetation is growing in the roadbeds. "Road Renovation" restores an existing road to its original design standards.

[8] The overall project area of 720 acres includes 704 acres of commercial thinning plus right-of-way clearing. The sum of individual rights-of-way acreage, unit acreage and/or logging system acres may differ from total acres due to rounding of individual items.

"Maintenance Renovation" is the normal, periodic work done to maintain existing, open roads in a useable, safe and environmentally sound condition. Actions include: cutting vegetation from the roadbed and ditches; blading and shaping the roadbed and ditches; repairing small slides and slumps; cutting brush adjacent to the road; maintaining, repairing, adding cross drainage culverts; replacing undersized culverts; and adding rock to replace depleted rock surfaces. The BLM would maintain approximately 6 miles of existing road on BLM managed land to be used for the Highland Fling Thinning project area as part of the proposal.

- ***Culvert Installation:*** No new culvert needs on perennial streams have been identified for the Highland Fling Thinning project.
- ***Log Fill Removal:*** The BLM would remove one collapsed log-fill stream crossing after logging; stream channel and banks would be restored to their original location.
- ***Temporary Stream Crossing:*** The BLM would allow the operator to ford one stream with logging equipment in lieu of constructing a temporary culvert stream crossing.

2. Landings

The BLM would require the timber sale operator to construct ground based and skyline landings according to the approved logging plan.

3. Fuels Treatments (*EA Sections 7.2,* Maps)

The BLM would require the operator to reduce forest fuel accumulations after thinning operations have been completed on approximately 370 acres (approximately 270 acres within the Highland Fling project units, 100 acres outside of harvest unit boundaries) in order to reduce the potential for human caused ignition, and to reduce the rate of spread and intensity and facilitate wildfire control if a fire does start. The BLM would assess each area designated for fuels treatment during logging operations and after they are completed to determine the most appropriate method or combination of methods of fuels treatment to implement.

The BLM fuels management specialist has prepared the potential fuels treatment options shown in Table 2 and preliminary treatment recommendations shown in Tables 3 and 4.

Table 2: Potential Fuels Treatment Methods

Fuels Treatment	Description
Thinning	Thinning from below removes ladder fuels and decreases tree crown density to the lower level of relative density (RD).
Hand pile and burn (or not burn)	Pile small to medium size fuels (< 8" diameter and 6 ft. long) into piles. Piles to be burned would be covered and burned after rains in the fall.
Machine pile slash and burn	Pile all slash not needed for coarse wood debris component, cover and burn piles after rains in the fall.
Lop and Scatter	Cut slash into small sizes; keep all slash within 12" from ground and spread out any accumulations
Biomass removal and hauling offsite	Accumulate small to medium size fuel, grind at landing sites, and haul offsite for utilization
Machine treatment/mastication of slash on site	Use a machine to reduce the slash into wood pieces 6 inches long or less and spread across the area

Fuels Treatment	Description
Underburning the slash within units	Residual stands are composed of fire-resistant species, i.e. Douglas-fir, and a controlled surface fire is ignited slowly in a designated pattern.
Firewood cutting	Allow unmerchantable wood along the road or in piles to be cut for firewood
Closing or restricting access (road gating)	During periods of high fire danger
No Treatment	Behind locked gates and no high values at-risk.

Table 3: Initial Proposed Fuel Treatment Methods

Township-Range-Section Unit	Unit Acres	Treatment Acres	Initial Proposed Fuel Treatment Method and Comments
3-3-35A	19	19	Machine Treatment, >200 ft from channels (Alt. Biomass removal)
35B	102	13	Machine Treatment
35C	11	11	Machine Treatment , >200 ft from channels (Alternative: Biomass removal)
35D	10	10	Machine treatment, > 200 ft from channels (Alternative: Biomass removal)
4-3-1	265	67	300' Machine Treatment along west and southwest property lines and lop and scatter along southeast property line
4-3-21A	10	8	300' Machine Treatment along property line to RR
21C	54	30	Machine Treatment 300 ft. wide along prop. line and triangle
4-3-29A	6	6	Pile and burn or lop and scatter 300' wide along property line
29B	20	10	Machine Treatment 300 ft wide along road/line
4-3-27	28	23	Machine Treatment 300 ft. wide along property lines – all flatter ground outside RR
4-4-29A	23	7	Machine Treatment 300 ft. wide along property line
4-4-29B	86	50	Machine Treatment 300 ft. wide along property line and road
4-4-29C	20	16	Machine Treatment 300 ft. wide along west, south and east sides.
Total	654	270	

The initial proposed fuel treatment methods listed above are typical anticipated methods. The final selection of fuel treatment method would be made after logging has been completed on each unit, based on the BLM Fuel Specialist's evaluation of the amount and characteristics of the fuels and the availability and effectiveness of equipment that is available at the time. As of this writing, removal of slash as biomass for bio-fuel is not economically feasible. If it becomes feasible, removal of 60-80 percent of the slash material would be a viable fuel treatment method.

In addition to treatment of logging slash within proposed harvest units, additional fuels treatments are proposed to be done during the same time (season) as fuels treatments within adjacent thinning units. As with treatments within thinning units, a different method of accomplishing the fuels treatment may be selected by the BLM Fuel Specialist based on conditions, methods and equipment available and effective at the time treatment is needed.

Table 4: Initial Proposed Fuel Treatment Methods Outside of Proposed Units

T-R-Sec.	Acres	Fuel Treatments Outside of Proposed Thinning Units
4-3-21	5	Prune, thin small vegetation, machine treatment 300' along line to RR
3-3-25	5	Prune, thin small vegetation, machine treatment 300' from line between 2 units near Fellows road
	10	Prune, thin small vegetation, machine treatment SW corner 300' from line
	5	Prune, thin small vegetation, machine treatment between units 300' from line
3-3-25	25	Prune, thin small vegetation, machine treatment in slivers of BLM lands near the timber sale unit and in Wildland Urban Interface (WUI)
4-4-29	10	Prune, thin small vegetation, machine treatment 300' from property line
4-3-21	10	Prune, thin small vegetation, machine treatment 300' south, 300' north end to steeper slopes
4-4-21	5	Prune, thin small vegetation, machine treatment in the northeast corner of the BLM block nearest residences
4-3-27	25	Prune, thin small vegetation, machine treatment in 3 units along property lines near residences.
Total	100	

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

- Where existing physical barriers currently block OHV access, the logging operator would prevent unauthorized access during operations as part of their normal security measures. The BLM would require that physical barriers be replaced at the end of operations, as well as other measures described under Design Features (*EA section 2.3.4).*
- The BLM authorized contract administrator would ensure that operators make skid trails impassible for OHV as required by the timber sale contract, as described under Design Features (*EA section 2.3.4).* The BLM would require that the operator block and otherwise close roads according to design criteria developed by BLM staff that would effectively eliminate OHV use while making it feasible for fire suppression personnel to open those roads with bulldozers commonly used for wildland fire initial attack response.
- Road and skid trail closure methods would be designed to avoid causing erosion and avoid damaging retained trees. See Design Features (*EA section 2.3.4).*

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

- The 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 products that can be found in the forest and can include: edible mushrooms, firewood, posts and poles, and transplants of native plants.

2.3.4 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 section 3.1-3.3. Project design features described in this section would be implemented in the proposed project.

These design features are based on the management guidance, 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). Based on its combined experience, professional judgment, familiarity with published research, and field analysis of this project area, the BLM Interdisciplinary Team of Resource Specialists (IDT) then refined them into the proposed action and project design features (PDF) described in this EA.

The BLM would incorporate these design features into the project layout, contract requirements, and contract administration to ensure that the project is implemented as analyzed in this EA and that the risk of effects to the resources are no greater than those described in *EA Section 3*. The BLM would require the operator to implement each of the following project design features, unless otherwise stated. Performance would be 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 practices analyzed in this EA. The BLM timber sale contract requires bonding in an amount sufficient for the BLM to complete restoration work if the operator fails to perform the preventive and restorative requirements of the contract.

1. Soil Productivity:

In All Timber Harvest Operations:

The BLM would require the operator to design and implement a plan for logging operations in accordance with the timber sale contract to:

- Limit the area compacted by those logging operations to less than ten (10) percent of the harvest area, calculated for each timber sale contract unit ("unit") (RMP, C-2). The logging operations plan would include: length, width and location of skid trails; length, location and design of skyline corridors; size and locations of landings; and other equipment and operating techniques to be used.
- 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 (typically less than 30 feet).
- Limit landing size to the minimum area needed for safe and efficient operations. Compaction caused by landing construction and operations which is outside of road rights-of-way would be included in the 10 percent maximum allowable compacted area.
- Implement erosion control measures to prevent rill or gully erosion that would displace soil more than a few feet. Typical measures include: shaping to modify drainage (water bars, sloping, etc.); tilling; placing logging slash and debris on bare, compacted or disturbed soil such as skid trails or in skyline yarding corridors; and seeding with native species.
- Block roads, skid trails and any other access points and obstruct them with logging slash and debris to prevent use by Off Highway Vehicles (OHV).
- Seed and mulch disturbed soil associated with roads and landings, using native species and sterile mulch as described in PDF for vegetation in EA section 2.3.4, #3.

In Ground-based Skidding and Other Ground-based Logging Operations:

- The BLM would allow skidding (dragging logs behind a skidder) operations only during dry soil conditions, when soils have the most resistance to compaction.
- Authorized BLM personnel would examine the operator's proposed skid trail locations and approve them for use only when they comply with the approved logging operations plan and meet the following conditions:
  - Use existing skid trails whenever they are feasible for use in logging (lead toward an approved landing, on stable ground, located where they are needed), are properly spaced to stay within the 10 percent compacted area, do not cross wet or fragile areas, and are aligned on the slope to avoid channeling water and causing erosion.
  - Locate new skid trails only on slopes not greater than 35 percent to avoid gouging, soil displacement, and erosion with effects exceeding those analyzed in the FEIS (pp. 4-11 through 4-13).
  - Generally limit uphill skidding to slopes of 20 percent or less to avoid soil displacement from skidders breaking traction.[9]
- Lift the leading end of all logs off of the ground during skidding (one-end suspension) to prevent the blunt ends of logs from displacing soil and creating a channel for erosion.
- For winching operations where it is not feasible to achieve one –end suspension (winching logs to designated skid trails and specially designated winching areas), fall trees to orient logs so that they cause the least soil disturbance (and damage to retained trees) when being winched.
- The BLM would only approve operation of mechanized falling/processing, log handling machinery and fuels treatment machinery on slopes not greater than 45 percent. The BLM would require these machines to operate only on approved skid trails or on top of a slash and brush mat that is sufficiently thick (as determined onsite by the BLM) to avoid displacing soil, to dissipate ground pressure and to avoid deep compaction.
- Implement the following special design features in 29A,B-4S-3E to enable treatment of unit 29A, west of Randall Creek:
  - Ford the stream with equipment on the existing rock streambed to avoid producing sediment by installing and removing a temporary culvert and fill.
  - Lift logs over the stream with full suspension to avoid dragging soil and debris into the water and to avoid sediment created by overturning rocks in the streambed by skidding or yarding with only one-end suspension of logs.
  - Use logs and rock as necessary to create equipment operating and log handling platforms adjacent to the stream banks to prevent damage to stream banks and sediment production.
  - All work would be done during the in-stream work period when stream flows are at their lowest.
  - The BLM would inspect equipment that would ford the stream to ensure that soil and petroleum products would not be transferred to the stream in more than trace amounts.
  - The operator would be required to include measures in the approved operating plan to prevent introducing sediment, logging debris or any other foreign matter into the stream in amounts that would exceed State water quality standards.

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

In Skyline Yarding Operations:[10]

- Design the skyline yarding so that corridors are generally no closer than 150 feet apart on at least one end of the corridors and to laterally yard logs up to 75 feet to the skyline.

  This reduces the number of skyline corridors needed in order to reduce the amount of ground disturbed by dragging logs and the resulting potential for erosion.

- Lift the leading end of all logs off of the ground during in-haul under the skyline (one-end suspension) to prevent the blunt ends of logs from displacing soil and creating a channel for erosion.
- For lateral yarding operations where it is not feasible to achieve one-end suspension (cable angles often do not create enough lift to achieve one-end suspension until logs get close to the skyline), fall trees to orient logs so that they cause the least soil disturbance (and damage to retained trees) during lateral yarding.

In Other Operations:

- Pile logging slash and debris to be burned on the compacted area of the landings to affect the minimum area necessary for safe operations. The BLM would require that the piles be tightly constructed with and designed to create a small "footprint" of soil where heat could reduce soil productivity.
- Cover slash piles with plastic sheeting during the dry season and conduct burning operations after a consistent pattern of fall rains begin and the soil is wet to the touch at least six inches deep into the surrounding soil profile in order to reduce the amount of heat potentially imparted to the soil. The BLM expects the combination of wet soils that can resist heat and covered piles that are still dry enough to burn to occur in November in the Highland Fling area.

2. Water Quality and Aquatic Habitat/Fisheries: The objectives are to: protect water quality (RMP 5-6, 22-23, C-1, C-11) and aquatic habitat/fisheries (RMP 5-6, 27-28). The standard for water quality is the Water Quality Standards set by the Oregon Department of Environmental Quality (Oregon DEQ). *(Hydrology Report* p. 14)

In All Logging and Road Operations:

The logging system PDF that prevent or reduce potential erosion also contribute to achieving the objectives to protect water quality and aquatic habitat/fisheries by preventing sediment transport to streams, wetlands[11] and riparian zones[12]. The BLM would also implement the following requirements and practices to protect water quality and aquatic habitat/fisheries:

[10] 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).

[11] Wetlands are areas with enough surface or ground water to support vegetation adapted to saturated soil conditions. Generally includes swamps, marshes, bogs and similar areas. FEIS 6-17. RMP 10.

[12] Riparian zones are biologically associated with streams, ponds and wetlands and are not equivalent to Riparian Reserves, which are a Land Use Allocation. FEIS 6-12. RMP 10; 24-25.

- New roads would be located, designed and constructed to avoid increasing the size of the stream network by collecting water (in ditches and on road surfaces) and channeling it directly to streams (Wemple et al. 1996).
- New, improved and renovated road surfaces would be designed to drain surface water to adjacent slopes where it would infiltrate into the soil and groundwater.
- To ensure ongoing compliance with Oregon Department of Environmental Quality (ODEQ) water quality standards, the BLM timber sale administrator and the BLM harvest inspectors would visually monitor turbidity (a visible reduction in water clarity, Hydrology Report p. 26) [13] caused by road-generated sediment entering the stream at stream crossings on the haul route. The ODEQ standard is less than ten percent increase in turbidity.
    - BLM personnel would frequently monitor for turbidity during normal timber sale contract administration and do additional checks during wet weather patterns.
    - If turbidity is visible in the stream at the crossing, the BLM would check for turbidity beyond the mixing zone downstream (about 100 meters).
    - If water clarity is visibly altered beyond the mixing zone, the BLM would suspend hauling and other operations immediately and require the operator to immediately reduce fine sediment runoff into the stream by one or more of the techniques described in the following paragraphs. The BLM would allow operations to resume when weather and road conditions combined with measures taken to reduce sediment are deemed sufficient to comply with State of Oregon turbidity standards.
- Prevent sediment runoff from entering streams that would cause a visible increase in turbidity in those streams by using one or more of the following methods: maintain vegetation in the ditch; create small settling basins; or install straw bales, wattles or other artificial filters.
- Shape road surfaces and/or add rock to the road surface as directed by the BLM to prevent sediment runoff from entering streams and increasing turbidity in those streams.
- Haul logs only during times and road conditions that would not generate sediment that would enter streams and cause a visible increase in stream turbidity.

    - On natural surface roads and road 4-4E-28.2 and the private haul road from unit 3-3-35B the BLM would allow the operator to haul and conduct other operations on these roads only during the dry season (typically June through October) and dry conditions when there is no surface mud and the surface supports traffic without creating ruts that damage the subgrade.

    - On rock surface roads, not otherwise restricted – The BLM would allow the operator to haul and conduct other operations on these roads only when traffic and other activities would not "pump" fines (sand, silt and clay size particles) to the surface where they could be washed into streams by runoff.
- Stabilize all new roads and some existing roads after use to prevent erosion and reduce changes to natural drainage patterns.

[13] Turbidity is a measurement of water clarity and is not convertible into a volume measurement of sediment yield unless correlated to suspended sediment data. For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to ***Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest*** (Takashi *et al*, 2005).

- The BLM would require the operator to use one or more of the following methods: water bars or other surface shaping to drain runoff water to vegetated slopes; surface tilling; seeding with native species; sediment traps, and/or other techniques to promote infiltration and prevent erosion and sediment transport to streams that would cause a visible increase in turbidity, and increases in peak flows. Culverts and the subgrade would be left intact so that the road can be renovated for future use or fire control with minimal disturbance and expense.
- When natural surface roads would be kept intact over winter for use on this project the next year, the BLM would require the operator to 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.
- The BLM would restrict road construction, stabilizing operations to the dry season (typically June through October) and dry conditions when no surface mud or sediment laden runoff would be generated.
- Seed and mulch all disturbed soil at stream crossings with native species seed approved by the BLM and sterile mulch (free of non-native seed).

Other Components of Hydrologic Functions, Aquatic Habitat and Fisheries (Channel, Bank, Temperature, Etc.):

- Directionally fall trees[14] in the harvest units so that they do not enter the SPZ, to avoid impacts to the SPZ.
- If any trees or snags in the SPZ must be felled for safe logging operations, the BLM would require the operator to leave them on site in order to create CWD habitat.
- BLM engineers would locate and design roads to be constructed 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.

3. Stand Structure, Wildlife Habitat and Other Vegetation:

To protect old growth, wildlife habitat, and other retained trees, the BLM would require the operator's approved logging plan to include operational methods to:

- Retain all old growth trees[15] and protect them from logging damage that would potentially affect the health or function of the trees. Unit boundaries would generally be located to exclude these trees from the thinning area. Whenever any such old growth trees are included in the proposed thinning unit, the BLM would designate all old growth trees as "Reserved" and contractually prohibit the operator from cutting them.
- Maintain intact and standing snags larger than 15 inches diameter and taller than 15 feet (IDT BMP based on Wildlife Report) during logging activities, with rare exceptions 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).

[14] 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, reduce fuel accumulation next to roads or property lines and protect retained trees.
[15] Trees older than 200 years – RMP/FEIS, Table 3-16, p. 3-28 and glossary.

- The BLM marking guidelines would direct the tree markers to make a conscious effort to protect large standing snags (at least 15 inches diameter, Wildlife Report, pp. 6-10) by marking some of the prescribed number of leave trees per acre as close to these snags as possible. Consider snags when planning road and landing locations to avoid impacts to snags larger than 15 inches diameter and taller than 15 feet whenever the BLM determines it is safe and feasible to do so.
- Retain Coarse Woody Debris (CWD) meeting RMP standards of at least 20 inches diameter (large end) and 20 feet long wherever feasible (RMP p. 21) and protect them from logging damage. Leave existing CWD in place whenever feasible. The required logging operations plan would include a design for skid trail location and operating techniques that require minimal movement of CWD to protect its physical integrity. (RMP p. 21).
- Retain some (number varies according to local abundance) trees that have desirable characteristics for wildlife habitat, such as multiple tops, broken tops, large limbs, disease, dead areas being used by cavity excavators, deep crevices and cavities.
- Retain a visual buffer of unthinned trees and brush along major public access roads to reduce sight distances and disturbance factors from traffic.
- Protect retained trees from logging damage by avoiding operations during the spring growing season when bark and cambium are easily damaged, and/or use operating techniques and mechanical protection devices to prevent damage to retained trees.

To reduce the spread of invasive/non-native plant species:

- Seed and mulch exposed soil using native plant species seed and sterile mulch, in order to stabilize the soil and prevent establishing invasive/non-native plant species on disturbed soil in the project area.
- Clean all ground-disturbing logging and road construction equipment to be free of off-site soil, plant parts and seed prior to entering the project area to prevent introducing invasive and non-native plants into the project area. The BLM would require the operator to make that equipment available for BLM inspection before moving it onto the project area.
- *Areas within the project area with high priority weed species*[16]*:* The BLM would require the contractor to clean all ground-disturbing logging and road construction equipment to be free of soil, plant parts and seed at a BLM approved site prior to leaving the project area, or at an approved industrial wash facility immediately after leaving the project area. The objective of this PDF is to prevent transporting soil, seed and plant parts from the project area to another area.

[16] Weed species that are not yet widespread in this region and which have the potential to spread to new areas. (e,g, if known sites of BLM Manual 9015 Class A and B or ODA List T and A species are detected in the proposed harvest area or on lands immediately adjacent to the proposed harvest area).

4. Threatened, Endangered or Other Special Status Plant and Animal Species:

- The BLM would require the operator to operate under the following seasonal restrictions:
  - No habitat modifying activities (timber harvest, road construction and burning) March 1 through July 31 on units in T. 4 S., R. 3 E., sections 21 (unit 4-3-21A) and 29 (units 4-3-29B&C); and in T. 4 S., R. 4 E., sections 21 and 29, for nesting raptors (RMP p.26). Seasonal restrictions could be waived if surveys indicate no presence of nesting raptors within disturbance range (0.25 miles).
  - The BLM would restrict or suspend operations at any time if plant or animal populations that need protection are found during ongoing surveys or are found incidental to operations or other activity in the area.
  - The BLM would modify project boundaries at any time to buffer plant or animal species/populations that require protection (protocol specific to each species) that are found during ongoing surveys or are found incidental to operations or other activity in the area.

5. Fire and Air Quality:

To reduce the risk of fire and risks to air quality:

- The BLM would conduct all burning operations in compliance with the Oregon Smoke Management Plan to maintain air quality and visibility in a manner consistent with the Clean Air Act.
- The BLM would require the operator to construct slash and debris piles for burning according to the following requirements to achieve clean burning, to protect retained trees and to prevent burning anything outside of the piles:
  - construct piles with compact fuel arrangement to promote efficient burning;
  - place landing piles on soil already compacted by landing operations;
  - place piles to avoid heat damage to crowns and boles of retained trees; and
  - cover piles with plastic sheeting to keep fuels dry so they would burn efficiently during the wet season.
- The BLM would prepare a Burn Plan after piles are created by the operator that would define specific parameters for burning operations. These parameters include acceptable ranges for weather conditions (temperature, relative humidity, wind direction and wind speed ranges), forecasted weather conditions, fuel moisture in the pile, and fuel moisture in adjacent fuels.

  The Burn Plan would also specify personnel needs, equipment needs, and escape fire prevention plans in order to conduct safe, efficient and effective burning operations.
- The BLM would require the operator to meet or exceed ODF fire prevention and fire suppression equipment standards.

6. Public Safety, Rural Interface and Recreation:

Oregon Occupational Safety and Health Administration (OR OSHA) and the BLM would require the operator to place signs, temporarily block roads with vehicles or moveable barricades, and/or use flaggers to ensure public safety while logging, hauling and fuel treatment operations are active in locations where the public could potentially encounter these operations.

7. **Cultural Resources:** The BLM would restrict or suspend ground disturbing activities immediately if prehistoric cultural resources are encountered during project implementation. The BLM would conduct a professional evaluation of the resource site and develop appropriate management practices to protect it.

8. **Seasonal Restrictions and Operational Periods:** The Seasonal Restrictions and Operating Periods are summarized in Table *5*.

Table 5: Summary of Seasonal Restrictions and Operational Periods

Seasonal Restriction	Reason	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Most logging, road work and site preparation operations, Units 21A,C; 29A-4S3E; 21-4S4E; and 29A,B,C- 4S4E.	Raptor breeding and nesting season			■	■	■	■	■					
Falling and yarding	Bark slippage			▒	▒	■	■	▒					
Hauling	Water quality and sedimentation	▒	▒	▒	▒	▒						▒	▒
Skidding operations	Soil compaction	■	■	■	■	■				▒	▒	▒	■
Road Construction / Decommissioning	Soil damage/erosion control	■	■	■	■	▒				▒	▒	▒	■
In-water work: stream culvert maintenance, logging unit 29A-4S3E	Protect fish and aquatic habitat	■	■	■	■	■	■	▒		▒	■	■	■
Logging operations	Fire season, ODF regulated use						▒	▒	▒	▒	▒		

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

2.4 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 the 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 items would not be done in the project area at this time: silviculture 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).

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. Selection of the No Action alternative would not constitute a decision to change the land use allocations of these lands. Selection of the No Action alternative would not set a precedent for consideration of future action proposals.

2.5 Alternatives Considered But Not Analyzed In Detail

- **Treatment of other forest stands within the Riparian Reserve LUA:** The IDT evaluated all Riparian Reserve stands adjacent to proposed harvest units to determine whether treatment would contribute to attaining ACS objectives for habitat. Two general criteria were used in this screening process: 1) If the stand has a simple structure that would benefit from thinning to accelerate development of elements of complex structure for habitat enhancement; and 2) If the stand can be treated in conjunction with the adjacent Matrix unit using only existing roads and roads that would be constructed to manage Matrix land (no road construction for the sole purpose of treating Riparian Reserve stands). Riparian Reserve stands that did not meet both of the above conditions were dropped from further consideration for treatment.
- **Two additional options were considered for 29A-4S3E:** The IDT considered dropping treatment of unit 29A to avoid crossing Randall Creek, but concluded that the dense, simple, uniform conifer plantation stand structure within the Riparian Reserve (essentially all of the unit is RR) needs treatment at this time to develop needed complexity to provide quality wildlife habitat. The current stand composition is also developing fuel characteristics that would endanger adjacent WUI in the next several years if not treated, so the IDT concluded that access for fuel treatment is important. The IDT then considered constructing a temporary culvert stream crossing to provide access the unit. The temporary culvert would be at the original, eroded stream crossing location where the existing road has been washed out, leaving the culvert sitting in the middle of the creek. The IDT concluded that building up fill over a culvert, then removing it to restore the stream channel would create more disturbance and sediment than simply fording the armored (rocky) channel with the design features incorporated into the proposed action.
- **Units dropped from the proposed action:**
  - The IDT dropped unit 21B – 4S3E from the proposal because updated stream mapping showed that most of the unit is in Riparian Reserve and the IDT determined that no treatment was needed to achieve ACS Objectives in this stand. The small remaining Matrix area has difficult access and the IDT concluded that there was little benefit to treating this small area at this time.
  - The analysis area in Section 29, T. 4 S., R. 4 E. included parts of stands that contained trees with old growth characteristics. The IDT dropped these areas from the proposed action and will adjust unit boundaries as needed to exclude them from the treated area.
- **Units considered for adding to the proposed action:**
  - The IDT considered adding a thinning unit in the NW corner of Section 1, T4S, R3E. IDT members examined the site and determined that a combination of lack of access, small size and marginal silvicultural needs for thinning made this a poor candidate for treatment at this time and the unit was dropped from further consideration.
  - The IDT considered adding a thinning unit in the SW¼SW¼ Section 23, T. 4 S., R. 3 E. Most of the potential unit is in Riparian Reserve and the IDT determined by informal field examination that density management thinning is not needed in this stand at this time.

- **Unauthorized user-created trail systems**, especially in Section 35, T3S, R3E and Section 1, T4S, R3E: The IDT considered management options for a network of unauthorized user-created trails in these sections. In response to scoping comments the IDT considered the following options for managing these trails: restoration of the trails after logging operations; developing the trails to meet BLM standards, including access; and obliteration and restoration of trails that are eroding. The IDT determined that no special management action would be taken to either preserve or eliminate these trails under the proposed Highland Fling Thinning project because management of recreational facilities is outside of the scope of this timber sale project and because providing and/or enhancing recreational opportunities in areas outside of a designated Special Recreation Management Area (SRMA) conflicts with the goal and intent of the GFMA Land Use Allocation. See EA section 3.3.8 for additional analysis.

  After completion of timber sale operations, the BLM is open to considering a future project using volunteer resources to develop recreational opportunities in the area that would be environmentally sound and in harmony with Management Objectives for the Land Use Allocation.

- **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 Riparian Reserves are managed to help develop late successional habitat conditions in line with the Aquatic Conservation Strategy. The RMP does not include a Land Use Allocation that reserves lands or stands for carbon storage; and this alternative
  - 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".

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

Sources Incorporated by Reference: ABR Inc., Environmental Research & Services, Forest Grove, OR. 2004. *Lower Molalla and Milk Creek Watershed Assessment Final Report.* Prepared for Molalla River Watch. Molalla, OR. (MCWA 2004); Watershed Professionals Network, LLC., Boise, ID. 2002. *Clear and Foster Creek Watershed Assessment.* Prepared for: Clackamas River Basin Council, Clackamas, OR. (CFCWA 2002)

3.1 Analysis Assumptions and Methodology of the Analysis

3.1.1 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/GFMA lands 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 Riparian Reserve 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.
- If the proposed action is implemented, no further silvicultural treatments would be done for approximately the next 20 years in these stands, both Matrix and Riparian Reserve.
- Potential warming and drying trends predicted by some global climate change models within the next 20 years would not change these management recommendations because BLM's experience with similar projects has demonstrated that the same principles and effects apply to similar forest stands in warmer and drier areas further south and at lower elevations within the *Tsuga heterophylla* (western hemlock) forest zone classification. Warming and drying could theoretically increase stresses in overcrowded stands, but the BLM cannot reliably quantify this effect with current modeling tools and believes that the range of forest conditions and effects would continue to be within the ranges analyzed.
- Most private industrial forest lands in these watersheds will be intensively managed with regeneration harvests scheduled on commercial economic rotations occurring at 50-60 year intervals (PRMP/FEIS 1994, p. 4-3). BLM observations of recent trends in industrial forest management indicate that this interval may be reduced to 30-40 years for some landowners.

Vegetation/Silviculture

- As relative density (RD)[17] 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

- All lands on BLM are classified as either, Suitable for timber production, Suitable but fragile for a variety of reasons (e.g., nutrient status, compacted surfaces, slope gradient, etc.) or Non-suitable. BLM practice is to locate proposed timber harvest unit boundaries to avoid areas that are Non-suitable.
- If less than ten percent of the ground surface is compacted (≥10 percent increase in density) by logging operations (e.g. ground based equipment, landings, and skyline yarding), then impacts and potential reductions in growth and yield are within the standards analyzed in the FEIS/RMP.
- See the Hydrology section of this EA for discussion of assumptions for WEPP modeling of soil erosion.

[17] 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 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 controlled by private gates and road owner policy.

3.1.2 Methodology

General

The forest condition information was compiled from a variety of sources.

- 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 Highland Fling Thinning 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.
- Aerial photographs from the last 50 years, satellite imagery, GIS data and field reconnaissance by BLM personnel at various times from 2005-2008 were used to assess changes and to determine general forest conditions (species, structure, canopy cover, size classes) across all land ownerships within the project area watersheds.

Vegetation

- For stand structure information, Stand Exams were conducted in 2001-2008 and additional stand information was gathered by BLM personnel.
- The BLM analyzed the data using ORGANON 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 Table 6, Silvicultural Report pp. 7-9).
- Threatened/Endangered/Special Status/Special Attention Botanical Species: The 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).

  Known Site Survey: Prior to field surveys, the botanist reviewed data bases for the presence of known Threatened or Endangered (T/E), Special Status Species (SSS), and Invasive/Non-native plant species in or near the project area; evaluated habitat requirements for T/E, SSS and S&M species; and evaluated the known habitat in the proposed harvest area for habitat suitability for T/E, SSS and S&M species.

Field Surveys: The botanist conducted botanical inventories of the proposed harvest area on May 5, 6, 12, 22, and June 4, 2008 to determine if T/E, SSS and S&M species are present that require protection or special management under the following guidance: The Endangered Species Act of 1973, BLM Manual 6840 – Special Status Species Management, Oregon-Washington Special Status Species policy – Instruction Memorandum, 1995 Salem District Resource Management Plan and Record of Decision, BLM Manual 9015 – Integrated Weed Management, 1995 DOI Department Manual – Part 609 - Weed Control Program, and 1999 Executive Order13112- Invasive Specie**s.**

Hydrology

- The Water Erosion Prediction Project (WEPP) soil erosion model was used to predict potential changes in erosion and sediment yield from actions proposed in this EA. Documentation of the WEPP model is available at the following web site: http://fsweb.moscow.rmrs.fs.fed.us/fswepp.
- The WEPP model is a physically-based soil erosion model developed by an interagency group of scientists from the U.S.D.A. Agricultural Research Service, Forest Service, and Natural Resources Conservation Service and the U.S.D.I. Bureau of Land Management, and Geological Survey.
- For WEPP calculations of erosion and sediment generation only skyline logging acres on slopes greater than 35 percent in the Riparian Reserve were calculated. Skyline logging areas outside of Riparian Reserves are at least 200 feet from any stream and, as is evident from calculations and discussion below, it is reasonable to assume that no sediment would reach streams from these areas.

Fisheries and Aquatic Habitat

- Resident fish distribution was determined from surveys of project area streams conducted by BLM Fisheries Biologists during the summer of 2008.
- Locations and conditions of existing culverts, proposed stream crossings, and log hauling roads were examined by BLM civil engineering staff, logging systems engineer, fisheries biologist and hydrologist at various times during 2008 and 2009.
- Since skidding is limited to slopes less than 35 percent and skid trail treatments (see design features) would be implemented, it is reasonable to assume that runoff water would not develop the velocities that would potentially erode soil and transport sediment through undisturbed vegetation to a stream. This is supported by BLM observations on similar sites with similar logging operations.
- Since skyline yarding would be done with one-end suspension, logs would be yarded over slash within the yarding corridors, and erosion control treatments would be done as needed (see design features), it is reasonable to assume that runoff water would not develop the velocities that would potentially erode soil and transport sediment through undisturbed vegetation to a stream. This is supported by BLM observations (Hawe 2008, unpublished memo) on similar sites with similar logging operations.

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) database18.
- From the TPCC preface: "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".
- The WEPP (Water Erosion Prediction Project) soil erosion model was used to predict potential changes in erosion and sediment yield.
- 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:

- For Special Status/species of concern: They compiled a list of species in the Cascades Resource Area using BLM wildlife databases, BLM Special Status Species lists (BLM IM OR-2008-038), Oregon Natural Heritage Information Center lists (ONHIC 2007), various wildlife field guides, literature, and texts.
- BLM wildlife biologists visited the project area during the 2007 and 2008 field seasons and examined habitats in and adjacent to proposed Highland Fling Thinning 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 Highland Fling Thinning 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 Highland Fling Thinning Project Area and their habitat preferences is included in Table 21.
- For Bureau Strategic species (a new category identified in Instruction Memorandum BLM IM OR-2007-072, July 25, 2007): Biologists looked for the species incidental to other surveys. No additional surveys are required.
- For migratory and resident birds: The biologists developed a list of migratory and resident birds and addressed them according to new interim guidance in Instruction Memorandum BLM-IM-WO-2008-50 To develop this list they identified bird species which are documented or suspected to nest on BLM lands in the Cascades Resource area, then identified which of those species have at least a low probability of nesting in the Highland Fling Project Area. They consulted a variety of sources and criteria to identify a list of priority species, sources and species priority determination (*EA Table 22*).

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

- For amphibians: Wildlife biologists conducted optional surveys for amphibians in 2008. Additional surveys may be conducted in the future.
- For northern spotted owl (NSO): Some surveys for spotted owls were conducted during the 1990s in the vicinity of the Highland Fling Thinning project area. No spotted owls were found. No additional surveys are planned because the proposed units are located over three miles from the closest known spotted owl site; and are either non-habitat and/or located in the North Willamette Valley in rural residential areas outside of the normal range of the Northern spotted owl.

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

- Conducting visual "walk through" examinations of those Riparian Reserve stands to assess stand complexity and other habitat characteristics based on their training and professional experience.
- Consulting 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.

3.2 General Setting/Affected Environment

Existing Watershed Condition

The proposed units in T 3 S, R 3 E, section 35; T 4 S, R 3 E, section 1; T 4 S, R 4 E, sections 21, 27 and part of 29 are in the Little Clear Creek, Middle Clear Creek and Upper Clear Creek 6th field watersheds of the of the Clear Creek Watershed in the Lower Clackamas River Basin. The Clear Creek Watershed is in Clackamas County, north and east of the town of Colton, Oregon. The management/ownership pattern in the 46,540 acre Clear Creek Watershed includes: 9 percent BLM, 3 percent US Forests Service (USFS), 1 percent state/county/local government, 22 percent private timber company and 65 percent undefined private. Zoning shows land use patterns of 56 percent timber, 34 percent agriculture and other forest, and 11 percent farm/forest/residential ten acres or less. (CFCWA, p. 1-31. Percentage totals do not equal 100 percent due to rounding.)

The proposed units in T 4 S, R 3 E, sections 21, 27 and 29 and units 29A, B and part of C in T 4 S, R 4 E, section 29 are in the Upper Milk Creek and Headwaters of Milk Creek 6th field watersheds of the Milk Creek Watershed (5th field) tributary to the Lower Molalla River. The Milk Creek Watershed is in Clackamas County, north and east of the town of Colton, Oregon. The management/ownership pattern in the 65,791 acre Milk Creek Watershed is over 95 percent private ownership, less than 5 percent managed by the BLM and other federal/state/county/local government. Private ownership and management patterns are apparently similar to those in the Clear Creek Watershed.

The Clear Creek and Milk Creek Watersheds are not key watersheds as defined in the Northwest Forest Plan (NWFP), (NWFP p. A-5; RMP p. 6).

Historical human use in the watershed focused on agriculture and logging (CFCWA, multiple references; MCWA p. 5).

Across all ownerships, there are approximately 333 miles of mapped road in the Clear Creek Watershed, an average road density of 4.6 miles/square mile; and approximately 206 miles of mapped road in the Milk Creek Watershed, an average road density of 3.4 miles/square mile. In the lower reaches of both watersheds most of the road systems are public.

In the upper reaches where more of the ownership is private industrial forestland, many of the roads are closed to the public. Approximately 18.6 percent of the roads in the combined Lower Molalla and Milk Creek watersheds are described as being within 200 feet of a stream, but only a small fraction of those are on steep (>50 percent) slopes (MCWA pp. 42, 74) (the CFCWA does not provide estimates of roads within 200 ft. of a stream, but it is logical to assume that the ratio is similar).

Due to the small amount of BLM managed land in these two watersheds, detailed slope data was not collected. Field observations show that slope gradients in most of the watersheds are less than 20 percent except in the upper reaches of the watersheds which have slopes of 20-70 percent. Very little of the watersheds has slopes greater than 50 percent. In the vicinity of proposed project units, most of the slopes that are steeper than 20 percent are in stream canyons throughout the watersheds and ridges in the upper reaches/headwaters of the watersheds. This observation is generally supported in the Watershed Analyses by the low number of miles of road on slopes within 200 feet of streams that are on slopes greater than 50 percent (MCWA p. 74) and that only 6 percent of the watershed is potentially subject to debris flows (MCWA p. 110).

Established land use patterns in these two watersheds are closely correlated to ownership and zoning, see the opening two paragraphs in this section. Aerial imagery shows that the agricultural, farm/forest and residential (10 acres or less) lands form a mosaic of tilled, long term cover crop/pasture and small closed canopy forest stands. Industrial forest lands are a mixture of ages and cover conditions, typically covering the spectrum of 30-60 year harvest rotations that vary by landowner. BLM managed lands include a variety of ages and cover conditions ranging from tree seed orchard to seedling/sapling stands to mature, closed canopy conifer or mixed conifer and hardwood forest. For additional description of stands and vegetation, see *EA Section 3.3.1*, Vegetation and Forest Stand Characteristics.

BLM managed lands in the Highland Fling Thinning project area are typically 40-540 acre parcels near or adjacent to residences on parcels smaller than ten acres. The remaining adjacent lands are primarily larger private agricultural and farm/forest tracts and industrial timberlands.

Many of these tracts can be accessed from public roads and/or directly from residential properties, so individuals and small groups regularly access BLM managed lands in the area for horse riding and other recreation.

The following acreage summaries provide additional context for the project:

- There are 1634 acres of BLM managed land in the general project area vicinity (GIS data base). These acres include:
- 848 acres within the Matrix (General Forest Management Area (GFMA)) land use allocation (LUA), 52 percent of the BLM's 1634 acres.
- 545 acres of thinning is proposed within GFMA LUA for the Highland Fling Thinning project, 33 percent of the BLM's 1634 total acres and 63 percent of the BLM's 848 Matrix acres.

- 303 acres of GFMA would remain unthinned after the implementation of the Highland Fling Thinning project, 37 percent of the BLM's 848 Matrix acres.
- 786 acres within the Riparian Reserve LUA, 48 percent of the BLM's 1634 acres.
- 175 acres of thinning is proposed within the Riparian Reserve LUA for the Highland Fling Thinning project, 10 percent of the BLM's 1634 acres, and 22 percent of the BLM's 786 Riparian Reserve acres.
- 611 acres of Riparian Reserve would remain unthinned after the implementation of the Highland Fling Thinning project, 78 percent of the BLM's 786 Riparian Reserve acres.
- 20 total acres are proposed for thinning in the Highland Fling thinning project, 44 percent of the BLM's 1634 acres.
- 914 acres of BLM managed land in the general project area vicinity would remain unthinned after the implementation of the Highland Fling Thinning project, 56 percent of the BLM's 1634 acres.
- 14 acres are proposed for Right-of-Way clearing, less than 1 percent of the BLM's 1634 acres in the project area. These acres are included in the thinning acres above.

Historical Influences on Forest Development in the Area Watersheds

The following historical information was compiled from BLM archival records of timber sales, land surveys, and reforestation records; the *Cultural Resources Report* (incorporated by reference); *Clear and Foster Creek Watershed Analysis, 2002 (CFCWA);* and the *Lower Molalla River and Milk Creek Watershed Assessment, 2004 (MCWA)*

Prior to Euro-American settlement in the project area the forest was shaped by fire, wind, insects and disease. Native Americans used fire to manipulate vegetation. Fire and wind patterns were influenced by topography (slope steepness and aspect). These forces created a mosaic pattern of forest stands of different ages and also created multiple age classes within a forest stand at scales ranging from as small as a fraction of an acre to many thousands of acres following large scale fires or wind events.

Euro-American settlement in the vicinity of the project area began in the 1840s. Settlers cleared increasing acreages of forest for farming. Logging and sawmills were also dominant forces in shaping the landscape from the 1870s until World War II. Logging practices such as damming streams for mill ponds, using streambeds as skid roads, building splash dams and breaching them to float logs downstream to mills, and choking stream channels with logging slash damaged stream habitat and contributed to the dramatic decline in salmon populations. Major fires and floods from the 1860s into the early 1900s also shaped the watersheds and their habitats. Rapid population growth around the Portland area following World War II affected ownership patterns and contributed to Oregon land use planning laws in the 1970s.

The original timber sale dates on BLM managed land in the Highland Fling Thinning project area ranged from 1920 to 1941. Some stands were logged a second time to recover some of the wood that was not marketable in the first entry. Site preparation was apparently largely neglected (based on the time lag between the sale dates and the current timber ages), or incidental to fires in the area. The record keeping system changed after this time period and there is a gap in the narrative until two of the stands in the current proposal were harvested and planted in the 1970s and 80s, see the Vegetation section of this EA.

Most of the stands in the project area were naturally regenerated. A common method was to leave two seed trees per acre and log them after the new stand became established. Some of the regeneration was very likely from seed produced by the smaller, more poorly formed or diseased trees that survived logging of the merchantable timber, rather than the larger, healthier and straighter trees.

Railroad logging was a very common logging method in the northwest in that era, and was used in parts of the Highland Fling Thinning project area. There are railroad grades through parts of the project area. There are also numerous other roadbeds and trails throughout the stands in the area that were likely a combination of railroad spurs, truck roads and skid trails used by oxen and/or bulldozers.

Yarding on most slopes was done with steam donkeys and hi-lead cable systems that often provided no suspension while dragging logs up or across the hillside. In relatively flat areas or where gentle slopes led downhill to loading areas, skidding with oxen, bulldozers, and hi-lead yarding were used.

Many of these railroad grades, truck roads and skid trails are still evident today in various stages of recovering to natural forest floor conditions. See the Soils section of this EA for additional descriptions.

Cumulative Actions

Past Actions - BLM timber sales: Jackson 5, 1995, 117 acres of regeneration harvest; Clear Creek Thin, 1996, 65 acres of partial cut; Clear Down, 1997, 57 acres of regeneration harvest; Artful Dodger, 1997, 38 acres of regeneration harvest and 29 acres of partial cut; Clear Dodger, 2003, 143 acres of partial cut; Hillock, 2005, 293 acres of partial cut.

Private clearcut adjacent to unit 27-4S3E, approx. 12 acres on Nate Creek upstream of BLM parcel; private industrial lands, early seral stage conifer forest north of units 35B and C-3S4E and west of unit 1-4S3E.

Present Actions – BLM timber sales: Hillock Take 2, 2010, 52 acres that were included in Hillock 2005 sale but not completed; Bee Line, 2010, approximately 390 acres of partial cut Delph Creek 2010, 200 acres density management. Private: Stands that are at least 40 years old are expected to be assessed for timber harvest.

Foreseeable Future Actions - BLM timber sales: Airstrip, 2010, approximately 312 acres of harvest, mostly thinning; Buckner Creek, 2011, 60 acres of commercial thinning. Private: Stands that are at least 40 years old are expected to be assessed for timber harvest.

3.3 Resource Specific Affected Environment and Environmental Effects

This section of the EA describes the current condition and trend of the affected resources and the environmental effects of the alternatives on those resources. The interdisciplinary team of resource specialists (IDT) reviewed the elements of the human environment, required by law, regulation, Executive Order and policy, to determine if they would be affected by the proposed action (BLM Handbook H-1790-1: p. 137), [40 CFR 1508.27(b)(3)], [40 CFR 1508.27(b)(8)] (EA section 3.3.10), as well as the issues raised in scoping (EA section 1.4.2).

The resources potentially affected by the proposed thinning activities are described in the following sections: Vegetation and Forest Stand Characteristics; Hydrology; Fisheries and Aquatic Habitat; Soils; Wildlife; Air Quality and Fire Hazard/Risk; Carbon Storage, Carbon Emissions, and Climate Change; Recreation, Visual Resources and Rural Interface; and Cultural Resources.

3.3.1 Vegetation and Forest Stand Characteristics

Sources Incorporated by Reference: *Vegetation Description – Highland Fling Thinning and Silvicultural Prescriptions, Bonney, 2008 (Silviculture Report); Cascades Resource Area Botanical Report Proposed Highland Fling Thinning Timber Sale, Fennell 2008 (Botany Report); Cascades Resource Area Wildlife Report for the Highland Fling Thinning Project, England and Murphy 2009 (Wildlife Report); Highland Fling Thinning Project Air Quality and Fire Hazard/Risk Specialist Report, Raible 2009 (Fuels Report). Additional sources: Stand Exam data and analysis, botanical surveys, field reconnaissance by BLM personnel, Salem District Forest Operations Inventory (FOI) data, Salem District Timber Production Capability Class (TPCC), Salem District Geographic Information System (GIS) data, Salem District archival records.*

Affected Environment

Stand Structure and Development

Matrix (GFMA) LUA

The forest stands on BLM lands throughout the Highland Fling Thinning project area are currently second-growth, managed conifer forest. Most of the BLM land in the project area was clearcut in the 1920s, 30s and 40s. The current stand ages and tree distribution are consistent with natural regeneration. The stands range from 28-93 years old (as of the 2008 stand exam data) and, except as described in the following paragraphs, are dense, single storied stands of Douglas-fir, western hemlock, hardwood trees and other conifers. None of the stands in the Highland Fling Thinning project area have reached CMAI, so they are not considered to be ready for regeneration harvest (RMP, p. 48). Table 6 presents key information from collected stand data.

The RD throughout the project area ranges from 44-71 and stocking typically ranges from 82-318 trees per acre (TPA). These densities and stocking levels are associated with overstocked stands where competition for site resources (water, nutrients and light) results in moderately to severely reduced growth rates and stand vigor with increased susceptibility to damage from insects, disease, fire and windthrow.

All known old growth trees in the vicinity have been excluded from the project area or would be reserved from cutting and protected from damage.

Proposed Thinning Unit Characteristics:

Section 35, T3S-R3E, is located in the Lower Clackamas River Watershed. BLM records show: This area was logged in 1923 and regenerated naturally. Thirty-five acres in the southern portion of unit 35B was pre-commercially thinned in 1978. These mid seral stands range in age from 43 to 54 years and are dominated by Douglas-fir with a component of western hemlock, western red cedar, red alder and big-leaf maple.

These stands are dense single story stands with no large remnant old-growth trees. There is laminated root rot present in the south half of unit 35B which has created canopy gaps that are filling in with hardwoods and shrubs. The Riparian Reserves outside the proposed units have a major hardwood component consisting of big-leaf maple and red alder.

Section 1, T4S-R3E, is located in the Lower Clackamas River Watershed. BLM records show: This section was logged in 1920 and naturally regenerated. Portions were logged again in 1954, and 188 acres were commercially thinned in 1979. These mid seral stands are 51 to 61 years of age, and are dominated by Douglas-fir with a minor component of western hemlock, western red cedar and big-leaf maple. The proposed units are dense single story stands with no large remnant old-growth trees. The Riparian Reserves outside the proposed units have a major hardwood component.

Section 21, T4S-R3E, is located in the Lower Molalla River Watershed. BLM records show:

Unit 21A: This stand was logged in 1920 and again in 1939 and naturally regenerated. This mid seral stand is dominated Douglas-fir but there are clumps of western hemlock. The western hemlock is about 10 years older than the Douglas-fir, up to 32 inches Diameter Breast Height (DBH), probably seeded in after the first logging and was left as advanced regeneration during the second logging. There are no remnant old-growth trees present from the previous stand. There is scattered advanced regeneration consisting of western hemlock and western red cedar. Unit 21A is located adjacent to a man made pond which extends onto BLM from neighboring private lands.

Unit 21C: This area was logged in 1920 and naturally regenerated. There are no other harvest records available for this stand. This dense single story stand is almost pure Douglas-fir with no large remnant old-growth trees. The stand is crowded and suppression mortality is occurring. Vegetation in the Riparian Reserves is very similar to the GFMA upland portions.

Section 27, T4S-R3E, is located in the Lower Molalla River Watershed. BLM records show that this stand was logged in 1941. The ages of trees indicate that this was a partial cut and not a clear cut. The current stand is an uneven-aged diverse mixture of species and layers, with Douglas-fir, western red cedar, western hemlock, and a minor hardwood component of big-leaf maple and red alder. This stand is dense and the ground cover is fairly sparse with areas of bare ground. There are some large remnant trees present, particularly western red cedar, and structural stages for this stand range from mid seral to mature.

Section 21, T4S-R4E, is located in the Lower Clackamas River Watershed. BLM records show: There are no records of previous harvest in this stand. The overstory is a nearly pure stand of mature 89 year old Douglas-fir with no old-growth remnants in the proposed unit. Suppression mortality is occurring. There is a substantial layer of western hemlock advanced regeneration. The Riparian Reserve has some western red cedar along the creek.

Table 6: Stand Characteristics

T-R-Sec Unit	Stand Acres*	Seral Stage	CWD** (Linear feet/acre)	Snags per 100 acres >15"Diameter & >15'Tall	Stand Age*	Current Condition			Average Diameter, Year 20 No Thin	After Proposed Treatment			
			Hard/Soft	Hard/Soft		Trees per Acre	Average Diameter	Curtis RD		Trees per Acre	Average Diameter Year 1	Average Diameter Year 20	Curtis RD
3S-3E-35A	19	Mid	0'/0'	0/40	60	93	22.3	55	26.4	49	24.0	29.0	32
3S-3E-35B	111	Mid	15'/0'		60, 48	93, 147	22.3, 17.3	55, 58	26.4, 21.8	49, 72	24.0, 20.3	29.0, 25.2	32, 36
3S-3E-35C	11	Mid	0'/57'		43	143	19.5	67	24.5	75	21.4	26.6	41
3S-3E-35D	10	Mid	0'/0'		43, 48	143, 147	17.3, 19.5	58,67	24.5, 21.8	75, 72	21.4, 20.3	26.6, 25.2	41, 36
4S-3E-1	256	Mid	0'/342'	0/0	61, 51	115, 128, 184	19.3, 18.3, 13.7	51, 54, 53	23.1, 21.5, 18.2	54, 64, 113	22.9, 21.5, 16.1	27.5, 25.9, 20.6	40
4S-3E-21A	10	Mid	0'/342'	460/0	59	104	21.7	57	24.4	56	23.6	27.1	35
4S-3E-21C (No. & So.)	54	Late Mid	0'/171'		61, 64	93, 138	20.0, 18.9	62, 45	23.7, 22.3	60, 59	21.5, 22.4	25.8, 26.1	32, 34
4S-3E-27A	25	Mid to Mature	58'/414'	120/120	93	122	22.5	71	26.3	56	27.2	30.3	44
4S-3E-27B	3												
4S-3E-29A	6	Early	0'/0'	0/0	28	260	11.1	52	16.4	106	11.6	17.7	34
4S-3E-29B	20	Early	0'/0'		28	318	10.5	59	15.5	176	11.0	17.0	35
4S-4E-21	14	Early Mature	209'/69'	260/180	89	82	22.3	47	25.5	53	23.6	27.4	33
4S-4E-27A	8	Late Mid	0'/0'	0/230	65	177	15.4	59	19.0	82	18.4	22.3	35
4S-4E-27B	23	Late Mid to Early Mature	0'/642'	0/230	83	100	19.4	46	22.8	63	21.2	24.9	33
4S-4E-27C	21	Late Mid	209'/326'	0/230	65	177	15.4	59	19.0	82	18.4	22.3	35
4S-4E-29A	23	Mid	0'/228'	0/250	57	171	17.0	65	20.3	90	17.7	21.9	37
4S-4E-29B	86	Early/Mid	0'/260'		31, 57	171, 188	12.4, 17.0	44, 65	20.3, 16.8	90, 130	17.7, 12.9	21.9, 18.0	37, 33
4S-4E-29C	20	Late Mid	0'/257'		72	89	22.7	52	25.9	55	24.8	28.4	37
Total	720				Stands less than 80 years old								

*****As of Stand Exams in 2008. Ages, T/A, Diameter and RD separated by a comma (##, ##) denote two FOI types within the treatment unit.

*** RMP requirements for CWD are minimum 20 inches diameter large end x 20 feet long.

Section 27, T4S-R4E, is located in the Lower Clackamas River Watershed. BLM records show: There are no records of previous harvest in this section. These late mid seral to early mature stands are 65 to 83 years of age. There is a large tree component in Unit 27B, which is a two storied stand of almost pure Douglas-fir. The majority of the stand consists of the younger, lower story trees but the upper story still is a major component. Units 27A and 27C are single story almost pure Douglas-fir late mid seral stands. Suppression mortality is occurring and western hemlock advanced regeneration is establishing in the understory. There is windthrow along a portion of the east edge of unit 27C.

Section 29, T4S-R3E and section 29, T4S, R4E, are located in the Lower Molalla River Watershed. BLM records show: These areas were clearcut logged in 1976 and 1980, planted with Douglas-fir, and pre-commercially thinned in the early 1990s. The resulting stands are nearly pure Douglas-fir early seral stands with a minor component of big leaf maple. The current stands are dense with canopy closures of 90 to 95 percent, and understory vegetation is sparse with areas of bare ground.

Section 29, T4S-R4E is mostly located in the Lower Molalla River Watershed, with portions of unit C in the Lower Clackamas. BLM records show: Units A-C includes stands that were partially logged in 1935 through 1937, resulting in mixed species composition. The predominant species is Douglas-fir with components of western hemlock, western red cedar and big-leaf maple. Unit C has a major hardwood component of red alder. There is western hemlock and western red cedar advanced regeneration present, with some up to 10 inches DBH. There are no old-growth remnants, but there are large trees in the north end of unit B and unit C, which have two layers. These stands have a diverse structure and composition with some mature trees in the overstory.

Riparian Reserve LUA

The Riparian Reserve LUA stands proposed for thinning are similar to and contiguous with the Matrix stands proposed for thinning. When BLM lands in the Highland Fling Thinning project area were logged and reforested, there was no distinction made between forest stands in what is now classified as Riparian Reserve and those in Matrix LUAs. Stands in the Riparian Reserve LUA that are naturally developing structural complexity are not proposed for treatment; therefore they are not "in the project area". Forest stands that are associated with ecological riparian zones where the water table largely defines site conditions typically developed more species and structural diversity with hardwood trees, brush species and western redcedar providing greater variety than is found in the adjacent uniform conifer stands and are not proposed for treatment.

The BLM wildlife specialists for the Highland Fling Thinning project evaluated Riparian Reserve LUA stands in the project area and determined that selected portions of those stands are lacking vertical canopy structure in terms of tree regeneration or tall shrubs. Within these stands, there are other areas where understory trees and/or shrubs are present, but their growth is severely hindered by the shade of the dense overstory canopy. The wildlife biologists and silviculturists determined that in these selected stands thinning would accelerate key elements of habitat development in these areas.

Survey Results

Threatened or Endangered /Special Status Plant Species

No Threatened & Endangered or Special Status vascular plant, lichen, bryophytes or fungi species were found during field surveys and there are no known sites within the proposed harvest areas as determined by a known site data search.

Suitable habitat for thirty-one (31) Sensitive Special Status species was found to exist within the boundaries of the proposed harvest areas. Twenty-one (21) of these species are seasonal fungi that appear in the spring or fall when conditions are favorable.

Invasive / Non-native Plant Species

BLM field surveys found the following BLM Manual 9015 Class C and/or Oregon Department of Agriculture (ODA) List B invasive/non-native species to occur within the project area: himalayan blackberry (*Rubus discolor*), tansy ragwort (*Senecio jacobaea*), bull thistle (*Cirsium vulgare*), Canadian thistle (*Cirsium arvense*), St. John's wort (*Hypericum perforatum*), meadow knapweed (*Centaurea pratensis*), english ivy (*Hedera helix*) and scotch broom (*Cytisus scoparius*). All of these invasive/non-native species were found to inhabit areas of high light and soil disturbance (such as maintained road rights-of-way) and none were found within the proposed harvest units. False brome (*Brachypodium sylvaticum*) a BLM Manual 9015 Class C and an Oregon Department of Agriculture (ODA) List B, T species was found in one location and was the only invasive/non-native species found within the forest and in a low light setting.

All of the identified species are regionally abundant and well distributed throughout northwest Oregon. Eradication of these invasive/non-native species is not practical due to the widespread ubiquitous nature of their infestations. Class C species receives the lowest priority (BLM Manual 9015) and management direction and emphasis is to contain spread to present population size or decrease population to a manageable size.

The BLM botanist conducted a Noxious Weed Risk Assessment of the project area and determined that the area has a risk rating of "moderate" (*Botany Report, p. 9*). A moderate rating indicates the proposed project could proceed as planned with measures in place to control and/or prevent the establishment of invasive/non-native plant species in areas of ground disturbance (*EA section 2.3.4 #3*).

Environmental Effects

3.3.1.1 Proposed Action

Within the Matrix (GFMA) LUA

Stand Structure and Development

Observed Characteristics and Direct Effects Immediately after Thinning:

Immediately following a thinning the stands should appear healthy with minimal logging damage[19] to the residual trees. Most of the stand should appear more uniform in spacing and tree size than it currently does. Average stand diameter would be increased, since the bulk of the harvested trees would be in the smaller diameter classes.

Fewer trees and lower relative density would result in less competition for site resources (light, nutrients and water). The canopy would be more open than it is currently so that the crowns of retained trees would receive sunlight from the sides as well as above, and lower limbs would be less shaded. Enough light would reach the forest floor to allow establishment of native ground cover species, and brush understory with some conifer regeneration.

Observed Characteristics and Trends in the Long Term:

In the next 20 years, growth on the retained trees should continue at a steady rate, which would be greater than the growth rate if the area remained unthinned. The crowns should expand and fill the spaces created by the thinning and the site should be fully occupied so that growth is slowing down by the end of the second decade after thinning. The understory vegetation should become less vigorous as the site resources become concentrated in the trees and less light reaches the forest floor.

The effect of the thinning on total net yield in the GFMA should be positive since available site resources would be redistributed and utilized by fewer stems. For subsequent rotations the productivity of this site should be maintained. It should produce a sustainable supply of timber and still meet all of the other resource objectives outlined in the ROD and RMP.

Indirect Effects:

As site resources are concentrated on fewer trees, the growth rates of the retained trees increases and the trees are more vigorous and healthy compared to what they would be in a crowded stand[20].

[19] We consider a logging-damaged tree as one that has had its cambium removed from more than 50% of the circumference of its bole, and a minimal amount of damage would typically be not more than two trees per acre (2 TPA) having that amount of damage.

[20] This is the same concept as thinning carrots in a vegetable garden. So many seeds typically sprout that the crowded carrots would be small and unhealthy if not thinned. The first thinning is usually done when the carrots are too small to be eaten (precommercial thinning). When some of the carrots are harvested during the growing season they may be large enough to eat (commercial thinning) and the ones left in the ground will grow larger until harvested in the fall (regeneration harvest).

With faster growth rates, it is reasonable to assume that more trees would get larger faster, with proportionate increases in average log volume and timber value for the remainder of the rotation (the planned cycle of a forest stand from establishment to regeneration harvest).

The faster growth rates after thinning would also provide trees of suitable size for snags (15+ inches diameter) and CWD (20+ inches diameter) as needed for management plans sooner than would be available without thinning.

In the Pacific Northwest, many studies have been done which document the differential growth rates and structural development of thinned versus unthinned forests. Two of the most recent studies are: Emmingham *et al*, 2007; and Davis *et al*, 2007. Roberts, et al (2007) looked at wind damage following the implementation of variable-density thinning prescriptions. They found no significant difference in wind damage following thinning, between thinned and unthinned areas. Further, internal edges created by gaps, skid trails, and unthinned patches did not inherently increase wind damage risk. The paper also recommends that care be taken to locate gaps and skid trails away from topographically vulnerable positions.

BLM experience with similar thinning projects has shown that thinning as prescribed in the proposed action retains sufficient strength in the stand to resist windthrow of more than scattered individual trees. As trees in the stand become more vigorous, increased root mass (as the roots spread into areas previously occupied by competing trees) and limb-to-limb contact that further dampens swaying, wind-firmness will continue to increase.

There is a theoretical, unquantifiable risk that an unusually intense windstorm in the first year to three years would result in more extensive windthrow than would occur in the untreated stands. Observations of stands within the general project area that have been thinned over approximately the last 20 years support the BLM's conclusion that we would not expect increased windthrow.

Trees damaged by logging would either survive to be logged in future timber harvest, develop decay pockets that could be used by cavity excavating/nesting wildlife species, or die and become snags or CWD.

Thinning these stands would reduce the number of small diameter (less than 15 inches DBH) snags over the next 20 years because thinning from below removes the smaller suppressed and intermediate trees that would be most likely to die from suppression mortality and become snags within that time period.

Skid trails and skyline corridors would result in cutting and removal of some retained trees. The width of skid trails and skyline corridors would be less than the average spacing of retained trees, so the resulting density would be within the proposed action analyzed in this EA.

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

Since no T&E, SSS or S&M species were found within proposed project area boundaries, no direct or indirect impacts would be expected. Suitable habitat will remain in both the thinned area and reserves, and the BLM anticipates no adverse impact to suitable habitat or any undiscovered SSS or S&M species. The proposed project would not contribute to the need to list any species as T&E.

Invasive/Non-native Plant Species

A slight increase in the number of individual invasive/non-native plants is likely to occur where they are currently present in and near the project area as a result of project activities. It is unlikely that this increase (individual plants in established populations) would result in the spread of any population (extent) of these species for the following reasons. When considering the widespread and ubiquitous nature of the invasive species identified in the proposed project area, any increase that might occur would be difficult to quantify, but would not contribute immediately or cumulatively to the impact these species have in western Oregon or in the Highland Fling Thinning project area for the following reasons:

- Based on observations of the location and abundance of invasive species made during field surveys, invasive species will continue to be present along roads in and adjacent to the proposed Highland Fling Thinning area, but they are not and are not expected to become strong competitors with native species. .
- In the professional opinion of the BLM botanist, the increase in the number of plants would be so small as to be difficult to quantify relative to the existing invasive species populations identified in the proposed project area. For example, if 10 new scotch broom were to start growing as a result of the proposed action, the increase would be undetectable compared to the current regional scotch broom population of many millions of plants.
- Washing of earth moving and logging equipment before entering BLM land, visual inspection of that equipment by BLM personnel, and monitoring invasive species after logging, have been proven over the last decade to reduce the risk of spreading invasive species to a very low level.
- In addition, if additional populations of invasive species that are not already widespread in the area are identified in or adjacent to the proposed harvest area, the BLM would require additional measures to reduce the risk of spreading those invasive species to other areas.
- Seeding native species on exposed soil associated with roads has been demonstrated for more than a decade on BLM land to consistently abate the establishment of invasive/non-native species on disturbed soil associated with roads where significant sunlight reaches the ground.
- Native species consistently establish themselves on disturbed soil in the forest interior, abating establishment of invasive/non-native species in these locations. This trend has been observed during post-harvest monitoring of BLM thinning projects for more than a decade.

Within the Riparian Reserve LUA:

Stand Structure and Development

The thinning prescription and logging methods are essentially the same in the Riparian Reserves as they are in the adjacent Matrix portions of the treatment area.

Therefore, the environmental effects are essentially the same as described above for thinning on Matrix and only differences in effects or emphasis will be described below. (The focus of the description of environmental effects to vegetation and stand structure on Matrix ground emphasized the effects important to timber production.)

The 25 percent variation in spacing (marking guides) would effectively create small clumps and gaps up to 1/6 acre. Enough light would reach the forest floor to allow establishment of native ground cover species, and brush understory with some conifer tree regeneration within three to five years.

The small clumps and gaps created by spacing variation would also introduce variation in the density, distribution and species mix of ground cover plants and brush and conifer understory.

Hardwood trees and conifer species having low local abundance to be retained in the stand would have less competition for site resources and should have higher survival and growth rates than would be expected if the stands were not thinned.

Skyline corridors would create linear openings in the canopy oriented up and down slopes (rather than across slopes). These openings would not change the character of the stand at ground level because the width of the corridor (12 ft.) is less than the average leave tree spacing (average 21-25 feet, ± 25 percent). The skyline cable and carriage would break limbs to create an opening in the canopy, which would allow additional light to reach the forest floor for understory growth. As limbs grow together in the canopy, this gap should close over the next 20 years.

Skid trails would not create linear canopy gaps since the 12 ft. width is also less than the average leave tree spacing and there are no cables in the canopy to break limbs. The compacted trail would be visible on the ground and take one to two decades longer to grow ground cover and understory than the 90 percent of the ground based yarding area in the Riparian Reserve that is not compacted by skid trails.

Observed Characteristics and Trends in the Long Term:

In the next 20 years, growth on the retained trees should continue at a steady rate, which would be greater than the growth rate if the area remained unthinned. The crowns would expand and fill the spaces created by the thinning and the site should be fully occupied so that growth is slowing down by the end of the second decade after thinning. The understory vegetation in the thinned area should be well established and vigorous by year five, but start to become less vigorous after about 15 years as the site resources become concentrated in the trees and less light reaches the forest floor.

Indirect Effects:

As site resources are concentrated on fewer trees, the growth rates of the retained trees increases and the trees are more vigorous and healthy compared to what they would be in a crowded stand. With faster growth rates, it is reasonable to assume that more trees would get larger faster. The faster growth rates after thinning would provide trees of suitable size for snags (15+ inches diameter) and CWD (20+ inches diameter) sooner than would be available without thinning. Thus, accelerated growth would help meet IDT goals for Riparian Reserve in the Highland Fling Thinning project area to develop and maintain later seral forest stand characteristics. Desirable stand characteristics include larger trees for a large green tree component and recruitment of large standing dead and down coarse woody debris in future stand.

Retaining minor conifer species and hardwoods and the development of understory vegetation would also help meet IDT objectives for multi-layered stands with well developed understories, and multiple species that include hardwoods and other minor species.

Since Riparian Reserve stands tend to be more on stream canyon slopes rather than on exposed upland ridges, they tend to be more sheltered from high winds than Matrix stands on exposed ridges. The BLM expects, based on experience with similar projects, even less windthrow in Riparian Reserves than in Matrix stands. Individual windthrown trees and small windthrown patches of trees contribute to structural complexity as natural openings with "debris pile" habitat that develops into a brush patch and eventually, again, conifers.

Trees damaged by logging would either survive and perhaps develop decay pockets that could be used by cavity excavating/nesting wildlife species, or die and become snags or woody debris.

Long Term Management Objectives:

To continue accelerated development of late seral characteristics beyond two to three decades after thinning, a second treatment would be needed approximately 20 years after this proposed thinning. At that time, the expected abundance of trees larger than 20 inches diameter with healthy crowns and understory of ground cover species, brush and conifer seedlings/saplings would provide opportunities to enhance and accelerate the late seral characteristics that would be developing.

Within Both LUAs:

Variable Density and Horizontal Complexity:

Immediately after thinning the Highland Fling Thinning project area would have a higher degree of complexity on a landscape level than it currently has due to the 25 percent spacing variation within thinned stands, treatments that vary between stands and the untreated areas adjacent to the thinned stands. The untreated areas include stands of almost pure hardwoods and brush, mixed conifers and hardwoods, and high-density conifer stands. As each of these stands continue to mature and be influenced by natural forces over the next 20 years and beyond, the different niche habitats provided by each stand type should continue to develop increasing complexity and diversity.

Future silvicultural treatments may be done in about 20 years to further develop this variation and complexity. The following photos indicate the visual differences in stand characteristics that typically result from thinning prescriptions proposed in the Matrix LUA.

Figure 1:*Typical dense stand with complete canopy closure proposed for treatment. Note the lack of ground cover vegetation and understory. Sec. 25, T10S, R1E.* T. Fennell 2008

Figure 2: ***Typical stand resulting after treatment, approximately five years after thinning. Note the typical understory development and snag.*** Sec. 12, T1S, R5E. File photo by K. Walton 2006

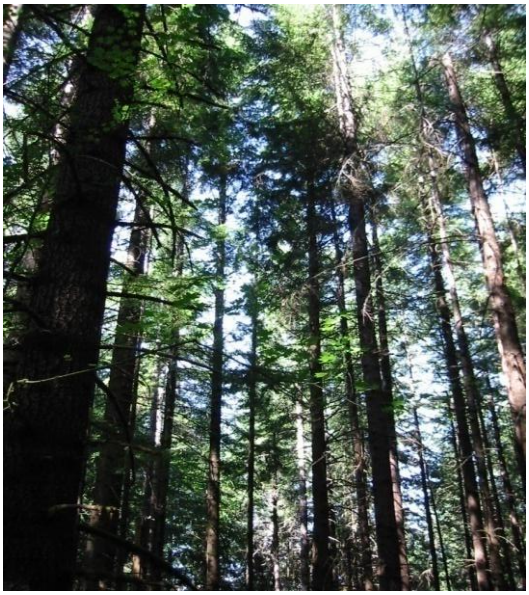


Figure 3:*Dense canopy in a typical stand proposed for thinning treatment. Sec. 1*., T1S, R5E. File photo, K. Walton 2007

Figure 4:*Canopy view approximately 5 years after thinning treatment, example of tree crown spacing and developing understory. Sec. 12, T1S, R5E.* File photo by K. Walton 2006

3.3.1.2 Cumulative Effects

No cumulative effects are expected with regard to stand structure and development because the proposed thinning would maintain a forested setting in the same age class as before thinning.

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

Suitable habitat for SSS will remain in the proposed thinning area because thinning will not remove such habitat, and suitable habitat for SSS will remain undisturbed adjacent to the proposed thinning areas. The proposed project will not contribute to the need to list any SSS as Threatened or Endangered.

In addition, no cumulative effects are expected with regard to invasive /non-native plants because the project would not contribute to the spread of invasive species populations or to the introduction of new species with the implementation of project design features and because little or no difference in the composition or numbers of invasive/non-native species populations have been observed in similar projects on BLM lands in the vicinity.

3.3.1.3 No Action Alternative

Stand Structure and Development (all land use allocations)

The stands would continue to grow but at a reduced rate. Crowns would close and there would be more suppression mortality resulting in more snags and down wood, especially in the smaller (less than 15" DBH) size classes. Understory vegetation would be reduced in quantity and diversity because of the ever-reduced light reaching the forest floor. In the Matrix LUA, at rotation age there would be smaller trees of lower quality to harvest and total net yield would be reduced below the potential for the site.

Within the Riparian Reserve LUA especially, there would be slower development of the 15+ inch DBH trees desirable for future snag and 20+ inch diameter trees desirable for future coarse woody debris recruitment. Fewer of them would reach these sizes within the next 20 years.

The dense stands would not increase in vigor and may decline in vigor, making them more susceptible to disease, insects, windthrow and fire. This condition would not meet O&C Act, or RMP objectives and would not fulfill the Purpose and Need for this project. The live crown ratio (live crown height/total height of the tree, expressed as percent) would continue to decline as lower limbs die from shading.

The unfavorable height-to-diameter ratios that develop in high-density stands would continue to develop, decreasing the general health and vigor of those stands and potentially increasing the risk of extensive windthrow.

Threatened/Endangered/Special Status/Special Attention/ Survey & Manage Plant Species

With no human caused changes and excluding natural disturbances to the habitat that currently exists at the proposed project sites, no impact to any known or undiscovered Threatened, Endangered, Special Status, and Special Attention botanical species would be expected to occur.

However, as the habitat in the proposed project area naturally changes over time, species composition for the different botanical groups would both increase and decrease during different stages of succession as suitable environmental conditions and substrates become available.

Invasive / Non-native Plant Species (including Noxious Weeds)

Over time existing populations of invasive/non-native species would decline in number of plants and vigor as native vegetation (including trees) displaces the non-native species in the absence of natural disturbances. These species would likely maintain a small population along roads and in natural openings and population size may increase in areas where natural disturbances occur. Management activities on land not managed by the BLM and public access into the area (as described in section 3.3.8 of this EA) may result in introducing additional species, or increasing populations of species that are currently in the area. If areas of the forest are heavily impacted by natural disturbance, higher infestations of invasive/non-native species would be anticipated in those disturbed areas.

3.3.2 Hydrology

Sources Incorporated by Reference: *Hydrology/Channels/Water Quality: Specialist Report for the Proposed Highland Fling Thinning Project, (Hawe, 2009) (Hydro Report), WEPP (Water Erosion Prediction Project) Report for Highland Fling Thinning (Hawe, 2008) (WEPP Report)*

Affected Environment

Project Area Setting

The project area is located in the Oregon Western Cascades range at elevations between 700-1,600 feet[21]. Portions of the project 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 assumed to lie between 1,500 - 3,000 feet in elevation.

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

The project area receives approximately 58-68 inches of rain annually and has a mean 2-year precipitation event of 3.0 inches in a 24-hour period (estimated at: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm).

The project area drains to four separate 6th field sub-watersheds (Middle Clear Creek, Upper Clear Creek, Upper Milk Creek, and the Headwaters of Milk Creek) with approximately 56,118 acres (88 miles^2) in combined drainage area.

The two fifth field stream systems in the area are Clear Creek to the north (tributary to the Clackamas River fourth field #17090009) and Milk Creek to the south (tributary to the Molalla-Pudding fourth field #17090011). Clear Creek is within the source water area for the town of Clackamas while Milk Creek is utilized as a drinking water source for the City of Canby and thus the project lies within a portion of two municipal watersheds. The project is not part of a key watershed.

Channel and Wetland Morphology (ACS Objective 3)

Project Area Stream Channels

Intermittent Channels

The eastern portion of the project area is situated in the Western Cascades physical province.

The western part of the project area is in the Willamette Valley province and streams reflect the geologic origin of the area[22]. Most of the terrain is composed of weathered rocks of basalt and basaltic-andesitic flows, flow breccia and pyroclastic deposits (extrusive volcanics) of the High Cascades dating to the Pliestocene and Pliocene around 1-4 million years ago (Walker, 1991). In some areas, these rocks overlay older tuffaceous sedimentary rocks which have been exposed by down-cutting of the local streams.

Stream channels immediately adjacent to, or in some cases within, the proposed treatment units are a mix of first order headwater channels with intermittent or ephemeral flow and 3rd-4th order perennial channels.

Stream channels in the project area were field reviewed by the area hydrologist in 2007 and 2008. The small headwater tributary channels formed in the deep soils of the benches and ridges in the Milk Creek drainage flow intermittently on the surface before disappearing underground, only to pop out again down-slope. It's likely that ground water and intricate patterns of subsurface flow, as opposed to surface run-off, is the primary system of water delivery to these channels. Most are moderate gradient (4-10%) with small substrates 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

[22] For a more detailed description of stream channel formation and geomorphology the reader is referred to ***Geomorphology of Steepland Headwaters: The Transition From Hillslopes to Channels*** (Benda *et al.*, 2005).

flow over a colluvial valley fill and exhibit weak or ephemeral fluvial transport." Most have too low of a gradient to be subject to debris torrents or landsliding.

The BLM Hydrologist used criteria provided in the *BLM publication Riparian Area Management. A User Guide to Assessing Proper Functional Condition and the Supporting Science for Lotic Areas* (U.S.D.I., 1998);[23] and compared conditions here to similar channels in the Western Cascades to assess project area channel conditions.

Project area channel reaches observed on BLM are currently in proper functioning condition (PFC) because there is adequate vegetation, landform, or large woody debris present to: dissipate stream energy, filter sediment, aid ground-water recharge, aid floodplain development, stabilize streambanks and maintain channel characteristics. A determination of "proper functioning condition" means that the channel elements and physical processes are in working order relative to an area's capability and potential.

It does not mean that the channel is functioning at full biological potential or that nothing could be improved by human intervention (i.e., placing additional wood structure, repairing infrastructure, thinning adjacent forest, etc.).

Many of the small tributaries in the Clear Creek watershed tend to be steeper due to main channel incision into the relatively weaker tuffaceous-sedimentary rocks that underlie the basalt flows. These channels are often steep A3/4a+ channel types (Rosgen classification): steep channels incised into resistant colluvial materials and subject to debris flows. They have steep side slopes that are prone to landsliding and, because it is difficult for conifer in these locations to establish, they tend to be dominated by deciduous species such as red alder and salmon berry.

Due to the relatively frequent disturbance regime in these channels, they are often open (i.e., not fully stocked) and "brushy" with large quantities of downed wood.

One small, intermittent channel is proposed for a temporary crossing (21C_4S3E) during the dry season to provide access for ground based logging equipment in the riparian zone on the east side of the channel. This channel is a flat swale with almost no visible surface flow (<1%) during the summer, not entrenched with bed and banks composed of the local soil (i.e., colluvial). Streamflow in this channel is so low that bed scour is barely evident and the bed and banks are well protected with wood, organic materials, and vegetation. The channel is stable and in proper functioning condition.

Perennial Channels

The small headwater tributaries adjacent to the proposed treatment units eventually reach the larger, perennial streams such as Nate Creek or Clear Creek. These larger 3rd- 4th order streams have entrenched into the relatively resistant bedrock forming constrained valleys with moderately steep adjacent slopes (average 50-60%). There is a low to moderate supply of gravel and cobble sized material actively transported in these Rosgen "B3" channels (Rosgen, 1996). Utilizing the Montgomery-Buffington typology (Montgomery & Buffington, 1997), 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."

[23] See page 5, paragraph 1 for the definition of proper functioning condition.

Some of these channels, such as Clear Creek, are shaded by dense stands of second growth conifer, often dominated by hemlock. Clearly 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.

Other channels in the project area are lower gradient, meandering C-type channels (Rosgen classification). These "self-forming" channel types are unusual on BLM lands in the Western Cascades: <2% grade, unconstrained by valley walls and meandering through depositional soils with well formed floodplains and pool-riffle morphology. These channel types are often associated with wetlands and support a wide range of riparian species from beaver to anadromous fish.

Due to the depositional setting of these channels and the low resistance of the bed and bank materials, these channels are highly sensitive to disturbance and will respond quickly to changes in sediment regime, wood inputs and flow.

Roads and Stream Channels in the Project Area

Where roads cross streams, channel morphology (the shape, size and slope of a channel) is generally altered in a predictable manner and this will affect channel equilibrium (the relationship between the channels morphology and its ability to transport materials and water)[24].

Within the area occupied by the road prism (this varies with the length, width and depth of the road prism), vegetation and organic materials are removed, the channel surface, banks and bed are compacted (bulk density, or the weight by volume, of the soil is increased by as much as 30% relative to undisturbed soil), the original channel is buried by road fill, and the channel morphology is reduced to the dimensions of the culvert.

There are numerous places where existing roads cross streams in and near the project area.

Culverts on BLM controlled roads on haul routes for the project are generally adequate to meet 100 year flood standards. In some other locations (not on the haul route or not on BLM controlled roads) the culverts are either damaged or under-sized (are not large enough to handle calculated 100 year flood event flows) and may lead to road failure if they overflow. At some culverts outflows have eroded or otherwise changed the nature of the stream, generally for less than 100 feet downstream of the culvert on the small streams in the project area. (Hydrology report pp. 7-8.)

Culverts meeting 100 year flood standards have 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 and the stream is said to be "at grade" and channel morphology upstream of the road fill is not affected. However, in other cases, the reduced "channel" dimensions of culverts and/or collapsed road beds have restricted the passage of water, sediment and organic materials from upstream resulting in the deposition of sediment and woody material above the crossing and the stream is said to be "aggraded".

[24] See: http://www.krisweb.com/hydrol/channel.htm for a discussion of factors in channel equilibrium.

The length of channel aggradation upstream of culverts varies with channel slope and the supply of material and water, but (based on professional judgment and observation) is generally restricted to less than 100 feet on the small streams in the project area.

Occasionally, deposition upstream from culverts completely blocks stream flow through the culvert and high water actively erodes the road fill, as happened at one culvert on Randall Creek between units 29A and B-4S3E.

Over time, the road fill at this location was destroyed by flooding and the channel has re-established its previous morphology, leaving the old culvert partially embedded in the rock of the streambed in the middle of the channel. The resulting road approaches and streambed condition have led to specific design features for crossing the stream at this location. (*EA section 2.3.4)* This stream crossing is in a gentle swale with low banks and rock armored streambed.

Adjacent to this crossing is a collapsed log fill stream crossing of an intermittent stream at the foot of the flood plain terrace. Flows in this stream are impounded by this collapsed fill, infiltrating into subsurface water within the flood plain rather than flowing into Randall Creek.

Project Area Wetlands

There are a few wetlands in the project area identified on National Wetlands Inventory maps (see http://wetlandsfws.er.usgs.gov/wtlnds/launch.html). These features are also identified as wetlands in the BLM GIS Lakes theme and the BLM GIS Timber Production Capability Classification (TPCC). The BLM GIS Lakes theme, for smaller wetlands, ponds and lakes, identified additional areas adjacent to local streams as wetlands. All wetlands are excluded from treatment.

Project Area Hydrology (ACS Objective 6)

There are two U.S.G.S. gaging stations several miles downstream of the project area on the lower Molalla River near Canby and on the Clackamas River near Oregon City. On project area tributaries there is one gage on Nate Creek http://waterdata.usgs.gov/or/nwis/uv/?site_no=14199704&PARAmeter_cd=00065,00060), less than one mile above Unit 27-4S3E. None of the other small, tributary channels in the project area have been gaged.

Base Flow

Summer base-flow (when mean stream discharge drops below 20% of the mean winter flow) normally begins in perennial channels sometime in July and continues from August-October. Many small headwater channels (intermittent or ephemeral) dry up completely during this period.

Peak Flow

Stream-flow is assumed to be typical of western Cascades streams where most runoff occurs during winter storm events[25]. Base-flow or low-flow occurs during late summer and early fall when mean stream discharge drops below 20% of the mean winter flow. Many small headwater channels dry up completely during this period.

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.

The two largest peak flow events in the last century took place in 1964 and in February of 1996. The '64 event was estimated at or above a 100 year flood return interval while the '96 was approximately a fifty year event; both were in response to substantial snow pack melt-off. The State of Oregon has estimated peak flows for most watersheds in Western Oregon, including project area watersheds. These estimates may be viewed at the following web site http://map.wrd.state.or.us/apps/wr/wr_mapping/. Project area stream flow (including peak flow) was analyzed for the Highland Fling project. (Hydro Report pp. 10-12)

Potential for Peak Flow Augmentation Due to Forest Harvest: Current Condition

A preliminary analysis for the risk of increases in peak flow as a result of forest harvest was conducted using the Oregon Watershed Assessment Manual watershed analysis methods for forest hydrology (OWEB, 1997 located at http://www.oweb.state.or.us/publications/wa_manual99.shtml).

Analysis indicates that the risk is low that peak-flows have been increased as a result of openings in the forest canopy in all of the project sixth field watersheds. The proportion of the 6th field watersheds in the project area within ROS varies from a high of 68% in Upper Clear Creek to a low of 0% in Upper Milk Creek. The risk of peak flow enhancement within each 6th field varies with the proportion of this area that has been recently harvested. The proportion of ROS area with current crown closure <35% ranges from a high of 17% in Headwaters of Milk Creek to a low of 10% in Middle Clear Creek. See Table 7.

Table 7: Risk of Peak Flow Enhancement by 6th Field Watershed in Highland Fling.

6th Field Subwatershed Name	Watershed Area (acres)	Percent of Watershed in ROS Areas	Percent of ROS area with <35% Current Crown Closure	Peak-Flow Enhancement Risk
Middle Clear Creek	21,733	1.2% (257 acres)	10% (26/257 acres)	Low
Upper Milk Creek	11,753	0	0	Low
Upper Clear Creek	12,433	68% (8,461 acres)	13% (1,080/8,461 acres)	Low
Headwaters of Milk	10,199	24%	17%	Low

[3] For a more detailed description of watershed hydrology in forested regions of the Pacific Northwest the reader is referred to ***Physical Hydrology and the Effects of Forest Harvesting in the Pacific Northwest: A Review*** (Moore *et al*., 2005).

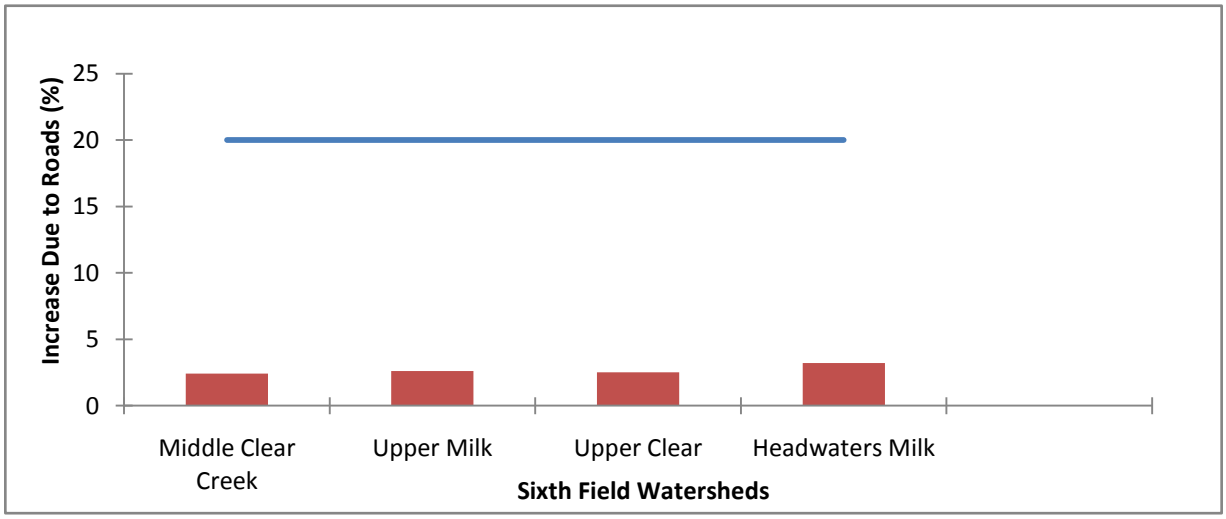
6th Field Subwatershed Name	Watershed Area (acres)	Percent of Watershed in ROS Areas	Percent of ROS area with <35% Current Crown Closure	Peak-Flow Enhancement Risk
Creek		(2,468 acres)	(407/2,468 acres)	
Total	56,118	20% (11,186 acres)	14% (1,513/11,186)	Low

Peak Flow/Water Quality Effects from Roads

Based on the analysis of road proximity to streams documented in the Hydro Report (pp. 11-12), none of the sixth field watersheds in the project area are currently at risk for augmentation of peak flows due to the road network in the watershed. Figure 5 displays channel network expansion at road-stream intersections for project watersheds (estimated from Salem District ARC-GIS data).

Channel network expansion values from roads in the project area 6th field watersheds range from a low of 2.4% in Middle Clear Creek to 3.2% in Headwaters of Milk Creek. The Wemple study concludes that drainage density increases due to road stream intersections of approximately 20% or greater (indicated by the line on the chart) have the capacity to alter both the timing and quantity of peak flows. Channel network expansion in these four 6th field watersheds is less than 1/6 of the extent that that this study indicates would potentially alter flows.

Figure 5:Stream Channel Network Expansion by Roads in the Project Area 6th Field Watersheds.



Project Area Ground Water

The Oregon Department of Environmental Quality (DEQ) has not identified any groundwater pollution problems within project watersheds. The Water Resources Department (OWRD), together with the DEQ, is responsible for the regulation and protection of ground water quality and quantity. See http://www.deq.state.or.us/wq/groundwa/wqgw.htm.

Local conditions of groundwater relative to quantity, location, flow and quality is understood only in a general sense. Interaction between surface flow and subsurface flow is intricate and varies across the landscape in response to conditions in soils, topography and lithology. The moderately deep soils in the project area uplands are well drained and generally lack horizons which impede water infiltration. Precipitation is thus free to saturate soil surface horizons and flow deep into the subsurface, as well as down-slope, under the influence of gravity. Soils in the project area have relatively high rates of water movement as indicated by infiltration rates between 0.25 – 2 inches/hour. Thus, under natural conditions, most precipitation either drains through the soil profile or is evapotranspired.

The topography, limited area of compacted soils and high variability of compaction (both in location and time) in the project area tend to nullify the potential effects of project related compaction on water movement through the soil. Soil surfaces which have been deeply compacted have reduced rates of water infiltration and thus less precipitation from these surfaces will reach the subsurface and a larger proportion will puddle near the soil surface, free to either run-off, transpire or evaporate. In this case, we can expect a proportionate reduction in ground water storage and flow. This effect is substantial enough in urban areas, where large proportions of the surface prevent infiltration, that alterations in flow and ground water storage may be measurable.

Forest roads and landings can alter patterns of subsurface flow by intersecting ground water and rerouting it to surface streams. This conversion of ground water to surface run-off can potentially alter the timing and size of peak flows and result in a proportionate reduction in water available for ground water storage (see the previous discussion "*Peak Flow/Water Quality Effects from Roads")*

Water Quality and Beneficial Uses (ACS Objectives 4, 5)

Oregon Department of Environmental Quality (ODEQ)

The ODEQ, under the Clean Water Act, has been delegated authority to protect the quality of all waters in the State of Oregon. Established water quality standards "not to be exceeded" for all waters of the state are published in the Oregon Administrative Rules, Chapter 340, Division 41 (Willamette Basis standards begin with 442). In addition, updated water quality standards have recently been approved by the USEPA. These standards may be reviewed at http://www.deq.state.or.us/wq/standards/Temperature/FinalRules340-041.pdf.

Designated Beneficial Uses

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 these uses. Both resident and anadromous fish are downstream from several of the proposed units (Table 8). Several municipal water providers withdraw water from the Lower Clackamas and the Molalla-Pudding to treat and provide city residents with drinking water. The South Fork Water Board (PWS# 41000591), North Clackamas County Water Commission (PWS #4100580) and Clackamas River Water (PWS# 4100187) have withdrawals downstream of the Clear Creek project area.

The Canby Utility Board (PWS# 4100157) and the City of Molalla (PWS #4100534) take water from the Lower Molalla River. Milk Creek is tributary to the Lower Molalla River. Additional beneficial uses include: Industrial Water Supply, Wildlife & 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*.

Willamette Basin TMDL: Effective Shade and Stream Temperature

The DEQ's 2002 303d List of Water Quality Limited Streams is a compilation of streams which do not meet the state's water quality standards (http://www.deq.state.or.us/wq/assessment/rpt0406). The Lower Clackamas River did not meet the State of Oregon's standards for stream temperature, river mile (RM) 0-22.9, based on data collected up to 2001. Although part of the Lower Clackamas River, Clear Creek was not listed as temperature deficient. The Molalla-Pudding also was listed for exceeding water quality standards for summer stream temperatures. In response, the DEQ completed a Total Maximum Daily Load (TMDL) for both the Clackamas and the Molalla-Pudding.

In the project area, the site potential for effective shade is estimated by use of effective shade curves and varies from 80-95% depending on stream channel orientation with a "near stream disturbance zone" of 25-50 feet.

According to the TMDL, effective shade is a surrogate measure for the heat load a stream receives when it is exposed to direct sunlight and thus, maintaining or recovering site potential levels of effective shade should result in reductions in stream temperatures to levels that achieve state standards. All the streams in the project area are subject to the conditions of the Willamette Basin TMDL completed by the DEQ in 2005 (http://www.deq.state.or.us/wq/TMDLs/willamette.htm).

The BLM has not collected stream temperature data in the project watersheds. Many of the tributaries adjacent to the proposed thinning units are intermittent and only flow during the wet season when exposure to solar heating is of no concern. Based on field surveys of streams and riparian zones in the project area, review of aerial photographs and IVMP data, the area hydrologist concluded that effective shade is near to full potential along most of the perennial streams on public lands in the project area with effective shade in the range of 80-95% along stream reaches field reviewed. It is precisely because of the high stand density, and hence high effective shade, in this area that some riparian forest stands are proposed for thinning.

Therefore, the existing riparian vegetation in the project area is adequate to maintain perennial streams in the temperature range required by the ODEQ under the Clean Water Act because the shade produced does not allow sufficient light to penetrate and increase summer stream temperatures above standards.

Dissolved Oxygen, pH, and Conductivity

No data for these variables in the immediate project area was located for this assessment. Considering the low stream temperatures in the immediate project area (temperature limited streams are outside of 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 [26]

No site specific data for stream turbidity in the project area was located for this assessment. During winter field reviews of area streams water clarity appeared high and high turbidity levels were not noted. For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to *Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest* (Takashi et al, 2005).

Recreation Trails and Off-Highway Vehicle (OHV) Use

A number of undesignated recreational trails on public and private lands were identified during project field work. Most of the trails are utilized for horseback riding and some are used by OHV. However, some of these trails are heavily compacted and eroded, primarily due to OHV traffic.

Most of the trail networks have been developed on surfaces that were originally utilized for forestry operations (i.e. skid roads, old logging trails and fire lines) that were not intended for continual use or for recreational access. In addition, in some cases users have expanded these trails by unauthorized cutting and removal of trees.

Although some of the trails are not properly constructed or maintained, the majority are not sources of water pollution. Nevertheless, some segments on steeper slopes have gully eroded to bedrock and are a clear source of erosion and water quality pollution.

Environmental Effects

3.3.2.1 Proposed Action

Channel and Wetland Morphology (ACS Objective 3)

Direct and Indirect Effects - Channel and Wetland Morphology

In general, there would be no direct alteration of the physical features of the project area stream channels or wetlands under this proposal. Stream banks, wetlands and channel beds are protected from direct physical alteration or disturbance by harvesting equipment.

With the exception of the normal cycle of road repairs at stream crossings and the temporary ford crossing of Randall Creek and removal of the collapsed log fill on the tributary immediately adjacent to that ford (discussed below), disturbances are kept a minimum of 60 feet from all wetlands and perennial stream channels (30 feet from intermittent channels).

[26] Turbidity is a measurement of water clarity and is not convertible into a volume measurement of sediment yield unless correlated to suspended sediment data. For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to **Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest** (Takashi *et al*, 2005).

The proposed action is unlikely to affect stream flow in a measurable manner (see the following discussion under watershed hydrology) and therefore any indirect effects to stream channels as a result of increases in peak flows is unlikely. Thus, the proposed action would be unlikely to result in any measurable effects, such as increases in bank erosion, channel incision, loss of floodplain connectivity or alteration of local wetland hydrology that could result from augmented peak flows or altered watershed hydrology.

No new road construction crossing perennial stream channels or wetlands is proposed. However, maintenance and repair of some stream crossings on roads that have not been maintained is proposed. Repairs to existing roads at stream crossings, undertaken as part of normal road maintenance cycles (RMP C-2) would maintain the channel alterations currently in place. In some cases, larger culverts and more stable fills would allow for improved channel morphology over the long term by reducing sediment inputs at the crossing and by increasing the culvert's capacity to accommodate the stream during peak flows (i.e., passage of water, wood and bed-load).

In all cases of crossing repair, maintenance and/or culvert upgrades, 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 bed and banks reach equilibrium with flow and sediment transport.

Based on previous experience with these type of channel crossings (i.e., judgment of the field hydrologist) long term effects to channel function or morphology from disturbance at stream crossings would be unlikely because the channels are resilient (i.e., they resist change) and would adjust to accommodate the new structures 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.

The temporary ford crossing of Randall Creek proposed for access to Unit 3-5-35A would result in bank and bed disturbance as the channel would be crossed multiple times at low flow by logging equipment and the existing roadbed in the floodplain compacted by logging equipment, log decking (i.e., landing) and transport. This disturbance would likely retard channel recovery for a period of two to three years as stream flows rebuild the bed, banks and floodplain.

Removal of the collapsed log fill crossing of the unnamed tributary to Randall Creek adjacent to the ford would open the former channel, which would recover within 2-3 years as the bed and banks stabilize.

Effects from maintenance and repair of stream crossings would be limited to the site of disturbance (i.e., not extend more than 100 feet downstream or upstream from the disturbance) and unlikely to result in any alterations to channels or floodplains downstream or elsewhere in the watershed. Indirect effects, such as increases in bank erosion, channel incision, loss of floodplain connectivity or alteration of local wetland hydrology, to stream channel or wetland morphology or function would be unlikely because of the stability and resiliency of channels in the project area.

Project Area Hydrology (ACS Objective 6)

Direct and Indirect Effects – Watershed Hydrology

Water Yield, Base Flow, Fog-Drip, and Peak Flow

The proposal would likely result in some incremental increase in annual water yield correlated to the partial removal of the conifer over-story, however "the increase in fall and winter discharge from forest activities is likely to have little biological or physical significance" (USEPA. 1991).

It is unlikely the proposed action would have a detectable effect on fog drip or a detectable effect on the base flow in project area streams because no studies have documented reductions in fog drip where close to 50 percent of the canopy is retained and less than 25 percent of the watershed is thinned and there is no data to indicate if fog-drip is an important contributor to soil moisture and watershed hydrology in the project area.

It is unlikely that the proposed reduction in stand density would have any effect on peak flows in any of the sub-watersheds in the project area because even with the removal of a portion of the canopy on 16 acres in the TSZ under this proposal, less than 13 percent of the Upper Clear Creek watershed Transient Snow Zone (TSZ) (the only watershed in the project area affected by harvest in the TSZ) would be in an "open condition." This is well below the level reported by any study for hydrologic change in this region (Grant, et al, 2008).

Also, the canopy closure in the project area would remain greater than 40 percent and the Oregon State method for determining risk of peak flow augmentation does not consider forest with canopy closure greater than 30 percent to be a contributing factor in rain-on-snow (ROS) events. Peak flows that have caused abnormal flooding are associated with large scale ROS events.

This proposal would not alter existing roads in a way that would likely reduce or increase effects to peak flows attributable to the current road network and thus it would maintain the current condition and trends relative to hydrology and stream flow. Currently, the risk of hydrologic change posed by the road system is low (see discussion in Affected Environment). In addition, existing roads were inventoried by area specialists and recommendations for improvement and repair of road surfaces would be implemented under the proposed action. Some of these actions would reduce road connectivity and routing to stream channels by routing water to soil surfaces where it can re-infiltrate.

The road construction proposed for this project has a low risk of altering watershed hydrology or peak flows because proposed road locations and design would not allow intercepted water to reach stream channels any faster than precipitation which falls on the forest floor. Compacted surfaces would be unlikely to affect infiltration because compaction would be limited to less than 10% of the project area, some of which is already compacted by previous logging operations. These compacted surfaces are located on topography with low to moderate slope so water that does not infiltrate where it falls would either be evapotranspired or infiltrate quickly into adjacent soils that are not compacted.

Ground Water

The proposed action is unlikely to affect the flow, quantity or quality of watershed groundwater because the action is unlikely to alter in a measurable manner patterns of surface flow and runoff, so there is little capacity to affect groundwater patterns which are intimately linked to the surface.

The proposed project would have no potential effect on ground water quality because no BLM action would affect nitrate, pesticide, volatile organic compounds or bacteria levels analyzed by DEQ. The proposed project would not affect ground water quantity because it would not affect the total infiltration capability of the project area, nor would it displace infiltration in any area by more than a few feet (half the width of skid trails, roads or landings).

Water Quality (ACS Objectives 4 and 5)

Direct and Indirect Effects - Water Quality

Summer Stream Temperature Maximums in Perennial Streams

The Highland Fling Thinning project would not increase summer temperature maximums in perennial streams adjacent to the proposed thinning areas because no shade producing vegetation within the primary shade zone of 60 feet from the active stream channel would be cut or removed, so shading would remain unchanged.

Also, the average canopy closure in the secondary shade zone that contributes to effective shade would be maintained above 50 percent which would not allow enough light to strike the water surface to increase the heat load. These measures are described in the *Northwest Forest Plan Temperature TMDL Implementation Strategies* (USFS and BLM, 2005) and by implementing them, the proposal would maintain stream temperatures in their current range and would protect beneficial uses.

The proposed action would have little potential to result in any measurable alteration of temperature regime in intermittent and ephemeral streams because almost all of the primary shade zone vegetation and at least 50 percent of the canopy in the secondary shade zone would be retained along these streams. Therefore, these channels have little potential to be heated by exposure to direct solar radiation so effects from thinning would not be detectable.

Dissolved Oxygen, pH and Conductivity

It is unlikely that the proposed action would have any measurable effect on dissolved oxygen (DO) levels in project area streams because the project would not measurably change the factors that contribute to reduced DO. The proposed action would not place large amounts of fine organic material in the stream, would not alter re-aeration, and would be unlikely to result in any measurable increase in stream temperature or sedimentation.

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

Sediment Supply, Transport and Turbidity

The proposed action is unlikely to have a detectable effect on sediment supply, routing or turbidity as demonstrated by the following review of the processes that control both the supply and transport of sediment in forested watersheds and potential effects of management practices. (Hydrology Report, pp. 23-29)

Mass Wasting

The proposed action is unlikely to affect mass wasting because very little treatment is proposed in steep headwater basins, treatment is not proposed on slopes that are steep (>60 percent) or unstable, and continuous forest cover and its root structure is maintained.

Surface Erosion, Stream Bank And Channel Erosion

The proposed action is unlikely to increase surface erosion because water would continue to infiltrate the native soil rather than concentrating runoff that would erode soil and transport it to streams (see the discussion of Project Area Hydrology, above). The proposed action is unlikely to increase stream bank and channel erosion because it would not contribute to increasing stream flows outside of normal ranges (see the discussion of Project Area Hydrology, above). The proposed action is unlikely to increase sediment production at stream crossings to a degree that would measurably affect the sediment regime of the project area streams (see the discussion of Channel and Wetland Morphology, above).

It is unlikely that the proposed action would lead to a measurable long-term alteration in sediment delivered to streams, stream turbidity, stream substrate composition, or sediment transport regime because BMPs and mitigation measures are proposed to eliminate and/or limit acceleration of sediment delivery to streams in the project area. In most cases, management practices with the potential to accelerate erosion fall into three categories: road construction/maintenance and hauling, timber harvest or "yarding," and site preparation for reforestation (particularly prescribed burning).

Road Construction, Maintenance and Log Hauling

New roads would not be connected to the stream system and therefore no pathway would exist for delivery of any sediment to streams generated by their construction or use. All new road construction would occur on low to moderate slopes emanating from the existing road network, on stable surfaces (i.e., surfaces that are not contributing to landsliding or mass wasting) and therefore road related landslides in these locations are also unlikely.

All road construction in the proposed action would comply with applicable water quality standards because project design features would utilize the BMPs[27] required by the Federal Clean Water Act (as amended by the Water Quality Act of 1987) to reduce non-point source pollution to the maximum extent practicable.

[27] http://www.epa.gov/owow/nps/forestrymgmt

Since road construction would occur on stable surfaces well away (generally more than 220 feet, minimum of 150 feet) from streams and incorporate design features to implement BMPs, the only opportunity for these roads to deliver sediment to the stream system would be at the proposed temporary crossing of Randall Creek (discussed below).

The temporary crossing of Randall Creek proposed for access to Unit 29A-4S3E would be unlikely to result in visible or measurable increases in turbidity or sediment levels beyond ½ mile below the crossing because all operations would be done during the in-stream work period when stream flows are low. Turbidity at the site and within ½ mile downstream would likely exceed state standards during the period of activity for short durations (several hours within a period of a few days) as a result of log decking and loading adjacent to the stream and momentarily (minutes) during and immediately after each crossing by logging equipment. Any sediment yield increase would be difficult to measure and is unlikely to contribute more than one percent to the supply or transport of sediment in this watershed.

Any increases in turbidity attributable to road work and log hauling would be unlikely to exceed the State of Oregon Water quality standards (> 10 percent increase relative to background levels) and would decrease as soon as hauling and road maintenance operations are completed. Maintenance and improvements of existing roads and log hauling may increase turbidity in project area streams relative to background or upstream water clarity during operations and during the first winter following operations.

Any overall sediment yield increase would be difficult to measure and is unlikely to contribute more than one percent to the supply or transport of sediment in the project area watersheds because project design features to implement BMP would reduce potential sediment production and transport from roads to low levels. Increased turbidity is unlikely to be visible or measurable beyond 800 meters below the site of the disturbance or stream crossing (Foltz and Yanosek, 2005).

Tree Harvest and Yarding

It is unlikely that tree harvest, including ground based logging, would increase sediment supply to streams because of factors discussed previously, including: forest cover would be retained with at least 40 percent canopy closure, water would normally infiltrate rather than runoff and erode soil, untreated SPZ would further filter any runoff or subsurface flow during high rainfall events, and design features would prevent concentrating runoff from roads and areas compacted by logging operations.

It is unlikely that skyline yarding would increase sediment supply to streams because of the above factors and because WEPP modeling demonstrates that thinning and skyline yarding done with the proposed project design features would result in surface erosion sediment yields that would not be detectable relative to background sediment transport in the main channels of the project area watersheds. Research in the Pacific Northwest has demonstrated over time that WEPP over-estimates sediment yields.

The Cascades Resource Area Hydrologist has conducted field reviews of skyline logging on similar sites in the Cascades Resource Area (e.g. Butte Creek, Pine Rock and South M&M timber sales) during multi-day rain storms and found no evidence of overland flow or sediment transport where WEPP had predicted sediment transport under similar conditions (*Hydro Report* pp. 27-29; Hawe, 2007; *WEPP (Water Erosion Prediction Project) Report for Highland Fling Thinnig).*

It is unlikely that this proposal would increase bank erosion or channel cutting by altering channel roughness, redirecting flows or altering bank-stabilizing vegetation because project design features, including the SPZ around all streams, would eliminate most disturbance of stream-side vegetation and protect stream banks, wetlands and channel beds from direct physical alteration or disturbance by harvesting equipment. The potential for increases in stream energy due to alterations of peak flows is low, as was discussed previously.

It is unlikely that the proposed action would increase potential for mass wasting because areas with potential for slope instability and mass wasting were identified and verified by BLM personnel during work for the project proposal. All proposed treatment units are outside of any areas that are identified as unstable or prone to mass wasting in the TPCC and/or identified in the field. Tree removal is not proposed on steep, unstable slopes where the potential for mass wasting adjacent to stream reaches is high as defined by the TPCC. Therefore, increases in sediment delivery to streams due to mass wasting induced by loss of root strength and increases in soil pore pressure are unlikely to result.

Site Preparation

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 on level ground outside of riparian areas 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.

3.3.2.2 Cumulative Effects

Channel and Wetland Morphology (ACS Objective 3)

With the exception of road maintenance sites at stream crossings and the replacement of some culverts, this proposal would be unlikely to result in any measurable direct effects to channel morphology. Since the proposal is not likely to result in effects that extend beyond the site of disturbance and these effects would be of relatively short duration (channel adjustment within one to three years) the proposal would be unlikely to contribute to any cumulative effects in these watersheds.

Watershed Hydrology (ACS Objective 6)

Since the proposal is not likely to result in measurable direct or indirect effects to peak flow the proposal would be unlikely to contribute to any potential cumulative effects to peak flows in these watersheds. Current condition of the watersheds in the project area indicates low risk for augmentation of peak flows due to forest openings.

This proposal would result in a minimal net increase in forest openings in ROS areas with crown closure <35% and would be unlikely to contribute cumulatively to the augmentation of peak flows even if they were occurring in these watersheds as a result of past forest harvest. Proposed road use and construction is unlikely to alter surface or subsurface hydrology or to contribute cumulatively to any change from current conditions in the watershed.

Since there is unlikely to be any measurable direct or indirect effect to the watershed's ground water, the proposed action carries low risk for contributing cumulatively to effects either in the uplands or in lower valley positions.

Water Quality (ACS Objectives 4 and 5)

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

Sediment Yield Cumulative Effects

The incremental increase in sediment yield and turbidity that could be attributable to the proposed action is of such a small magnitude and duration that it is unlikely to be detectable. Estimated sediment yield for the Middle Clear Creek sixth field watershed illustrates this principle: Assuming an "average yield" of 1.752 tons/acre/year (average for reported for small forested watersheds in Oregon [Patric et. al., 1984]) in the Middle Clear Creek sixth field watershed (21,733 acres), total sediment yield would be approximately 37,489 tons/year. The estimated average increase of 0.92 tons per acre (*Hydro Report; WEPP Report*) directly attributable to the proposed action is an increase of 72 tons (78 skyline yarded acres in the watershed). Accounting for the 50% estimated precision of the WEPP model, this ranges between 0.1-0.3% of mean annual yield in this watershed.

Given the inherent variability and error in sediment yield measurements[28], an increase of such small magnitude is not detectable with current technology. Typically, sediment yields from forest harvest decrease over time as a negative exponential (Dissmeyer, 2000). Therefore, the quantity of surface erosion with delivery of sediment during large storm events would likely drop back to current levels within three to five years as the remaining forest stand fills out. (*Hydro Report*, pp. 29-30)

[28] Accurate estimates of sediment yield are difficult to measure and may vary by two or more orders of magnitude (Gregory L. Morris, Jiahua Fan, 1998).

In a similar manner, the risk of short term (during the action and the first winter following) increases in stream turbidity levels directly below road/stream intersections as a result of road maintenance and hauling would be maintained below the limits required by the Oregon State DEQ. Cumulatively the limited magnitude (not visible more than 800 meters downstream of the crossing) and duration (primarily in the first winter following road repairs) of this effect would be non-detectable on the scale of the seventh field watershed (decreasing degree of effect on the scale of larger sixth and fifth field watersheds) and would be unlikely to have any effect on any designated beneficial uses.

3.3.2.3 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. Any existing effects in the watershed would continue to occur from the development and use of private and other agency lands (primarily agriculture, timber harvesting and road building).

3.3.3 Fisheries and Aquatic Habitat

Sources Incorporated by Reference: *Highland Fling Fisheries Specialist Report, Zoellick, 2008) (Fisheries Report) , Hydrology Report,* ***Additional Sources Referenced:*** *Logging Systems Report*

Affected Environment

Fish Presence and Aquatic Habitat in the Project Area

Coastal cutthroat trout (*Oncorhynchus clarki clarki*; Behnke 1992) are common and widespread across the project area. All third order and larger streams on the project area support populations of coastal cutthroat trout including Bittner, Clear, Little Clear, and Randall creeks and several unnamed third order tributaries to these streams (BLM Fish Inventories 2008). Coastal cutthroat trout inhabit one second order tributary stream to Randall Creek in T.4S, R.3E, Sec.21. Generally, fish are absent from smaller order streams due to small stream size (low stream flows) or steep gradients. Sculpins (*Cottus* sp.) were observed in Clear Creek and an unnamed tributary to Nate Creek in T.4S, R.3E, Sections 23 and 27 during summer 2008 (BLM Fish Inventories 2008).

Threatened / Endangered Species

Lower Columbia River (LCR) coho salmon (*O. kisutch*), LCR steelhead trout and Upper Willamette River (UWR) steelhead trout (*O. mykiss*), and UWR Chinook salmon (*O. tshawytscha*) are listed as 'threatened' under the Endangered Species Act of 1973 (ESA). Clear and Little Clear creeks are tributaries to the Clackamas River and provide habitat for LCR coho salmon and LCR winter steelhead trout adjacent to and downstream of several project sites (Streamnet 2006, Table 8). The upstream limit to coho salmon and steelhead trout distribution in Little Clear Creek is thought to be at the confluence of an unnamed tributary with Little Clear Creek in T.3, S,R.3E, Section 26 (Streamnet 2006). Coho salmon and steelhead trout distribution in Clear Creek ends at a barrier falls at the confluence with the North Fork of Clear Creek in T.4S, R.3E, Section 21 (Streamnet 2006; I. Sanders, ODFW, pers. comm.). Randall, Bittner, and Dorn Creeks are located in the project area and are tributaries to Milk Creek, which provides spawning and rearing habitat

for UWR winter run steelhead trout upstream of the Nate Creek confluence (Streamnet 2006, ABR, Inc. 2004). Project sites in the Milk Creek drainage are 2 to 5 miles upstream of steelhead habitat. UWR Chinook salmon are found in the Molalla River more than 25 miles from project area streams.

Table 8 shows the approximate distances downstream from proposed project units to resident cutthroat trout and potential ESA listed fish habitat[29].

Distances to Cutthroat trout habitat are in feet from treatment area (thinning) boundary to the stream bank. Distances to ESA Listed Fish are in miles from the treatment area downstream to recognized habitat.

Table 8: Distance to Fish Habitat

Unit Number	Distance (feet) to Cutthroat trout habitat	ESA Listed Fish Species	
		Distance in Miles	
		To Coho Salmon habitat	To Steelhead trout habitat
3-3-35	60 feet minimum to Little Clear Creek tributary	0.5 to Little Clear Creek	0.5 to Little Clear Creek
4-3-1	338 feet to un-named tributary to Clear Creek	0.6 to Clear Creek	0.6 to Clear Creek
4-3-21	60 feet minimum on Randall Creek	NA[b]	3.7 to Milk Creek
4-3-23	200 feet (est.) to unnamed tributary to Nate Creek	NA[b]	5.3 to Milk Creek
4-3-27	200 feet (est.) to unnamed tributary to Nate Creek	NA[b]	4.9 to Milk Creek
4-3-29	60 feet minimum on Randall Creek	NA[b]	3.0 to Milk Creek
4-4-21	590 feet to Clear Creek	0.1 to Clear Creek	0.1 to Clear Creek
4-4-27	400 feet to Clear Creek	0.3 to Clear Creek	0.3 to Clear Creek
4-4-29	240 feet to Bittner Creek	NA[b]	2.2 to Milk Creek

[a]Upstream limits of anadromous fish distribution were obtained from Streamnet (2006). Stream distances were measured using ArcGIS software.
[b]Coho salmon are not native to Willamette River tributaries upstream of Willamette Falls.

Special Status Species Presence in the Project Area

No aquatic BLM Sensitive, Bureau Strategic or Former Bureau Assessment Species have been documented in the Highland Fling Thinning project area.

Stream Habitat Conditions

Stream channels on the project area are stable (generally gravel, cobble, or boulder dominated) and streambanks are well vegetated (>90% vegetated with riparian and streamside vegetation; BLM Fish Inventories 2008). Some streams have elevated levels of fine sediment from past land use activities (Bittner, Clear and, Little Clear creeks) and possibly in one case from recent land management actions on adjacent non-BLM managed lands (Nate Creek tributary stream, T.4S, R.3W, Sec. 27; BLM Fish Inventories 2008).

[29] Upstream limits of anadromous fish distribution are obtained from streamnet.org or ODFW (1993) inventories. Stream distances were measured using ArcGIS software.

Instream large woody debris (LWD) numbers are low in much of Clear Creek (BLM Fish Inventories 2008,Watershed Professionals Network, LLC 2002), resulting in simplified aquatic habitats and less quality cover for fish. Most of the LWD in Clear Creek is old and decadent (Watershed Professionals Network, LLC 2002).

Unit 3-3-35

Coastal cutthroat trout are present in Little Clear Creek.. Little Clear Creek is a steep gradient channel (ca. 10%) with generally gravel/cobble dominated substrates, some steeper gradient bedrock controlled reaches, and a wetted channel width of about 1-2 meters. Fine sediment levels are currently elevated in pools. The north haul route would cross listed fish habitat (LFH) in Little Clear and Mosier creeks. The approaches to 3 crossings of LFH have aggregate surfaces that drain water away from streams.

Approaches and crossings for other streams have relative short ditch lines draining to these streams, and all ditches are densely vegetated with no signs of sediment moving in the ditch. Other haul routes would include several short spur roads off of existing paved roads with no impacts to fish habitat.

Unit 4-3-1

Cutthroat trout are present in the un-named tributary to Clear Creek in NW ¼ section 1. The channel has a steep gradient (ca. 9%) with generally gravel/cobble dominated substrates, gravels in riffles with little fine sediments; some sediment deposition in pools, and a wetted channel width of about 2 meters. Road 4-3-1.1 may cross a 1st order tributary to Clear Creek 0.9 mile upstream of steelhead trout habitat, but channel gradient and adjacent slopes are relatively flat at the crossing, which lessens the chance for sediment movement.

Cutthroat trout are present in Clear Creek.. Channel is cobble-dominated (B3 channel type predominantly) with a wetted channel width of about 15 meters. About 20% of the stream has a bedrock substrate. Fine sediments were elevated at the time of the survey in riffles (about 50% embedded) and pools (75-100% fines). Streambanks are stable (>90% vegetated with riparian and streamside vegetation; primarily alder, canary grass, and Douglas fir).

LWD counts from the access point on private land in NE¼ of NE¼ of Section 1 to the upstream BLM boundary in SE¼ NE ¼ of Section 1 identified 45 LWD pieces (≥6 inches DBH) on 760 m of stream, which is 5.9 LWD pieces/100 meters (low LWD levels). About one-half of the LWD was recently recruited alder logs, which were 6-12 inches in DBH (fall 2008). Cutthroat trout are likely present in the lower 100 meters of an un-named 2nd order tributary that joins Clear Creek in the NE ¼ of Section 1. Wetted channel width is about 1.25 meters. Fine sediment level is elevated and comprises about 50% of the substrate. Streambanks are stable (>95% vegetated with salmonberry with a big-leaf maple overstory).

Unit 4-3-21

In Randall Creek and unnamed tributaries, salmonids were observed in culvert plunge pool and cutthroat trout are common, especially in beaver ponds. Stream above beaver ponds has a C6 channel; low gradient (ca. 2%), silt-dominated substrate and floodplain soils. Stream flows and width of riparian/wetland area increases as one goes down the drainage from county road crossing.

An un-named tributary to Nate Creek in NE ¼ of section (unit 21C) has a low gradient channel, with silt-gravel dominated substrate. No surface water was present on 04 September 2008. Active channel (with scouring) is approximately 0.5 meters wide. Riparian area is densely vegetated with alder and salmonberry. Blackberries dominate area at road crossing.

Randall Creek in SW¼ NW ¼ section (unit 21A) is impounded most of its length on BLM land by a dam/reservoir on private land in section 20. Channel is low gradient (ca. 0.9%), C6 channel type with silt substrate. Banks are vegetated with herbaceous community dominated by *Scirpus microcarpus*, *Carex* sp. (1 m tall), and *Glyceria* sp.

The pond is stocked with trout by a local fishing club. There are no haul route impacts; and units are adjacent to paved roads.

Unit 4-3-23

Cutthroat trout and sculpin are present in an un-named tributary to Nate Creek.. The stream has a wetted channel width about 1 meter on the upper one-half of this reach, islow gradient (ca. 1.4%), and about one-half of the banks are vegetated with *Carex* sp. (1 m tall). Channel substrate contains about 50% fines, 40% large cobble, and 10% small boulder; and there is a high sediment load in pools. Stream in south half of the reach downstream of Unger Road crossing is moderate gradient (3-4%) B channel type with a wetted channel width of about 2 meters The channel appears over-widened, possibly due to sediment/bed loads. Twenty or more trees recently (as of Fall 2008) blew down on south boundary adjacent to clear cut on private land in section 26. First order tributary adjacent to south boundary had surface flows on 8 September 2008.The are no haul route impacts; and the unit is bordered by a paved road on the east.

Unit 4-3-27

Cutthroat trout and sculpin are present in the un-named tributary to Nate Creek... The channel has a wetted channel width of about 1 meter, has a moderate gradient (3-4%) B channel type. Fine sediment levels in stream substrates are elevated (100% in pools); likely some recent delivery from upstream private lands (recently logged). Large western red cedars are growing adjacent to creek.

The are no haul route impacts; and unit is bordered on the east by a paved road.

Unit 4-3-29

Cutthroat trout are present in Randall Creek.. The wetted channel is about 3 meters wide, and the stream channel has a steep gradient (ca. 8%) with short segment of lesser gradient at an old road crossing. Channel substrate is largely composed of cobble and gravel.

At the road crossing where the stream would be forded by logging equipment under the proposed action, the original fill used to bed the culvert has washed out and the culvert is half buried in the cobble and gravel of the channel substrate (Hydrology Report, p. 8). The channel is in a nearly flat vale and is slightly wider at the road crossing than it is either up or down stream, with soil loss on mid bank. The 1st order drainage adjacent to the Randall Creek road crossing is crossed by the same road with no culvert. There is little or no existing gravel on the road and it appears that there is some soil movement during heavy rains on steep grade adjacent to 1st order drainage crossing. There are no haul route impacts other than road conditions immediately adjacent to the stream described above.

Unit 4-4-21

Cutthroat trout are present in Clear Creek. The stream has a wetted channel of about 7 meters wide; is a B channel type with a 2.5% stream gradient, and small boulder/cobble dominated substrate. Low densities of cutthroat trout are present. The BLM fisheries biologist observed two 250-300 mm long cutthroat trout in high quality, large woody debris (LWD) scour pool.

Clear Creek has with a high sediment load; approximately 75 % of the surface appears embedded. There is also a barrier falls (ca. 6 m drop) upstream at confluence of North Fork Clear Creek in SE¼SE¼ of Sec. 21.

Streambanks are stable and well vegetated (>90% of banks with riparian and streamside vegetation).The haul route into sections 21 and 27 crosses section 28 and is dirt with little rock on surface. At the crossing of the 1st order tributary that flows northwest into SW ¼ of section 21 there is only a dirt road surface.

Unit 4-4-27

Cutthroat trout are present in Clear Creek.. The stream is a primarily B3 channel with about 10% B1 channel inclusions with stable banks, and is >95% vegetated with streamside and riparian vegetation. Channel is well-shaded by streamside vegetation and canyon slopes. There are some bedrock drops (low falls) in 400 meters of channel downstream of the 2nd order tributary in NW ¼ of section 27.

LWD (≥6 inches diameter) survey transects from confluence of 2nd order tributary in NW ¼ of section 27 to about 400 m downstream found an average of 15.75 pieces/100 meters (total), an average of 8.5 pieces/100 meters were ≥12 inches diameter. Percent fines were visually estimated as about one-half of that found downstream in Clear Creek downstream of the North Fork confluence. There is a second order tributary in NW ¼ of section 27 withvery low flow; and a wetted channel width of about 0.25 meters.

The haul route to Unit 27B (on north side of Clear Creek) is well-rocked up through section 27 and is on flat ground above the slope break to Clear Creek canyon. The route crosses N. Fork Clear Creek on BLM land in section 23 at 1.9 miles upstream of listed fish habitat. This stream crossing has a 6 to 8 foot diameter culvert. Road approaches from both sides are relatively flat (little to no slope towards the stream). The haul route for Unit 27A is same as and has the same issues as that of Unit 4-4-21.

Unit 4-4-29

Cutthroat trout are present in Bittner Creek. Avery short segment of the stream is on BLM where the SW and NE ¼s of the SW ¼ of Section 29 meet. Private land up and downstream has been clearcut.

Streambanks are >95% stable; vegetated with red cedar overstory/vine maple and salmonberry understory with some (ca. 20%) carex. There is a high sediment load in the stream with about 90% fines (visual estimate) in pools and 50% in riffles. It is a B5 gravel dominated channel, slightly incised (about 1.5 feet). LWD levels are low on Bittner Creek (visual estimate <5 pieces/100m). The 3 other 1st order channels in project units are too small to support fish; with indistinct scouring of channels; and much of stream in unit B has no defined channel. No surface water present in 1st order streams. There are no haul route impacts; and the area is accessed by paved roads.

Environmental Effects

3.3.3.1 Proposed Action

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

Proposed tree thinning in and adjacent to riparian reserves (RR) on streams would not impact fish habitat due to SPZs (Stream Protection Zones; minimum no-harvest buffers) of 60-100 ft on perennial streams and 30-50 feet on intermittent streams (Olson and Rugger 2007, Rashin et al. 2006). SPZs would be wider (50-100 ft wide) on streams that are within 1 mile of Listed Fish Habitat in units 3-3-35 and 4-3-1. Thinning in riparian reserves would be conducted as to not reduce stream shade per Aquatic Conservation Strategy (ACS) Objective 8: Maintain …adequate summer and winter thermal regulation (USDI BLM 1995, p. 6), and thus stream and springhead temperatures would not increase (Johnson 2004). SPZs would intercept and infiltrate water carrying sediment preventing its delivery to streams (Rashin et al. 2006, CH2MHILL et al. 1999, and Hydrology Report).

Reducing the density of trees within the RR is expected to have a long-term beneficial effect on aquatic habitat as a result of accelerating growth of the trees retained in the stands. Accelerated growth of trees within the RR is expected to improve future LWD recruitment potential to aquatic habitats.

Aquatic habitat would improve over the long term (>20 years) with increased LWD recruitment because LWD stabilizes stream channels, and increases pool frequency, complexity and depth, and provides high quality cover for fish (Hicks et al. 1991).

Cutthroat trout would be impacted by a short-term input of sediment and elevated turbidity from fording Randall Creek with logging and fuel treatment equipment at the washed out road crossing between units 29A and 29B-4S3E. Cutthroat trout would likely be temporarily displaced from riffle and pools adjacent to crossing.

Turbidity would increase in the short term[30], and locally from equipment mobilizing fine sediments while crossing the channel during low flow periods[31]. Cutthroat trout would likely be displaced (and have to compete with greater numbers of fish for food) or their feeding interrupted (unable to see prey items) by short term increases in turbidity (Bjornn and Reiser 1991). Sediment would also likely be delivered to the stream from ground disturbance associated with yarding logs to a landing on the road adjacent to the ford across Randall Creek. Effects to trout would be similar to that from increased sediment and turbidity associated with fording equipment across the stream.

Streambank soils would be compacted at the crossing and banks collapsed by the weight of the equipment, resulting in local (at crossing) widening and shallowing of the channel (decrease in habitat quality and availability for cutthroat trout).

Since logs would be lifted over Randall Creek and set down on the east bank before being moved to where they would be loaded onto trucks, there would be no compaction or soil movement from yarding logs across the ford.

Over the mid to long term (10-15 years) aquatic habitat would improve by removing the culvert in the channel, and the collapsed fill on the road crossing of the 1st order tributary stream that joins Randall Creek just downstream of the eroded road crossing.

Removing the road crossing on the 1st order stream (which lacks a culvert) would be consistent with ACS Objective 2: maintain and restore spatial and temporal connectivity within and between watersheds (USDI BLM 1995, p. 6).

Removing the non-functional culvert in Randall Creek would be consistent with the ACS Objective 3: maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations (USDI BLM 1995, p. 6).

Up to 5.3 miles (3.9 miles on BLM, 1.5 miles on private land) of new road proposed for construction would have minimal negative impacts to aquatic habitat (little to no increase in sediment delivery) as all new roads would be constructed on stable ground near or above slope breaks to riparian reserves and stream channels, and would be constructed as to not increase the size of the stream network (Wemple et al. 1996, and Hydrology Report).

Fish populations and aquatic habitat would not be impacted by timber hauling on rock surface roads under the conditions when hauling would be allowed because no sediment would move off of these roads into streams in amounts that would exceed ODEQ water quality standards. The BLM would monitor hauling and sediment movement to ensure compliance with water quality standards.

Fish populations and aquatic habitat would not be impacted by timber hauling on natural surface roads and roads with insufficient rock because hauling would be prohibited during wet road conditions that would generate sediment and because road surfaces and drainage patterns would be treated to prevent runoff during and following log hauling.

The BLM would monitor operations, road surface and drainage pattern treatments and sediment movement to ensure compliance with water quality standards.

[30] For several hours each day over a period of a few days, Hydrology Report, p. 25.
[31] Turbidity levels would be unlikely to exceed State of Oregon standards beyond 0.5 mi below the crossing; (Foltz and Yanosek 2005)

Because the new roads are located on stable ground at distances of more than 150 feet from streams, and are designed to not increase the size of the stream network (Wemple et al. 1996), runoff from the roads would infiltrate into the soil before reaching stream channels. Thus, no sediment would reach streams and there would be no impact to fish populations or aquatic habitats from wet season hauling on these roads.

Special Status Species – Aquatic

The proposed action would not result in adverse effects to BLM Special Status Species, Survey and Manage, or Bureau Assessment Species because no suitable habitat for any species known or likely to be present would be lost or altered to a degree that may impact existing populations. Therefore, the project would not contribute to the need to list any BLM Special Status Species.

Threatened/Endangered Species

Project design features, in particular stream protection zones (50' wide on intermittent channels and 100' wide on perennial streams within 1 mile of LFH) and Riparian Reserve management, would prevent increases in sediment input to stream channels or increases in stream turbidity or temperature from tree thinning, yarding, and road construction on all project sites except for Randall Creek in unit 4-3-29.

Turbidity would locally increase (<0.5 mi downstream of crossing; Foltz and Yanosek 2005) and for short durations (for several hours each day over a 2-3 day period; see Hydrology Report, p. 25, *EA section 3.3.2.1*) on Randall Creek as equipment is forded across the stream and logs are yarded adjacent to the stream.

Steelhead trout would not be affected by the proposed project as the nearest UWR steelhead trout habitat in Milk Creek is located 3 miles downstream.

Accelerated growth of trees from thinning within RR is expected to improve LWD recruitment potential to aquatic habitats over the long term. Log hauling during the dry season from unit 3-3-35B may affect LCR steelhead and LCR coho salmon as the north haul road crosses LFH habitat in Little Clear and Mosier creeks three times. However, approaches to stream crossings are well designed and drain water away from streams, and ditches are densely vegetated with no sign of sediment movement from road surfaces. Log hauling from two other project units (4-4-21 and 4-4-27A) with stream crossings adjacent to LFH would not deliver sediment to LCR coho salmon and LCR steelhead trout habitat in Clear Creek, because hauling would be restricted to dry weather periods during summer and early fall, when no water would be present on the road surface or in the intermittent channels that are crossed by this haul route.

All project units are >25 miles from the nearest UWR Chinook salmon habitat in the Molalla River. Project effects would extend up to 0.5 mile downstream of work areas (Foltz and Yanosek 2005). Thus, the project would not affect UWR Chinook salmon. Consultation with NMFS (National Marine Fisheries Service) on the potential effects of the project on LCR coho salmon and LCR winter run steelhead trout would be completed under the programmatic consultation process for thinning timber sales (NMFS 2008).

3.3.3.2 Cumulative Effects

There would be no cumulative effects to fish and aquatic species populations because there would be no cumulative impacts to aquatic habitats (ie. no cumulative changes to channel shape and form, peak flows, or sediment and turbidity levels, Hydrology Report, pp. 21-29, EA section 3.3.2)), which are the primary mechanisms through which aquatic habitats and consequently fish and aquatic species populations would potentially be impacted by a proposed action.

3.3.3.3 No Action Alternative

The No Action alternative would have little impact on fish and aquatic habitats in the project area. Under the No Action alternative, fish habitats in Randall Creek would continue to have minor impacts due to alteration of stream flows by the road fill and lack of culvert on the first order tributary and a very small impact of the abandoned culvert on increasing channel width and decreasing channel depth relative to site potential (Hydrology Report; EA Section 3.3.2).

The improvement of tree species composition in riparian reserves, and recruitment of large woody debris to stream channels would be slower under this alternative than under the proposed action, which includes tree thinning in riparian stands to improve species composition and tree growth.

Under the No Action alternative, populations of aquatic species would undergo natural increases and declines related to 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 for changes to tree canopy and consequently stream shade levels resulting from snow or ice break, wind storms, and wildfire. Stream temperatures would follow changes in stream shading (Johnson, 2004). Dense stands of riparian trees would self-thin over time, contributing LWD to stream channels, and windthrow from storms would also contribute LWD to streams. Natural sediment inputs to streams would vary as sediment contributing events (flooding) occur within the Riparian Reserve LUA..

Threatened and Endangered Species

The No Action alternative would have “no effect” on LCR coho salmon, LCR and UWR steelhead trout, and UWR Chinook salmon. The segment of Randall Creek with the eroded road crossing and road fill on the first order tributary is located 3 miles upstream of the nearest UWR steelhead trout habitat in Milk Creek. All project units are more than 25 miles from the nearest Chinook salmon habitat in the Molalla River.

3.3.4 Soils

Source Incorporated by Reference: *2008 Soils Specialist Report for the Proposed Highland Fling Project (Soils Report)*

Affected Environment

Typical soils in these project areas formed in colluvium (i.e., material rolling downhill) from sedimentary, tuffaceous, basalt, and andesite rock and volcanic ash. Soils in river floodplains formed in alluvium (i.e., water transported materials). Soils in the lower foothills of the project area are primarily clay to silty clay loams with high clay content in the surface horizon and low erosion hazard on slopes under 30%. In the steeper forested slopes to the west, soils tend toward cobbly loams on 30-50% slopes with slightly higher hazard of erosion. Project soils are well-drained to moderately well-drained and moderately deep to very deep, with some local areas of shallow soils on ridgetops. Project soils are suited for growing Douglas fir and western hemlock. Soil maps and descriptions of project soil characteristics are available at the USDA Natural Resource Conservation Service web site: http://www.or.nrcs.usda.gov/pnw_soil/or_data.html.

All of the proposed treatment areas are within areas classified as "Suitable" in the Salem District Timber Production Capability Classification (TPCC)[32].

"Non-suitable" areas such as wet areas and steep slopes (>60 percent) have been excluded from the proposed action and would not be treated and final layout of proposed unit boundaries would appropriately avoid "Non-suitable" areas.

Wet areas in the project vicinity are associated with streams and wetlands. Steep slopes are primarily associated with the inner canyon of the main Clear Creek channel.

The TPCC identified compaction (mapped as FSR2, fragile-restricted due to compaction exceeding 10 percent of the area) as a limiting factor in several parts of the project area. Field review by the Cascades Resource Area soils specialist found that 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 (increase in bulk density of less than 10% relative to un-compacted soils) may persist in the area outside of the visible skid trails and roads as a result of previous logging which was accomplished with heavy ground based equipment.

However, it is difficult to assess how much if any of this disturbance remains because it is obscured by tree growth and the surface duff layer. Random small pits dug by area specialists did not reveal any compacted soil surfaces beneath the duff and thus it is reasonable to conclude that compaction outside of road and skid trail surfaces, if it remains at all, is discontinuous and of no consequence to soil properties or fertility.

[32] Power, W.E., Tausch, W.A.. 1987. ***Timber Production Capability Classification. TPCC Technical Guide***. U.S.D.I. BLM Salem District. OR. The TPCC is a field-verified mapping and classification system of soil and land characteristics and the suitability of each classified area for commercial timber production. The three broad categories of classification are "Suitable" for timber production; "Suitable but Fragile" (for a variety of reasons such as nutrients, compaction, slope gradient, etc.) and "Non-suitable".

There are approximately 262 miles of existing roads within the four 6th field watersheds containing the Highland Fling Thinning project. Roads account for an average of approximately 2.6 percent of the surface area in these watersheds (range: 1.9-2.8 percent. MCWA and CFCWA). These roads range from unmaintained condition to paved highways.

A few areas of moderately compacted soil (soil bulk density increased 10-20 percent compared to natural soil conditions) and highly compacted soil (bulk density increased 20-50 percent) have visibly persisted in some of the skid trails, truck roads and railroad grades dating back to the original logging of the sites. Moderately compacted soils are primarily old skid trails approximately ten feet wide and are often discontinuous since portions of them are obscured by vegetation and a duff layer. Highly compacted soils are associated with railroad grades and truck roads, range from 20-30 feet wide, are generally continuous along their entire length, and are highly visible with comparatively little vegetation. Based on field observations, approximately 4 percent of the soils in the project area are slightly to moderately compacted (10-20 percent bulk density increase) and 1 percent highly compacted (20-50 percent increase). Based on this analysis and the road density estimates from the watershed analyses, total highly compacted surfaces range from 3-4 percent of the watersheds as a whole.

Environmental Effects

3.3.4.1 Proposed Action

Harvest

Direct and Indirect Effects on Soil Resources

Following completion of the proposed action, the majority of vegetation and root systems would remain, along with surface soil litter and slash from thinned trees. The expected amounts of surface soil displacement and soil compaction from commercial thinning operations would not exceed 10% of each project area, consistent with RMP standards and guidelines (p. C-1-2) because less than 10% of surface soils would be subject to operations that could result in compaction or soil displacement. The estimated rate of surface erosion, under the worst case scenario, is discussed below (see WEPP analysis below). In addition, the proposed action would maintain sufficient mycorrhizae populations because the root systems of most trees would remain undisturbed and there is no evidence that past disturbance of the area has effected mycorrhizae populations.

Direct Effects on Soil Compaction and Disturbance/Displacement

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

In ground based yarding areas, skidding would result in moderate to heavy (20-50 percent increase in soil bulk density), fairly continuous compaction approximately 10 feet wide within heavily used main skid trails.

The degree of compaction and continuity would be less on portions of skid trails that receive less use. The total percentage of the tractor[33] yarding area (622 acres) impacted by surface disturbance and soil compaction as a result of skid roads would be approximately 6%-8% (38 to 50 acres).

Some of the area impacted by ground-based yarding systems includes existing skid trails and road or railroad beds from previous logging. Where practical (the existing skid trail is not in a fragile area, goes in a useable direction and spacing is appropriate), portions of these existing skid trails would be used for this project. As a result, the amount of acreage for new or additional harvest impacts would be less than the totals listed above.

Harvester and shovel swing operations using tracked equipment operating on a slash mat between designated skid trails would result in very light (less than 10 percent increase in soil bulk density) compaction in discontinuous, parallel strips less than three feet wide.

In skyline yarding areas, impacts usually consist of intermittent light compaction within a narrow strip (less than four feet in width - the skyline road) within a cleared corridor less than 12 feet wide (the skyline corridor).

This is especially true for thinning of second growth stands where logs are relatively small and there would be slash on the ground to yard over. Since project design features require that the leading end of logs be lifted free of the ground during yarding (one end suspension), less than half of the weight of the log would be supported by the ground and the logs tend to ride on top of the slash rather than pushing it aside, distributing the weight over more ground surface area and reducing potential compaction. The area affected would range from 3-7% of the area skyline-yarding area (98 acres) or approximately 3-7 acres.

Road construction would displace topsoil and compact subsoil on approximately 12 acres, based on average 12 feet compacted width within 25 feet wide clearing area. Half of this area would be highly compacted (20-50 percent increase in bulk density), the remaining half would be disturbed but not compacted. Roads to be constructed would be on moderate topography (grades of approximately 3% to 10%). All of the new construction (natural surface) would be closed and stabilized following harvest, so some recovery back to a vegetated condition would occur over the next 20 years, but would not return to a forested condition since the roads would be planned for use in future (15-25 years) operations. Stabilizing the road surface by shaping it for drainage (such as water bars), placing slash debris over exposed surfaces, and blocking vehicle access would decrease surface erosion and runoff by preventing runoff velocities that could erode soil and by preventing continued disturbance (Hydrology Report). Placing slash and debris on road surfaces dissipates raindrop impact, provides roughness to slow runoff, provides a protected microclimate for germination and growth of vegetation and provides a source of organic material to the disturbed soil.

[33] "Tractor" is a somewhat generic term for a machine that pulls things. "Skidders" are specific types of tractors (such as tracked "crawler" tractors like bulldozers or articulated rubber-tired skidders) used to skid logs. In discussions of ground based logging, "tractor" is often used interchangeably with "skidder".

Approximately two miles of road renovation would disturb and/or compact the equivalent of approximately 50% of the area affected by new construction, or approximately 3 acres (half of which would be compacted, half only disturbed). This estimate is based on the reasonable assumption (based on field observations) that half of the area affected by renovation is already compacted and/or disturbed.

Road maintenance (maintenance renovation) would result in no change in the amount of current non-forest land. Some encroaching vegetation along these roads would be removed and surface rock would be added where needed. The improvement work would be expected to result in some minor short term roadside erosion; this would be most likely to occur when the established vegetation in the ditch and culvert catchment areas would be removed in affiliation with the cleaning, reshaping, or culvert installment operations. Litter-fall accumulations and the growth of vegetation generally re-establish within one-two seasons and erosion rates would be expected to return to very low levels thereafter.

Log landing construction and use would compact the soil and displace top soil at the site. However, about half of the surface area used for landings would be the existing road surface (which is already compacted). Areas where skidders turn to drop logs or turn around adjacent to the constructed portion of the landings are included in the calculated landing area. The additional area adjacent to roads that would be needed for landing area is estimated to be approximately 1 percent of the total project area (7 acres) and is included in the 10 percent areal compaction.

The degree of soil disturbance and compaction in areas where logs are sorted or decked would be expected to be low (shallow and relatively quick to recover). Soil disturbance from landings would be local to the landing area and would not affect soil resources on a watershed or landscape scale.

Indirect Effects on Site Productivity due to Soil Compaction and Disturbance

- Since the impacted area is 10 percent or less of the harvest area, there is no reduction in overall yield from that analyzed in the RMP (C-2).
- No measurable reduction in overall yield would be expected as a result of impacts from harvester or shovel swing operations.
- In skyline yarding areas no measurable reduction in overall yield would be expected to result from yarding impacts.
- As trees age and become established, the negative effect on growth from soil compaction and displacement becomes less pronounced and growth rates may approach that of trees on similar, undisturbed sites. This is especially true where the area of compaction/displacement tends to be in narrow strips, as is the case with skid trails, skyline yarding roads and small landings that would result from the proposed action.
- These estimates in reductions of overall yield are based on studies and observations done in Western OR and WA and are by no means conclusive.
- The compacted surfaces of landings would generally be planned for future use and would not be reforested. Understory vegetation would keep soil surfaces stable.

Surface Erosion Potential: Water Erosion Prediction Project (WEPP)

The rate of surface soil erosion under this proposal is unlikely to have any long term deleterious effect on soil productivity.

There may be some (not measurable) theoretical productivity loss on less than 100 acres proposed for skyline yarding as surface erosion potentially exceeds soil replacement rates (0.1-0.8 tons/acre/year, Pimentel, 1987) for three to five years .

No erosion is anticipated from ground based yarding areas because the combination of gentle slopes (≤35 percent slope) and project design features would not allow runoff to gain the velocity necessary to erode soil and transport it off site.

The WEPP soil erosion model was used to predict potential erosion and sediment yield from thinning with skyline yarding on 95 acres in the Highland Fling project area. WEPP modeling calculates that the current background surface erosion rate in the project area is 0.5 ton/acre/year. WEPP estimates that the surface erosion rate for thinning with skyline yarding in the project area is estimated to be 2.5 tons/acre/year[34], occurring during large storm events.

Surface erosion would be anticipated to return to current background levels within three to five years since typical sediment yields from timber harvest decrease over time as a negative exponential (Dissmeyer, 2000).

Pile Burning

On the sites where piles are burned off of compacted surfaces of landings, surface organic material (O-horizon) would be removed, increasing localized potential for soil detachment. Pile burning and rain impact on burned spots can decrease infiltration capacity until natural re-vegetation occurs within 1-3 years. Displaced soil would be filtered and retained by the intact vegetation immediately surrounding the burn pile spot so that it would not be transported more than a few feet. 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. BLM experience with similar pile burning operations demonstrates that the small area impacted and the low intensity of the effects described above would not result in an observable decrease in site productivity.

Skid Trail Stabilization

Blocking entrances to skid trails and stabilizing skid trails by shaping for drainage (such as water bars), covering with logging slash and seeding with native seed would prevent water from accumulating in large quantities, running down the skid trail surface, and eroding soil.

[34] For comparison, average surface erosion on croplands in the United States is 44.5 tons/acre/year. (Pimentel, 1987)

3.3.4.2 Cumulative Effects

The cumulative decrease in site productivity from soil compaction, disturbance and erosion at both local and watershed scales would be insignificant because it would be too small to reliably quantify. The limited magnitude (maximum area compacted/disturbed by all proposed operations is 79 acres, or 0.14 percent of the total watershed) and duration (maximum effect during the first year following disturbance with rapid recovery approaching existing levels in the first decade) of the cumulative increase in compacted/disturbed soil surfaces would not be expected to result in more than a small risk of measurable decreases in potential site productivity.

3.3.4.3 No Action Alternative

Existing, maintained rocked roads would continue to be part of the transportation system and be maintained according to the Salem District transportation management plan, and would remain as non-forest land and provide access for management activities.

Historic unmaintained roads and landings would be left in their current condition, which range from virtually no evidence of recovery to advanced recovery where understory vegetation is similar to adjacent areas. Vegetation and other natural processes would continue to slowly break up compaction and continue the process of recovering productive capability over time.

3.3.5 Wildlife

Sources incorporated by reference: *Cascades Resource Area EA Wildlife Report, Highland Fling Project, England and Murphy, 2009 (Wildlife Report); ABR Inc., Environmental Research & Services, Forest Grove, OR. 2004. Lower Molalla and Milk Creek Watershed Assessment Final Report. Prepared for Molalla River Watch. Molalla, OR. (MCWA 2004); Watershed Professionals Network, LLC., Boise, ID. 2002. Clear and Foster Creek Watershed Assessment. Prepared for: Clackamas River Basin Council, Clackamas, OR. (CFCWA 2002); USDA, Forest Service; USDI. Bureau of Land Management. August 2008. Biological Assessment of Not Likely to Adversely Affect (NLAA) Projects with the Potential to Modify the Habitat of Northern Spotted Owls Willamette Planning Province - FY 2009-2010 (BA); USDI, U.S. Fish and Wildlife Service. October 2008. Letter of Concurrence (LOC) Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY2009-2010, Proposed by the Eugene District, Bureau of Land Management; Salem District, Bureau of Land Management; Mt. Hood National Forest; Willamette National Forest; Columbia River Gorge National Scenic Area on the Northern Spotted Owl and its Critical Habitat; FWS Reference #13420-2008-I-0140.*

Affected Environment

Introduction

Descriptions of stand conditions as they relate to wildlife habitat are based on stand exam data, aerial photo interpretation and field review by BLM resource specialists in wildlife biology (wildlife biologist) and silviculture (silviculturist).

General Stand Condition

Forest management during the time when these stands were established was designed and intended to maximize timber production, with little or no consideration for habitat issues. Consequently, the forest stands proposed for treatment in the Highland Fling project area are typically even-aged stands lacking species diversity, ground cover and deciduous shrub understory layers. These stands lack structural heterogeneity, especially large remnant overstory trees and standing dead material (snags). Very little evidence of the previous stands is apparent, except for scattered concentrations of large CWD and scattered snags in advanced stages of decay. Canopy cover is generally 70-95 percent, so understory shrub development has generally been retarded and ground cover is sparse (less than 10 percent).

Stands initiated and managed in this way are not "equivalent" to similar-aged unmanaged stands and the trajectory originally intended for many of these stands "would neither contribute to nor perpetuate old-forest characteristics on these landscapes" (Hunter 1993).

Variation in forest stand conditions within stands and at the landscape level have been identified as a key factor in providing habitat for a diversity of forest organisms (Hayes et.al. 1997; Muir et.al., 2002).

Certain structural and compositional aspects that have been found to be important contributors to habitat diversity and species richness include dead wood in the form of snags and down logs, remnant live trees, and vertical and horizontal variation in tree and understory canopies. Also, hardwood trees and shrubs in particular have been found to be important contributors to forest biodiversity, providing habitat substrate, food sources, foraging substrate, and nesting opportunities. All of these features are generally lacking in the managed stands proposed for thinning. They are also features that would make the stands habitable by a broader range of forest-associated animal species.

Some of the stands, full or partial units, in the Highland Fling are in early mature successional stages. These stands vary from 83 to 93 years of age and are located in Units 27A &B in 4S3E; and Units 21 and 27B in 4S4E. They were not clearcut in the past and there are few records of past management, except for some selective cutting. These stands have a more diverse structure and composition than the typical mid seral stands proposed for thinning, including snags and CWD in advanced stages of decay, larger trees, and more complex, developed understory layering and ground cover..

Residual Old-Growth Trees, Coarse Woody Debris (CWD), and Special Habitats

There are residual old-growth trees present section 27, T. 4 S., R. 3 E. and there is a large tree component of some of the stands in sections 27, T. 4 S., R. 3 E. and 21, 27 and 29, T. 4 S., R. 4 E.

None of the proposed units has CWD that meets RMP management direction (240+ linear feet per acre of material in decay classes 1 or 2, at least 20 inches diameter at the large end and 20 feet long). The less decayed (class 1 and 2) CWD in the project area is primarily limited to smaller diameter material than would be considered adequate to meet RMP management direction. These less-decayed logs in smaller size classes are mostly the result of self-thinning (suppression mortality) in crowded stands.

These small logs are much less useful to forest floor-associated animal species for cover and other habitat characteristics because they have less volume, and persist for shorter time spans (usually less than two decades) than the larger material.

CWD in decay classes 3-5 is generally abundant (240-500+ linear feet per acre) is some of the units and is large enough to last for several more decades. CWD in these advanced decay classes are usually remnants of old-growth "cull" logs that were not removed after harvest and are often in the larger diameter classes. These logs provide valuable habitat for a whole host of CWD associated wildlife species (O'Niell et.al. 2001), and they persist for many decades before passing through advanced decay classes to become unrecognizable as down logs.

There is a small wetland with a pond adjacent to unit 29 B in 4S3E and a man made pond adjacent to 21A in 4S3E. Both of these features would be protected by an untreated buffer.

Table 9 summarizes the presence of residual old growth trees, special habitats, and the amount of CWD present in the units prior to thinning.

Table 9: Summary of special habitats, remnants, and coarse woody debris (CWD) present by project unit.

T-R-Sec Unit	Seral Stage	Remnant Old Growth	Special Habitats*	CWD**
				Hard / soft
3S-3E-35A	Mid Seral	No	No	0'/0'
3S-3E-35B	Mid Seral	No	No	0+'/0'
3S-3E-35C	Mid Seral	No	No	0'/60'
3S-3E-35D	Mid Seral	No	No	0'/0'
4S-3E-1	Mid Seral	No	No	0'+/240'+
4S-3E-21A	Mid Seral	No	Yes#	0'+/240'+
4S-3E-21C	Late Mid Seral	No	No	0'+/170'
4S-3E-27	Mid Seral to Mature	Yes	No	60'/240'+
4S-3E-29A	Early Seral	No	Yes#	0'/0'
4S-3E-29B	Early Seral	No	No	0'/0'
4S-4E-21	Early Mature	No	No	200'/60'
4S-4E-27A	Late Mid Seral	No	No	0'/0'
4S-4E-27B	Late Mid to Early Mature	No	No	0'/500'+
4S-4E-27C	Late Mid Seral	No	No	200'/240'+
4S-4E-29A	Mid Seral	No	No	0'+/230'
4S-4E-29B	Mid and Early Seral	No	No	0'+/240'+
4S-4E-29C	Late Mid Seral	No	No	0'+/240'+

Seral Stage Age Classes (years) based on Stand Exam data: Early Seral = 0-30; Early Mid Seral = 31-40; Mid Seral = 41 – 60; Late Mid Seral = 61 -80; Early Mature Seral = 81 - 120; Mature = 121 - 200; Old Growth =201+

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

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

** Linear ft/acre >=20" diameter large end & >=20' long, hard (decay classes 1-2)/soft (decay classes 3-5) logs.

Snags and Snag-Associated and Cavity Nesting Species

Table 10 summarizes the number of snags necessary to meet management direction in the RMP (p. 21) for five cavity-excavating woodpecker species which are referred to in Neitro et al (1985). Table 11 summarizes the snags present prior to thinning. 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). The presence of snags and standing dead material is based on stand exam data and field review by specialists. Stand exam data is based on a statistical sample from plots. Low numbers of snags may be present, but the sampling may not have picked up any on the plots. The use of 0+ in the table denotes when there are trace numbers of snags present that may not have shown up on the plots.

The hairy woodpecker, red-breasted sapsucker and pileated woodpecker are species associated with conifer stands in the western CascadesMountains, and are present in the Highland Fling Project Area.

Northern Flicker and Downy woodpecker are not typically associated with closed-canopy conifer-dominated stands in the western Cascades, though both species are found in or around the project area.

Snag habitat does not meet the 40 percent of maximum population densities requirement for the five woodpecker species throughout most of the project areas (RMP, p.21) due to a lack of 15 to 25 inch material and 25 inch plus large material. Trees that could have developed into large snags and down logs were removed by past timber management in mid seral stands. In most of the mature stands, snags are lacking due to selective cutting which targeted salvage logging in areas along existing roads. In general stands throughout the project areas are in a condition in which there is a near-term (less than three decades) snag deficit (RMP, p. 21).

Table 10: Snags to Support Cavity Nesting Birds

Diameter class (inches dbh)	Snag Decay Stage		Total by diameter class (per 100 acres)
	Hard 2-3	Soft 4-5	
11+		Downy woodpecker (6)	6
15+	Red-breasted sapsucker (18)	Hairy woodpecker (77)	95
17+		Northern flicker (19)	19
25+	Pileated woodpecker (2)		2
Total – all diameter and decay classes			**122**

Table 11: Snags Currently Available By Project Unit

Snags at least 15' tall/100 acres						
Section (all units)	Hard snags 15-25"	Soft snags 15-25"	Hard snags 25"+	Soft snags 25"+	Total hard snags 15"+	Total soft snags 15"+
3S-3E-35	0+	0+	0	40	0+	50
4S-3E-1	0+	0+	0	0+	0+	0+
4S-3E-21	460	0+	0	0+	460	0+
4S-3E-27	0	0	120	120	120	120
4S-3E-29	0	0	0	0	0	0
4S-4E-21	260	0+	0	180	260	180
4S-4E-27	0+	0	0	230	0+	230
4S-4E-29	0	180	0	70	0	250

Federally Listed Species: Northern Spotted Owls

The stands that contain the proposed thinning units and associated road construction provide 37 acres of suitable, 93 acres of dispersal and 65 acres of non-habitat in the Western Oregon Cascades Province. In addition, the proposed thinning units include 28 acres of suitable, 471 acres of dispersal, and 26 acres of non-habitat in the northern Willamette Valley, which is considered to be outside of the normal range of the spotted owl (Adamus 2001, Marshall et.al 2003). Furthermore, the Willamette Valley is a barrier to both natal and breeding dispersal (Forsman *et al.* 2002).

The closest known spotted owl site is 3 miles away from any proposed unit and some proposed units are over ten miles away from the nearest known spotted owl site. None of the units are located in Critical Habitat and there are no unmapped LSRs (100 acre core areas of known spotted owls as of January 1994) in the vicinity of the proposed units.

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

Table 19 *(EA Section 7.1)* lists BLM Special Status/Species of Concern which are documented or suspected to occur in the Highland Fling Project Area based on field inventories of the habitats present and a review of the existing literature.

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 CWD, snags, deciduous understory and ground cover vegetation, or deep accumulation of leaf litter. Habitat, range data, and previous surveys for mollusks and amphibians conducted over 9000 acres on the Cascades Resource Area since 1991 indicate that no Bureau Sensitive mollusk species are likely to be present in the proposed thinning units.

Bureau Sensitive – Oregon Slender Salamander

Oregon slender salamander, a Bureau Sensitive Species, is expected to occur in portions of the project areas where CWD of adequate size (RMP requirements are minimum 20 inches diameter at the large end and minimum 20 feet in length) occurs. Oregon slender salamander has been found throughout the Cascades Resource Area in stands across the full range of seral stages. Its distribution on BLM lands within the Cascades Resource Area appears to be limited by dry conditions at low elevations along the Willamette Valley floor, and by cold conditions at higher elevations (Dowlan, unpublished 2006).

Habitat is generally described as conifer stands dominated by Douglas-fir with large amounts of large rotten (decay class 3 to 5) Douglas-fir down logs. Old logs, stumps and large woody material piles around stumps, and exfoliated tree bark on the ground are used for cover, feeding and breeding. Larger material that can hold moisture through summer drought is generally considered to be most important in maintaining moderate subsurface microclimate conditions. Optimal habitat for these animals is generally described as late-successional forest conditions with cool, moist microclimates and large down wood.

Oregon slender salamanders have been found in T.3E., R.3E., section 35; T.4S., R.3E., sections 1, 21, and 27; and T.4S., R.4E., sections 21 and 29 of the Highland Fling Project Area, and is highly likely and assumed to be present in T.4S., R.4E., section 27.

Survey and Manage – Red Tree Vole and Certain Mollusk Species

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in *Conservation Northwest, et al. v. Rey, et al.*, No. 08-1067 (W.D. Wash.) (Coughenour, J.), granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the BLM and USFS 2007 Record of Decision eliminating the Survey and Manage mitigation measure.

In 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. On October 11, 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, including thinning projects in stands less than 80 years old. Most of the proposed units in Highland Fling are under 80 years of age with the exception of T.4S., R.3E., section 27; T.4S., R.4E., section 21 and 27 unit B (65 acres). These units will be surveyed for certain mollusk species in order to comply with the 2001 ROD without Annual Species Reviews (IM-OR-2010-017, Interim NEPA Direction for Survey and Manage Species). All of these units are located outside of the range of the red tree vole (Huff, Biswell et.al., 2002, rev 2008) with the one exception is T.4S., R.4E., section 27 unit B. The BLM will survey this unit prior to the timber sale decision.

Bats

Four bat species of concern are suspected to occur in the Highland Fling Area (silver-haired bat, long-eared myotis, long-legged myotis, and Yuma myotis). These species are associated with caves and mines, bridges, buildings, cliff habitat, or decadent live trees and large snags with sloughing bark.

Decadent live trees and large snags, particularly ones 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 (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). Old-growth and snags with sloughing bark are rare in the project areas (Tables 9 and 11), and these species are likely to be present in low numbers. In addition, the fringed bat and the Townsend's big eared bat, Bureau Sensitive species, could occur in the Highland Fling Area. These species are more closely associated caves, cliffs, rock outcrops, buildings and abandoned mines; habitat features not present in the action area. However, fringed bats have been known to use snags to a lesser extent, as described above. Buildings and bridges are present in the vicinity on adjacent lands.

Migratory and Resident Bird Species

Approximately 125 bird species are known or suspected to breed in the Cascades Resource Area (Altman and Hagar 2007, Altman 2008, Marshall et. al. 2003, Wildlife Report Appendix A). Of these species, 95 have at least a low probability of breeding in the Highland Fling Project Area. There are 54 bird species that nest in the Cascades Resource Area that are priority bird species of conservation concern identified by bird conservation partners (Wildlife Report Appendix B). Of these species, 39 have at least a low probability of occurring in the Highland Fling Project Area.

The proposed thinnings are located in the Western Oregon Cascades and the Willamette Valley Physiographic Areas. 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).

The conservation plan which addresses the Willamette Valley is the *Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington*. Focal species associated with various habitats, stand types and associated habitat attributes found in the Highland Fling Project Area are shown in EA Table 22 and Wildlife Report Appendix C.

Bird species richness at the stand level has been correlated in some recent studies 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, however, these species are also common or more abundant in mature conifer stands as well (Hansen et al., 1995).

Most of 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, and are low in landbird 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 which 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 these stands proposed for thinning.

Mature stands are proposed for thinning in T. 4 S., R. 3 E., section 27; T. 4 S., R. 4 E., sections 21, 27 (unit 27B). These stands have a more diverse structure and composition than the mid seral stands proposed for thinning, including snags and CWD in advanced stages of decay, larger trees, and more complex, developed understory layering and ground cover. Red-tailed hawk activity was noted in T. 4 S., R. 4 E., sections 21 and 29.

Big Game

Big game species that are 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. Early seral communities and mid seral stands are abundant on adjacent private lands surrounding the project areas. The RMP identifies no critical winter or summer range in the project areas (RMP p.26).

Environmental Effects

3.3.5.1 Proposed Action

General Habitat

Overall, short term (less than 5 years) canopy cover reduction, disturbance, and reduction of understories and ground vegetation would occur due to thinning. The long term (more than 5 years) effects would be to increase structural complexity and improve habitat quality for wildlife, particularly in early and mid seral stands proposed for thinning.

The effects of thinning the mature stands are expected to be similar to the effects in mid seral stands, although not as pronounced. In the short term, there would be a loss of some diversity in tree sizes and spacing, current understory structure, but stands would improve in the long term as understories develop and canopies close. Research that has occurred since the 1980s has determined that it is possible to develop desired structural and compositional diversity in young managed stands through specific actions (Bailey and Tappeiner 1997, Chan et.al. 2006). Thinning forest stands 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 wildlife habitat by providing more opportunities for foraging; nesting/breeding activities; resting, hiding and escape cover/habitat for a variety of species in the forest environment, including invertebrates, songbirds, and small mammal species.

Proposed road construction and renovation, skid trails and skyline corridors under the proposed action would create narrow linear openings through the vegetation, disturbing, reducing or removing ground vegetation and creating breaks in the canopy, which 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 cover that would increase access to the stand by certain wildlife species, specifically larger mammals such as big game, coyotes, and avian predators. In the long term and ground vegetation would become re-established due to increased light to the forest floor and the breaks in the canopy would close.

Riparian Reserves, Canopy Gaps and associated Wildlife Species

The 30 to 80 year age classes proposed for thinning provide the greatest opportunities for acceleration of tree diameter growth and understory development through thinning and density management (CFCWA 2002, p. 5-36). It is anticipated that thinning would improve habitat conditions in the Riparian Reserves for wildlife by accelerating development of late seral forest stand characteristics.

Desirable late seral forest stand characteristics include larger trees for a large green tree component and recruitment of large standing dead and down CWD in future stands, multi-layered stands with well developed understories, and multiple species that include hardwoods and other minor species.

Species which would benefit from the development of older forests in the Riparian Reserves include 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, and black-headed grosbeck, olive-sided flycatcher, brown creeper, and hermit warbler.

Residual Old Growth Trees, Snags and Coarse Woody Debris (CWD)

Residual old-growth trees would be preserved because of the design feature to reserve any such residual old growth-trees included within final unit boundaries. Residual old-growth trees outside of final unit boundaries would not be affected by the proposed action.

Thinning these stands would reduce the number of small diameter (less than 15 inches DBH) snags over the next 20 years because thinning from below removes the smaller suppressed and intermediate trees that would be most likely to die from suppression mortality and become snags within that time period.

Within thinning units, most existing snags in all sizes over 15 inches diameter would be retained. It is anticipated that 90+ percent of these snags would remain standing after treatment.

This would effectively reserve the best existing habitat features for primary excavators (woodpeckers), and secondary cavity users, such as songbirds, bats and small mammals. The remaining 10 percent or less of these snags may need to be felled for safety, road construction, skid roads, skyline corridors or would fall incidental to logging operations. More of the smaller diameter/taller snags (<12 inches diameter and >25 feet tall), would be felled for safety reasons, or fall incidental to thinning operations. These snags are less important for wildlife species than the larger material over 15 inches (Rose et. al., 2001).

Any snag that falls for any reason as a result of thinning operations would remain on-site as CWD, providing important habitat for a different, but also, key group of dead-wood associated species, including the Oregon slender salamander, a Bureau Sensitive species. All dead wood that is on-site when timber marking takes place would remain on-site, either in the form or standing snags or as down logs, after thinning.

Management direction for the Matrix LUA is to provide a renewable supply of snags and down logs well-distributed across the landscape (RMP p. 21). Most units throughout the project areas are expected to remain in a snag deficit condition (RMP, p. 21) for one to three decades, until live trees become large enough (at least 20" diameter) to provide for recruitment of large snags and CWD which will meet RMP requirements.

As a result of thinning, growth of residual live trees would be accelerated, so that larger trees would be available sooner than without thinning to contribute additional large snags and CWD in the future stand. The RMP guidelines for snags (40 percent maximum population densities) and CWD (240+ linear feet per acre of material in decay classes 1 or 2, at least 20" in diameter at the large end, and 20 feet in length), could be met in two to four decades. Large diameter CWD in more advanced decay conditions would persist and contribute to forest floor wildlife habitat conditions for many decades before passing through decay class five to become unrecognizable as down logs.

It is anticipated that less than ten percent of existing CWD would be directly impacted by logging. Less than ten percent of the thinning area would be directly impacted by skidding, which is the operation with the highest potential impact to existing CWD.

BLM oversight of skid trail locations would ensure that skid trails were located to avoid impact to high value CWD whenever feasible, reducing the anticipated impacts below the ten percent level that would be expected from locating skid trails without concern for CWD. The same principles generally apply to snag retention.

Federally Listed Species - Northern Spotted Owl

Table 12 presents a summary of the Highland Fling project and its effects on spotted owl habitat. In the short term, 37 acres of suitable, 93 acres of dispersal and 65 acres of non-habitat in the Western Oregon Cascades Province would be altered but maintained.

In addition, 28 acres of suitable, 471 acres of dispersal, and 26 acres of non-habitat in the northern Willamette Valley would be altered, which is considered to be outside of the normal range of the spotted owl (Adamus 2001, Marshall et.al 2003). Available scientific literature provides support for the finding that 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). Examples of silvicultural activities that may fall into this category are light to moderate thinning, down salvage, individual tree removal, and prescribed burning.

The greatest limiting factor for spotted owls in the Highland Fling Area is the lack of enough suitable habitat in the vicinity of all of the units to support nesting activities, and their location in rural residential areas immediately adjacent to the Willamette Valley, which severely limits the ability of spotted owls to disperse in and out of the area. For these reasons, the presence of nesting spotted owls within the proposed units or within disturbance distance (0.25 to 0.5 miles) is highly unlikely.

No suitable habitat would be altered or downgraded within the provincial home range radius of any known spotted owl sites. None of the proposed units are located in LSR or Critical Habitat for the northern spotted owl.

Current habitat conditions for the spotted owl would be maintained after treatment because the components and functionality of the habitat for spotted owl life history requirements (>60 percent canopy cover for suitable habitat, >40 percent canopy cover for dispersal habitat, down wood, tree-height class diversity, older hardwoods) are supported, even though treatments alter the stand.

Although in the long term, such treatments can have benefits to spotted owls by encouraging late-successional characteristics to occur more rapidly (BA p. 9, LOC p. 15), no benefits to spotted owls are anticipated due to the project's location in and adjacent to the Willamette Valley.

Table 12: Spotted Owl Habitat Modification

5th. Field Water-shed	T-R-SecUnit	Proposed Treat-ment [1]	Acres	LUA [2]	Pre/Post Treatment Habitat Type [3]	Habitat Modi-fication [4]	Effect [5]
Lower Molalla	4S-3E-21A, C	Light to Mod. thin	64	GFMA/RR	Dispersal/Dispersal*	Maintain	NLAA
Lower Molalla	4S-4E-29 A, B (part)	Light to Mod. thin	44	GFMA/RR	Dispersal/Dispersal	Maintain	NLAA
Lower Molalla	4S-3E-29	Light to Mod. thin	26	GFMA/RR	Capable/Capable*	Maintain	NE
Lower Molalla	4S-4E-29 B (part)	Light to Mod. thin	65	GFMA/RR	Capable/Capable	Maintain	NE
Lower Molalla	4S-4E-29 C	Light to Mod. thin	20	GFMA/RR	Dispersal/Dispersal	Maintain	NLAA
Lower Molalla	4S-3E-27	Light to Mod. thin	28	GFMA/RR	Suitable/Suitable*	Maintain	NLAA
Lower Clackamas	3S-3E-35; 4S-3E-01	Light to Mod. thin	407	GFMA/RR	Dispersal/Dispersal*	Maintain	NLAA
Lower Clackamas	4S-4E-21; 27B;	Light to Mod. thin	37	GFMA/RR	Suitable/Suitable	Maintain	NLAA
Lower Clackamas	4S-4E-27 A, C	Light to Mod. thin	29	GFMA/RR	Dispersal/Dispersal	Maintain	NLAA
TOTAL			720				

Notes and definitions for Table 12 (BA, Table 4, pp. 3, 4-5; LOC, pp. 10-11)**.**

* Denotes units located in the Willamette Valley, outside the normal range of the spotted owl.

[1] **Treatment Type:**

Light to moderate thinning in dispersal or suitable habitat can be for forest health or 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.

Heavy thinning in suitable (NRF) habitat is the partial removal of the over story for forest health or to improve the structural characteristics of a stand or to provide commodity outputs. Such treatments may be described as commercial thinning, density management, selective cut, partial cut, or mortality (standing) salvage. Heavy thinning in NRF habitat results in <60% but > 30% average canopy cover. No heavy thinning is proposed.

[2] **Land Use Allocations: GFMA**=General Forest Management Area Matrix; **RR**=Riparian Reserve.

[3] **Habitat Types:**

Capable habitat consists of habitat which is not currently dispersal or suitable habitat, but has the capability to become dispersal and/or suitable habitat in the future.

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.

Suitable habitat consists of forested stands used by spotted owls for nesting, roosting and foraging (NRF). Generally these stands are conifer-dominated, 80 years old or older and multi-storied in structure, and have sufficient snags and downed wood to provide opportunities for owl nesting, roosting and foraging. The canopy cover generally exceeds 60 percent. No suitable habitat is proposed for thinning.

[4] **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 suitable habitat a canopy cover of >60 percent, and for 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 means to alter the functionality of spotted owl suitable habitat so that the habitat no longer supports nesting, roosting, and/or foraging behavior, but still functions as dispersal habitat. No downgrading of habitat is proposed under the proposed action.

[5] **Effect: NE**=No effect; **NLAA**=May affect but not likely to adversely affect; **LAA**=May affect and likely to adversely affect.

Special Status Species

Bureau Sensitive – Oregon Slender Salamander

Thinning these stands would not be expected to result in significant effects to Oregon slender salamanders or their habitat because they would be expected to persist at sites within stands where CWD of adequate size (RMP requirements >20" diameter at the large end, >20' in length) currently exists.

Research based on post-thinning treatment surveys in the Keel Mountain Density Management Study Area indicates that Oregon slender salamanders are not significantly affected by thinning (Rundio and Olson 2007). These results are consistent with survey results elsewhere in Cascades Resource Area from stands that have had timber harvest in the past (Dowlan, unpublished 2006). The CWD currently on-site prior to thinning would continue to provide refuge for terrestrial salamanders many years after treatment.

In the short term (< five years), direct effects (disruption or mortality) to Oregon slender salamanders may occur during logging operations. Ground based logging would result in the most impact due to higher ground disturbance and skyline logging would have fewer impacts due to less ground disturbance. Design features would minimize disturbance to existing CWD because tractor skidding trails would be limited to ten percent of project unit areas and other ground based operations would avoid impacts to CWD, therefore no more than ten percent of potential Oregon slender salamander habitat within any unit would be directly impacted by logging.

Red Tree Vole

Most of the proposed units in Highland Fling are either under 80 years of age, and/or are located outside of the range of the red tree vole (Huff, Biswell et.al. 2002, rev 2008). The exceptions is T. 4 S., R. 4 E., section 27 (unit 27B) in the Western Oregon Cascades Province which is over 80 years of age. In the short-term (< five years), undetected nests within these stands could be destroyed or disturbed during thinning. No habitat is being removed as a result of this proposal, and habitat conditions for red tree voles would gradually become more suitable after thinning as the stands continue to mature and develop older forest characteristics.

Bats

Old-growth forests provide higher quality roost sites than younger forests and many species prefer older forests (Thomas and West 1991, Perkins and Cross 1988). No old-growth forests are proposed for thinning. Bat species which use snags would be affected due to a loss of 10 percent or less of the standing dead material within the thinning units. Most existing snags in all sizes over 15 inches diameter would be retained. It is anticipated that 90+ percent of these snags would remain standing after treatment.

The remaining 10 percent or less of these snags may need to be felled for safety, road construction, skid roads, skyline corridors or would fall incidental to logging operations. Bat activity appears to be higher in thinned versus unthinned stands. Structural changes in thinned caused by thinning may benefit bats by creating habitat structure in young stands that bats are able to use more effectively (Humes, Hayes, Collopy 1999).

The fringed bat, is more closely associated with buildings, bridges, mines, cliff crevices and caves than snag habitat. The Townsend's big-eared bat is associated with caves, bridges, buildings and mines. No suitable roost sites are present in the Highland Fling parcels but there are buildings and bridges in the vicinity which would be unaffected by the proposed action.

Migratory and Resident Birds

Soil disturbance (affecting ground-nesting birds) and vegetation manipulation of bird habitat during the breeding season may unintentionally destroy birds' nests and kill eggs and nestlings. Unintentional take of nests, eggs, nestlings and nesting failure would be highly likely if harvest operations occur during active nesting periods. However, the impacts would be short term, involving loss of nests during one nesting season or part of a nesting season, and would not reduce the persistence of any bird species in the watershed or populations at the regional scale.

Much of the nesting season each year would be completed before logging operations begin. The majority of birds in the Pacific Northwest complete their breeding cycle within the April 15 to July 31 time period (Altman, Hagar 2007) and design features typically result in logging beginning later than mid June. The effects of thinning on priority bird species' habitat with at least a low probability of nesting in the Highland Fling Project Area are shown in Table 22.

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 help minimize short term disturbance.

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. In the short term, there would be a loss of some diversity in the mature stands proposed for thinning, but stands would improve in the long term as understories develop and canopies close.

Reducing the canopy cover 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). The thinning would be expected to produce positive long term (> five years) 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 be expected to gradually increase for up to 20 years as hardwood components of stand structure 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.

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 temporarily.

Thermal and hiding cover would be maintained after harvest but 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, USDA (PNW) 2006).

Vegetative forage such as saplings, shrubs, grasses and forbs would increase as a result of thinning and road closures, beginning within one to two years 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.

In the long term (5+ years), thermal and hiding cover quality would increase and vegetative forage such as saplings, shrubs, grasses and forbs would gradually decrease as a result of canopy cover decreasing the amount of light reaching the forest floor.

3.3.5.2 Cumulative Effects

Residual Old Growth Trees, Snags and CWD

Regardless of the scale for assessing cumulative effects, design features would retain existing CWD, residual old growth trees, and snags 15+ inches diameter.

It is expected that 90+ percent of these snags would remain standing after treatment. Some snags, especially smaller diameter/taller snags (<12 inches diameter and >25 feet tall), would be felled for safety reasons, or fall incidental to thinning operations. Any snag that falls for any reason as a result of thinning operations would remain on-site to become 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), including the Oregon slender salamander, a Bureau Sensitive species.

Beneficial cumulative effects to CWD, snag habitat and associated species may 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.

Northern Spotted Owl

The proposed project would not contribute to cumulative effects to spotted owls because dispersal habitat within and between known owl sites would be maintained, and no suitable habitat would be removed or downgraded within known owl sites. Much of the Highland Fling Area is outside the normal range of the spotted owl, and the Highland Fling Area is not critical for the spotted owl. The Highland Fling Area lacks enough suitable habitat in the vicinity of all of the units to support nesting activities, and their location in rural residential areas in or immediately adjacent to the Willamette Valley severely limits the ability of spotted owls to disperse in and out of the area.

The scale for cumulative effects for the northern spotted owl is the provincial home range of known spotted owl sites (1.2 miles for the Cascades of Western Oregon ; BA, p. 3; LOC, p. 11) 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) goal for conservation and recovery for spotted owl is to maintain suitable owl habitat within the provincial home range of known owl sites, and maintain dispersal habitat between LSRs and known owl sites.

Cumulative effects to spotted owls and their habitat were analyzed thoroughly at multiple scales in the BA, including the current Environmental Baseline (BA pp.11-20), and Cumulative Habitat Effects Summary (BA pp. 38).

Unit Specific Data, including the environmental baseline and effects of proposed projects that are not likely to adversely affect spotted owls, are summarized by Administrative Units in the Willamette Province (BA pp. 43-105), including the Cascades Resource Area where the Highland Fling Project is located (BA pp. 51-59).

The LOC issued by the USFWS concurred with the analysis in the BA that the combined effects to spotted owl habitat and populations of all of the actions proposed in the Willamette Province (including the Highland Fling Project) would not be significant because they would not reduce the landscapes ability to function as dispersal habitat for spotted owls (LOC p. 29), and would not likely diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat (LOC p. 29-31).

Other BLM Special Status Species

The proposed action would not contribute to cumulative effects to the Oregon slender salamander and other CWD associated species. Suitable habitat conditions would be maintained in the short term in the project areas, providing refugia for low-mobility amphibians and invertebrates. In the long term, larger trees would be available sooner than without thinning to contribute additional large CWD in future stands. Implementation of the project would not eliminate connectivity between proposed units or adjacent untreated stands under BLM management.

No adverse cumulative effects to red tree vole habitat is expected because the red tree vole is considered to be a late successional associate and most of the proposed units in Highland Fling are either under 80 years of age, and/or are located outside of the range of the red tree vole (Huff, Biswell et.al., 2002, rev 2008). The exception is T. 4 S., R. 4 E., sections 27 (unit 27B). No habitat is being removed as a result of this proposal, and habitat conditions for red tree voles would gradually become more suitable after thinning as the stands continue to mature and develop older forest characteristics.

Thinning in the project areas, either individually or collectively, would not be expected to contribute to the need to list any Bureau Sensitive species under the Endangered Species Act (BLM 6840) because habitat for the species that is known to occur in the project areas would be not be eliminated, habitat connectivity would not be changed, any habitat alteration would have only short-term negative effects, and long-term effects would be beneficial.

Migratory and Resident Birds

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 eliminate any forest cover type, change any habitat or 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. Therefore, no adverse cumulative effects would occur to migratory birds.

Big Game

No adverse cumulative effects to big game species populations are expected. The proposed action would not fundamentally change or eliminate any forest cover type or change any habitat patch size. Therefore, thermal and hiding cover present before treatment would be maintained after harvest.

3.3.5.3 No Action Alternative

Habitat Structure, Residual Old Growth Trees, Snags and Coarse Woody Debris

Overcrowded stands with low vigor and small crowns would grow more slowly compared to thinned stands. Self thinning would occur, but diameter growth would not accelerate as fast as in thinned stands. Snags and CWD created by self thinning mortality would not be large enough to meet RMP standards until later in the life of the stand (approximately 20 to 60 years) when suppressed co-dominates achieve these diameters before dying. Understory and ground cover development would take longer than if these stands were thinned. Without management intervention, stands would take longer to develop late successional habitat conditions and remain less diverse for a longer period of time.

In mature stands, conditions would remain as described in the affected environment and natural processes would continue. Self thinning would occur creating snags and CWD, understory and ground cover would continue to develop at a slower rate. No acceleration of residual tree growth would occur due to thinning.

Federally Listed Species: Northern Spotted Owl

There would be no difference in the status of spotted owl habitat due to thinning versus no action due to the project's location in or adjacent to the Willamette Valley in rural residential areas, and the lack of suitable habitat in the vicinity. There would be no immediate change in minor amount of spotted owl habitat in the vicinity caused by management action. The marginal habitat conditions described in the Affected Environment would remain and continue to develop slowly over time.

BLM Special Status Species

In the short term, there would be no immediate change in current habitat conditions for BLM Special Status Species. In the long term (20 to 50 years):

- Trees will grow more slowly, and material available for CWD recruitment would average smaller in diameter than if thinning were to occur. Development of Oregon slender salamander habitat conditions would likely be delayed without the addition of new large woody material to replace existing well-decayed material that will eventually disappear.
- Since no new disturbance to the conifer canopy would occur, no undetected red tree vole nests would be affected. Optimal red tree vole habitat conditions, presumed to be older forest conditions, would develop more slowly without thinning.

Migratory and Resident Birds

Habitat conditions would remain as described in the Affected Environment, and would continue to develop slowly over time. 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 long-lasting, especially those that provide habitat for cavity-nesting species.

Big Game

In the short term (less than five years), 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 (more than five years), thermal and hiding cover quality would gradually decrease as overstocked stands mature, hindering mobility. Forage quantity would continue to decrease over time as less light reaches the forest floor.

3.3.6 Air Quality and Fire Hazard/Risk

Source Incorporated by Reference: *Highland Fling Air Quality and Fire Hazard/Risk Specialist Report. 2008, Raible (Fuels Report)*

Additional Resource Specific Assumptions

- The Oregon Smoke Management Plan of December 2007 would not have major revisions that would affect operations during the Highland Fling Project.
- Climate change may increase the duration and severity of wildfire season to an unknown extent during the project period, but that any such overall increase would not exceed the conditions used to model fire potential.

Resource Specific Methodology

- Contacted Northwest Coordination Center Predictive Services for past fire occurrences.

Field Surveys

- Surveys are done during operations and prior to fuel treatment to assess planned treatment methods and effectiveness.

Affected Environment

Air Quality

The air quality in the Highland Fling project area is generally good. Some standard Willamette Valley pollution occurs when inversions or air stagnation occurs regionally. The project area is located in the Willamette Valley Cascades Foothills between Molalla and Estacada. The Willamette Valley is a smoke sensitive receptor area (SSRA). Burning is regulated to prevent any smoke intrusion into SSRA. The burning may change the local air quality for a short duration but transport winds affecting the area would keep the air shed scoured out preventing a build up of particulate matter and provide atmospheric mixing to prevent any intrusions.

Fire History

Continuing fire history research (Kertis 2009)shows that fire has occurred more often than earlier believed, and that it has not been as severe on the landscape as previously thought. The research has shown that old growth stands have multiple age classes that were not easily discerned, leading to the understanding that there were more disturbance events (such as fire) than were previously thought.

Landscape Vegetation Patterns

Modeling has been completed for measuring the overall landscape departure or deviation of both process (fire frequency/severity) and effects (succession class or vegetation/fuel condition class (CC)). The national fire regimes condition class (FRCC) is designed as a landscape analysis since fire operates at that scale, so this interpretation is done at the watershed (Lower Clackamas and Lower Molalla) which encompass the project area. For this area the Rapid Assessment Reference Condition Model percentages were:

Rapid Assessment Reference Condition Model	% of Lower Clackamas Watershed	% of Lower Molalla Watershed
Douglas-fir Hemlock – wet mesic	18%	15%
Douglas-fir Hemlock – dry mesic	17%	23%
Douglas-fir Willamette Valley	7%	15%
No vegetation classification (developments, fields, roads, etc.)	48%	43%
Oak Woodlands	1%	2%
Pacific silver fir – high elevation and low elevation	1%	trace
Other minor vegetation models	1%	trace

Fire Regime Condition Class

Fire regime condition classes offer another approach to evaluating potential fire conditions and again are most useful at the watershed and larger scales.

A stratum level condition class assessment looks at the compositional makeup of all the seral stages within a terrain feature of the watershed while a stand level condition class provides insights as to which seral classes are contributing to a departure in the overall landscape's condition class.

Douglas-fir Hemlock – wet mesic: Fire plays a major role in infrequently resetting landscapes within this vegetation model with intervals ranging roughly from 300 to 800 years. Mixed severity fires occur less frequently than in the Douglas-fir Hemlock dry regime. Insects, pathogens and windthrow occur in this type at variable intervals creating fine scale variability on the landscape.

Table 13: Historic Vegetation Class Representation in the Lower Clackamas and Lower Molalla Watersheds, Douglas-fir Hemlock - Wet Mesic (Wet DF)

Vegetation Class	Historic Watershed Representation	Present Vegetation Class Comparison To Historical Amounts
A- Early Post-stand replacement with shrubs, herbs and seedlings	1%	Abundant (7%)
B – Closed canopy young stands with trees up to 20" dbh.	2%	Over represented (4%)

Vegetation Class	Historic Watershed Representation	Present Vegetation Class Comparison To Historical Amounts
C – Young forest stands opened up by mixed severity fire with trees up to 20" dbh.	trace	Abundant (1%)
D – Mature to old-growth forest stands that have been opened by mixed-severity fire with trees greater than 20" dbh.	<1%	Abundant (2%)
E – Mature to old growth forest stand stands dominated by large tress with an understory of western hemlock	12%	Trace (3%)
Fire Regime is Group 5 – 71% of all fires are high severity stand replacement at 400 year intervals and 28 % are mixed severity at 100 year intervals		

Douglas-fir Hemlock – dry mesic: Fire is the major disturbance process. Mixed Severity fires are more common than stand replacing events, occurring at 50-150 year frequencies. Stand replacement fires that reset large landscapes occur at 250-500 year frequencies. This fire regime is largely responsible for the dominance of Douglas-fir in these landscapes. Insects, pathogens and windthrow also occur in this type at variable intervals, often interacting with drought and other extreme weather conditions. These disturbances affect smaller areas than fire.

Table 14: Historic Vegetation Class Representation in the Lower Clackamas and Lower Molalla Watersheds, Douglas-fir Hemlock - Dry Mesic (Dry DF)

Vegetation Class	Historic watershed representation	Present vegetation class comparison to historical amounts
A- Early Post-stand replacement with shrubs, herbs, and seedlings	1%	Abundant (8%)
B – Closed canopy young stands with trees up to 20" dbh.	3%	Over represented (5%)
C – Young forest stands opened up by mixed severity fire with trees up to 20" dbh.	1%	Similar (1%)
D – Mature to old-growth forest stands that have been opened by mixed-severity fire with trees greater than 20" dbh.	3%	Similar (2%)
E – Mature to old growth forest stand stands dominated by large tress with an understory of western hemlock	12%	Trace (3%)
Fire Regime is Group 3 – 25% of all fires are high severity stand replacement at 250-500 year intervals and 75 % are mixed severity at 50-150 year intervals		

Douglas-fir Willamette Valley: Fire is the major disturbance process. Scattered surface fire (underburns) occur around every 30 yrs with mixed severity fires being more common than stand replacing events, occurring at 50 year frequencies.

Stand replacement fires that reset large landscapes occur at 250 year frequencies. This fire regime is largely responsible for the dominance of Douglas-fir in these landscapes. Insects, pathogens and windthrow also occur in this type at variable intervals, often interacting with drought and other extreme weather conditions. These disturbances affect smaller areas than fire.

Table 15: Historic Vegetation Class Representation in the Lower Clackamas and Lower Molalla Watersheds, Douglas-fir – Willamette Valley (WVDF)

Vegetation Class	Historic watershed representation	Present vegetation class comparison to historical amounts
A- Early Post-stand replacement with shrubs, herbs, and seedlings	10%	Abundant (31%)
B – Closed canopy young stands with trees up to 20" dbh.	20%	Similar (15%)
C – Young forest stands opened up by mixed severity fire with trees up to 20" dbh.	10%	Similar (9%)
D – Mature to old-growth forest stands that have been opened by mixed-severity fire with trees greater than 20" dbh.	25%	Similar (24%)
E – mature to old growth forest stand stands dominated by large tress with an understory of western hemlock	24%	Lower Molalla watershed – Under represented (21%) Lower Clackamas watershed - Similar
Fire Regime is Group 3 – 25% of all fires are high severity stand replacement at 250-500 year intervals and 75 % are mixed severity at 50-150 year intervals		

Table 16: Modeling Predictions of Fire Regimes for the Highland Fling Thinning Project Area

Reference Condition Model	Terrain features	Fire Return Interval	Severity
Douglas-fir Hemlock Wet Mesic (Wet DF)	North facing slopes, riparian reserves	300 + years	High - Stand replacement
Douglas-fir Hemlock Dry Mesic (Dry DF)	South, west facing slopes, flats	50-150 years	Mixed
Douglas-fir Willamette Valley (WVDF)	Lower elevations, drier sites	50-250 years	Mixed

Units in 4S3E are a mix of the WVDF with the Dry DF
Units to the east are a mix of Dry and Wet DF
Units to the north are mostly dry with a mix of Wet DF and spots of WVDF

Fire Hazard Rating, Fire Risk and Values at Risk

Fire hazard ratings provide an index of resistance to control a wildfire and are based on vegetation, fuel arrangement and volume, condition and location. All are determinants of the potential for spread of a fire and difficulty of suppression. Fuel loading, risk of a fire start and the resistance to control a fire, will all increase at the sites as a result of the proposed action. The fuel model on the site is now a Model 8 / 10 (closed timber litter / timber litter and understory).

Fire risk reflects the probability of ignition in a given area. There are predictions that climate change will result in more frequent and larger fires (Westerling et al 2006; Swetnam 2002; Whitlock et al 2003). In 2006, a complex of lightning-caused fires occurred near Mt. Hood. Another fire, the Blister Fire, (20+ miles E of Highland Fling and north of Bagby Springs started by a lightning strike and burned ~800 acres). There are two primary sources of fire ignitions: lightning and humans.

We have no control over lightning; however we can reduce the potential for human caused fires. Most of the fires in the project area are caused by landowners burning debris.

"Values at risk" provide an index of resource and human values that could be impacted by wildfire. The resource values at risk for the project area are timber value, wildlife habitat and water quality while the human values at risk for the project area are residences, farmland and aesthetics. Economically, this list presents a higher value in the western portions of the project area because of the human values.

Wildland / Urban Interface

Wildland / Urban Interface (WUI) is a term used to describe the area where developed lands meet undeveloped lands. The developed lands can be homes, businesses or agricultural lands.

Under the Healthy Forest Restoration Act of 2003 the term "at risk community" means either the interface community defined in the notice of 2001[35] or a group of homes and other structures with basic infrastructure and service (such as utilities and collectively maintained transportation routes).

All of the units with the exception of the extreme eastern units are within this definition. (www.edo.or.blm.gov/infms/HTML/FIRE/BIO.HTM) The Leisure Woods residential area in section 35 of T3S., R3E. has numerous homes and narrow access roads with a single entry/escape route.

Large Scale Factors Affecting Fire Behavior

The physical setting for the Cascades has major west-east lying mountain drainages. This allows for the creation of strong up-canyon winds in the afternoon during the late spring, summer and early fall. The west to east oriented drainages also provide funneling to strong, dry East winds that can occur unpredictably. During the summer and fall seasons, these dry, warm winds reach velocities of 30 to 40 miles per hour, with stronger gusts over the higher ridges and down east-to-west oriented drainages. East winds are important because they often occur when fuel moistures are at critically low levels. Large wildland fires igniting on the lower and middle thirds of slopes may spread to ridgelines before safe suppression action can be taken. (NWOR FMP, p.41)

[35] "Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire" Title V, Dept. of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed Reg. 753, January 4, 2001)

In temperate ecosystems like the Pacific Northwest, biomass accumulates faster than it decomposes. New studies have linked occurrence of wildfire with global weather changes such as El Niño/La Niña, the Pacific Decadal Oscillation (PDO) and global warming trends.

Currently, climate-model projections indicate that warmer springs and summers will occur over the region in coming decades. The trends will reinforce the tendency toward early spring snowmelt and longer fire seasons which will accentuate conditions favorable to the occurrence of large wildfires (Westerling et al, 2006; Swetnam, 2002).

Environmental Effects

3.3.6.1 Proposed Action

Air Quality

There may be some drift smoke within ¼ - ½ mile of burning piles for a few hours after they are ignited. Transport winds affecting the area would keep the air shed scoured out preventing a buildup of particulate matter and provide atmospheric mixing to prevent any intrusions or visibility.

The total amount of slash debris expected to be piled for burning is estimated to be between 3000 and 7000 tons over an extended period of 3 to 6 years. Burning between 1000 and 3000 tons of dry, cured, piled fuels under favorable atmospheric conditions each year in the project area is not expected to result in any long term negative effects to air quality in the air shed for the following reasons.

Generally, once covered dry piles have been ignited, the fire intensity builds rapidly to a point where the fuels burn cleanly and very little smoke is produced. The strong convection column produced carries the smoke and gases well up into the atmosphere where it is diluted and carried away in the air mass. After a few hours, as the piles burn down and the intensity subsides, additional smoke may be produced due to lower temperatures and less efficient combustion.

Depending on size, arrangement, type and moisture content of the remaining fuel, the smoke will diminish over several hours or days as the piles cool and burn out (sooner if rain develops).

Generally this smoke only affects the immediate area (¼- ½ mile or less) around the pile. If a temperature inversion develops over the area during the night time hours, smoke may be trapped under the inversion and accumulate, resulting in a short term impact to the local air quality. The accumulated smoke generally clears out by mid-morning as the inversion lifts. Due to the location of this project in the foothills of the Cascades it is unlikely that inversions will present a problem. Burning of slash would always be coordinated with ODF and conducted in accordance with the Oregon State Smoke Management Plan. This serves to coordinate all forest burning activities on a regional scale to prevent negative impacts to local and regional air sheds.

Other treatments such as mastication or lop and scatter would have no effect on air quality.

Fire Hazard Rating, Fire Risk and Values at Risk

Slash created from timber harvest would add an estimated 10-15 tons per acre of dead fuel to the thinned areas, most of which would be smaller than 100 hour fuel size class (3 inches diameter) (PNW-105 series: 1-DF-2, 2-DF-2-PC and PNW-GTR -258 series: 1-DFWH-PRE-01-03). The fuel arrangement would tend to be continuous with patches of low fuels. The fuel model would shift from fuel model TL3 (183) Moderate Load Conifer Litter to a fuel model SB2 (202) Moderate Load Activity Fuel (RMRS-GTR-153).

These models predict the spread rate changing from very low (132-400 ft/hr) to moderate (3300 to 9240 ft/hr) and the flame length changing from low (1-2 ft) to moderate (2-15 ft) with the project (Scott and Burgan, RMRS-GTR-153, 2005, pp. 59,68).

All thinning projects result in increased fire risk potential for 1 to 3 years because of the increased dead fine fuels (1 and 10 hour fuels)[36]. The relatively low amounts of larger 100 to 1000 hour fuels persist much longer and remain a factor contributing to resistance to control because they contribute to fire intensity and duration.

As previously stated, fuel treatments (51% of the area) are based on the need to reduce the potential risk from fire starts or high intensity fires.

The thinning from below itself reduces fire risk by removing ladder fuels which can move ground fire into the tree canopy and removing small diameter trees which can ignite easier. Reducing surface fuel loads also results in more efficient and quicker fire suppression, less risk for fire fighters and less resource damage. Machine treatment would reduce the risk by turning logging slash into all 10 hour fuels which will decay more rapidly, take on moisture more quickly with humidity changes and make accomplishment of any fire suppression more successful.

Forty-nine percent of the project area would have no surface treatment of the thinning slash. Fuel loading, risk of a fire start and the resistance to control a fire, would all increase at the untreated sites as a result of this action. Untreated areas are located away from residential properties and/or are buffered by areas with treated fuels and are located where human caused ignition is unlikely. Therefore, there is very little potential for fires to start, and if started very little potential for those fires to escape early control and impact residences or other high value resources.

Risk of a fire start in the untreated slash would be greatest during the first season following cutting, - the period when needles dry out but remain attached. These highly flammable "red needles" generally fall off within one year and risk of a fire start diminishes. A study of precommercial thinning effects on fine fuels (<1" in diameter) showed a decrease by 50 percent in loading (tons/ac) and in fuelbed depth in less than two years.

[36] Forest fuels are classified according to how long it takes their moisture content to equalize with the surrounding air, also referred to as timelag classes. Timelag is the midpoint of this response time, i.e. 1-hour fuels respond in less than 2 hours, 10-hour fuels respond in 2 to 20 hours, etc. Grass and straw are one hour fuels (<¼ in. diameter). Twigs and small branches (¼ - 1 in.) are 10 hour fuels. Dead limbs (1-3 in.) are 100 hour fuels. Small logs (3-8 in.) are 1000 hour fuels. Different time-lag classes burn differently: 1-hour fuels (needle litter, hardwood leaves) ignite quickly and combust at rapid rates. Progressively larger particles (10-, 100-, 1000-hour and larger fuels) require more heat for ignition and combustion. Fires usually start and spread in dead fine fuels (< ¼ in. diameter), which ignite increasingly larger size classes of fuels. If fine fuels are reduced or missing, a fire may not ignite or spread.

This study also looked at blowdown (windthrown trees) which typically has high levels of fuel at the start. Fine fuels essentially fall to background levels in two to four years. Larger branch fuels and 1000-hour fuels persist for longer periods with the conversion of sound 1000-hr fuels to rotten 1000-hr fuels is a gradual process of about 80 years (Christiansen, 1991).

Fire risk would continue to diminish as the area "greens up" with under story vegetation, and as the fine twigs and branches in the slash begin to break off and collect on the soil surface.

Past experience in the geographic area of this proposed action has shown that, in approximately 15 years, untreated slash would generally decompose to the point where it no longer contributes significantly to increased fire risk.

Depending on the amount of large, down wood left on site from logging, the resistance to control would also decrease over time but more slowly. This is what is expected to occur for the areas considered in this proposed action where the slash created would be left in place, untreated.

In the untreated areas the resulting total residual dead fuel loading would vary throughout the site ranging from 5-15 tons per acre. It is expected that about half of the dead fuel tonnage to be left on site following treatment would be in the form of down logs and pieces in the 10 inch and larger size class. The decision to leave the slash untreated under this proposed action is based on a number of factors:

- Historically, the number of fires that have occurred in this area has been very low and it is unlikely that this additional slash would result in a fire occurring in the area.
- The cost to treat all the slash would be fairly high (>$500 per acre) with limited benefit.
- Most of the roads leading into the units would be blocked or have limited access that controls entry to much of the site by the public.
- The continued existence of a tree canopy to shade the fuels would maintain cooler temperatures and higher humidity on the site reducing the risk of a fire start.

3.3.6.2 Cumulative Effects

Current trends in human activity and related potential for fire starts would be expected to remain the same or increase as increased human activity around the project area increases the potential for human caused fires. However, the logging itself and the slash created would result in reduced human activity within the project areas. The cumulative potential for wildfire start and growth would increase in the short term (1-3 years) as a result of the proposed action because fuel loading on the ground would increase as a result of harvest.

Cumulative potential for wildfire start and growth would decrease in the longer term (1-2 decades) as the logging slash decays and because the natural heavy fuel loading from suppression mortality (trees dying) would not be present after treatment.

3.3.6.3 No Action Alternative

Air Quality

For air quality the No Action alternative means no effect on air quality from burning, although the potential risk from more intensive wildfires would produce a large quantity of smoke in a short period of time.

Fire Risk

Current trends in human activity and related potential for fire starts would be expected to remain the same or increase as population and WUI increases. Fire severity and the potential for a crown fire would be higher for dense stands with accumulating surface fuels in the long term (one to several decades) because of the high number of small diameter snags and woody debris created by suppression mortality. Fuel loading would likely change to TL5 High Load Conifer Litter or TL7 Large Down Logs with similar fire behavior characteristics for rate of spread or flame length as the current conditions.

The major change would be that surface fires would be long duration due to more down wood and the potential for a crown fire to occur would increase due to increased ladder fuels and canopy closure. The potential risk can change annually with weather conditions and possibly increase faster in the long term with predicted climate change. If a wildfire were to occur the effects may include: 1) total tree mortality, 2) elimination of the duff and litter layers, 3) reduction of the downed woody component, especially logs in later stages of decay, 4) increased erosion and sedimentation of water courses, and 5) formation of snags. Consequently, without treatment potential fire hazards are greater to the neighboring communities, adjacent high value lands and private property.

3.3.7 Carbon Storage, Carbon Emissions, and Climate Change

Sources Incorporated by Reference: *Highland Fling Carbon Calculations (HLF Carbon Calc), 2008 FEIS: Volume I, Pages 220-224; Volume II, Pages 537-543, and Volume III, Appendices, Pages 28-30, USGS May 14, 2008 Memo on Carbon Emissions and Climate Change, and Memo on Carbon in Harvested Wood.*

Resource Specific Methodology

On July 16, 2009, the U.S. Department of the Interior withdrew the Records of Decision (2008 ROD) for the Western Oregon Plan Revision. The information contained in the Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management (2008 FEIS) is relevant since it examined recent and applicable science regarding climate change and carbon storage. That analysis concluded that effects of forest management on carbon storage could be analyzed by quantifying the change in carbon storage in live trees, storage in forests other than live trees, and storage in harvested wood. The discussion on Volume I, Pages 220-224; Volume II, Pages 537-543, and Volume III, Appendices, Pages 28-30 are relevant to the effects analysis for this project and are incorporated by reference.

The BLM collected stand data and calculated carbon storage, sequestration and release based on stand projection modeling in decadal increments. Specific elements of these calculations are described below (Context - Calculations...) and the calculations and are detailed in the Highland Fling Carbon Calculations.

Context –Greenhouse Gases, Climate Change and the Spatial Scale for Analysis

Uncertainty about the nature, effects and magnitude of the greenhouse gases and global climate change interrelationship is evident in a wide range of conclusions and recommendations in the literature reviewed.

The spatial scale for analysis of carbon, greenhouse gasses and climate change is global, not local, regional, national or continental because climate change is inherently a global issue and carbon cycling is only an issue as it relates to contributing to greenhouse gasses and they potentially contribute to climate change. The U.S. Geological Survey, in a May 14, 2008 memorandum to the U.S. Fish and Wildlife Service, summarized the latest science on greenhouse gases and concluded that it is currently beyond the scope of existing science to identify a specific source of greenhouse gas emissions or sequestration and designate it as the cause of specific climate impacts at a specific location. That memorandum is incorporated here by reference. Regional and national information is presented for some elements of carbon storage and cycling for additional context.

Based on the BLM's review of statutes, regulations, policy, plans and literature, the BLM accepts the conclusions above as appropriate context for a reasoned choice among alternatives.

Context – Temporal Scale for Analysis

This analysis assesses short-term and long-term effects on carbon storage and carbon emissions. The BLM has selected 0-10 years as the analysis period for short-term effects on carbon storage and carbon emissions, because this time period would encompass the duration of all of the direct emissions from the proposed thinning.

The BLM has selected 11-30 years as the analysis period for long-term effects on carbon storage and carbon emissions for this project because that is the maximum time period before the BLM would assess the forest stands in the project area to determine if additional treatments are needed to meet management objectives. If this is the case, carbon cycling analysis at that time would incorporate new scientific knowledge and modeling tools that are not currently available.

Context – Calculations of Carbon Storage and Carbon in Greenhouse Gas Emissions, Project Area Scale

The purpose of calculating carbon sequestration, storage and emissions at the project scale is to provide a basis for evaluating their significance relative to the temporal and spatial scales described above.

The BLM calculated estimates of existing carbon stores, carbon to be removed by the proposed thinning, sequestration of carbon through tree growth, storage of carbon removed from the forest, and future carbon storage in the forest stand. All numbers presented are estimates based on the data and models used by the BLM. The Highland Fling Carbon Calculations (HLF Carbon Calc) are incorporated here by reference.

The BLM used site specific data from stand exams as input to the Oregon Growth Analysis and Project System Growth and Yield Project for Northwest Oregon Forests (Version 8.2 – 2006) (ORGANON) (a forest stand model) to determine stand growth over the analysis period. Using Highland Fling stand growth data, the BLM calculated carbon in the live trees and other than live tree pools using the methodology described in the 2008 FEIS Appendix C, pp. 28-29.

The BLM calculated the amount of carbon stored in harvested wood using an overall conversion factor of 1,000 board feet (1 MBF) = 1.326 tonnes of carbon. This method for converting board feet of harvested wood mass to carbon was used in the 2008 FEIS based on Smith et al. 2006 and has been refined based on more current, region-specific data of wood products and how they store or release carbon over time (Hardt, 2009).

Carbon emissions from equipment used to harvest trees (logging operations) and transport logs to the mill were calculated using an estimated fuel consumption of 2.65 gallons of diesel per thousand board feet (MBF) of timber harvested. This fuel consumption is based on BLM staff interviews with purchasers who buy timber sales in the local area, fuel consumption specifications from equipment manufacturers' published information, and field observations by BLM personnel. The BLM fuels specialist calculated the carbon associated with the burning logging slash.

Affected Environment

Climate Change

The 2008 FEIS described current information on predicted changes in regional climate (pp. 488-490) and is incorporated here by reference. That description concluded that the regional climate has become warmer and wetter with reduced snowpack, and continued change is likely. That description also concluded that changes in resource impacts as a result of climate change would be highly sensitive to specific changes in the amount and timing of precipitation, but specific changes in the amount and timing of precipitation are too uncertain to predict at this time.

Because of this uncertainty about changes in precipitation, it is not possible to predict changes in vegetation types and condition, wildfire frequency and intensity, streamflow, and wildlife habitat.

Carbon Storage

Total carbon contained in forest ecosystem vegetation[37] can be divided into three pools: live trees (foliage, branches, stems, bark and live roots of trees), forest carbon other than live trees (dead wood and roots, non-tree vegetation, litter and soil organic matter) and harvested wood products. These quantities are shown in Table 17, Items 1a - 1d.

The following show total quantities of carbon in forest ecosystem vegetation worldwide, in the United States, the Pacific Northwest and in the Highland Fling project area.

- Total carbon, forest ecosystem vegetation, Worldwide (Matthews et al, 2000, p. 58) = 132-457 Gt[38]
- Total carbon, forest ecosystem vegetation, United States (US EPA, 2009) = 27 Gt
- Total carbon, forest ecosystem vegetation, Pacific Northwest, Cascades Range =1.5-1.7 Gt (Hudiburg, et al. 2009)
- The annual accumulation (sequestration) of carbon from forest management in the United States is 0.191 Gt, and 0.00169 Gt from current management on BLM-managed lands in western Oregon (2008 FEIS, p. 4-537). (Table 18, Items A and B)
- Total carbon, forest ecosystem vegetation, Highland Fling proposed thinning units = 146,903 tonnes (0.00015 Gt), which consists of live tree carbon (118,026 tonnes) and other than live tree carbon (28,877 tonnes). (Table 17, Items 1a, 1b and 1c.)

Environmental Effects

3.3.7.1 Proposed Action

The proposed thinning would emit carbon as carbon dioxide (CO_2) as a result of harvest operations and fuel treatment. The major changes in carbon storage caused by the proposed action would be in the live tree pool, by moving carbon from the live tree pool to the "other than live trees" and "harvested wood products" pools. Modeling used by the BLM assumes that inputs (logging slash) and reductions (fuel treatments, breakage) to the "other than live trees" pool approximately balance each other, so only changes to live tree and harvested wood products pools are calculated.

Short-term Effects (0-10 years after timber harvest)

Carbon Storage

Live Trees Pool: Thinning would directly affect the live trees pool because the project would remove live trees. Table 17 shows that the proposed thinning would remove approximately 39,583 tonnes of carbon from the live trees pool. Approximately 78,443 of the original 118,026 tonnes of carbon would be retained in the live trees pool and be available for future growth and carbon storage (Table 17, items 5, 2, 1a).

[37] Carbon contained in both above ground and below ground parts of trees and forest vegetation, and downed wood, litter and duff. It does not include mineral carbon in soil, nor fossil fuels.

[38] Metric tons are approximately 2,200 pounds and are referred to in this document as tonnes. A Gigatonne (Gt) is one billion tonnes.

The average annual carbon sequestration by growth of trees in the Highland Fling project area after harvest would be 2,255 tonnes (Table 17, Item 3a). This would sequester carbon in the live trees pool in an amount at least equal to the direct emissions of the first decade (5,052 tonnes, Table 17, Item 11) within three years after thinning.

Carbon Emissions

Harvest Operations: Harvest operations (logging and log haul) would use diesel fuel and emit carbon as greenhouse gases. Estimated fuel consumption for harvest operations for the Highland Fling project is 40,500 gallons of diesel to log and transport thinned timber to the mill. This represents total emissions of 110 tonnes of carbon (Table 17, item 9).

Fuels Treatment: Treating forest fuels, primarily logging slash and existing hazardous fuel accumulations,, would likely accelerate carbon emissions compared to natural mortality and decay processes, assuming absence of wildfire. Of the fuel treatment methods described in EA section 2.3.3, burning piles of slash would emit the most carbon as greenhouse gasses in the short term, 327 tonnes (Table 17, item 10). If there is a demand for forest residue for energy production, removing forest fuels from the site to be used for energy production would reduce the total carbon released without energy capture. Since it is unlikely that this option would be economical during the project period and there are no historical use patterns on which to base estimates of quantities removed, no calculations were made.

Trees Harvested from the Live Trees Pool: In addition to the fuels treatment described above, some of the carbon in harvested trees is emitted by burning, either with or without energy capture. Other carbon is released by decay of logging slash and roots of harvested trees. Much of the emissions from harvested wood would occur shortly after harvest (a few weeks to five years), and harvest would be spread over one to five years within the 10 years short-term effects analysis period. In the first 10 years after harvest, approximately 4,615 tonnes of carbon would be emitted by decay and burning without energy capture (not including fuels treatment described above) from wood harvested from the project area (Table 17, item 8). Emissions from the harvested wood products pool are addressed under "long term effects" below.

Other Than Live Trees Pool: On-site dead material would decay over time. In all alternatives, including the no action alternative, the decay of dead material (dead wood and roots, non-tree vegetation and litter) would result in some portion of carbon emitted and some portion of the carbon entering into long-term storage as soil carbon. There rate of emissions from decay of dead material is unknown because there are so many variables of site conditions, material size and the species mix of the dead material. Therefore, how the rate of emissions from decay of dead material would differ between the action alternatives and the no action alternative is also unknown so carbon storage and emissions in this pool are not quantified in this analysis.

Table 17: Summary of Carbon Storage and Carbon Emissions

Item	Element of the Carbon Cycle	Tonnes Carbon (C)		Remarks	Proposed Action GT (Gigatonne)
		Proposed Action	No Action Alternative		
Current Condition and Background Information					
1a	C in Live Tree Pool Before Treatment (2010)	**118,026**	**118,026**		0.0001180
1b	C in Other Than Live Tree Pool	28,877	28,877		0.0000289
1c	Total C in vegetation and soil	146,903	146,903	Items 1a + Item 1b	0.000147
1d	Harvest Volume: 15272 MBF	See item 5 for tonnes of C			
Carbon Storage					
2	C in Live Tree Pool Immediately After Treatment (2010)	78,443	118,026		0.0000784
3	C Sequestration, 30 Year Growth Period (2040)	67,639	64,365	Item 4 - Item 2	0.0000676
3a	Average Annual Sequestration (from Growth)	2,255	2,146	Item 3 / 30 (years)	0.0000023
4	C in Live Tree Pool End of 30 Year Analysis Period (2040)	146,082	182,391		0.000146
5	C Removed From Live Tree Pool by Timber Harvest (2010)	39,583	0	Item 1a - Item 2	0.0000396
6	C Stored in Harvested Wood (Wood Products) at End of 30 Year Analysis Period (2040)	14,456	0		0.0000145
7	Total C Storage (Live Tree & Products) at End of Analysis Period (2040)	160,538	182,391	Item 4 + Item 6	0.0001605
Carbon Emissions					
Short Term Emissions (0-10 Years)					
8	C Emissions from Harvested Wood (Decay or Burn Without Energy Capture)	4,615	0		0.0000046
9	C Emissions from Harvest Operations (Logging, Transportation)	110	0	MBF*2.65 gal. diesel / MBF * 6 lb. C / gal. diesel	0.0000001
10	C Emissions from Fuel Treatment (Burning piled slash)	327	0		0.0000003
11	Total Short Term Carbon Emissions (Direct Effect)	5,052	0	Sum of Items 8, 9 & 10	0.0000051
11a	Average Annual Carbon Emissions Years 0-10	505	0	Item 11 / 10 (years)	0.0000005

Item	Element of the Carbon Cycle	Tonnes Carbon (C)		Remarks	Proposed Action GT (Gigatonne)
		Proposed Action	No Action Alternative		
Long Term Emissions (11-30 Years)					
12	Carbon Emissions from Harvested Wood (Decay or Burning of Products Without Energy Capture)	1,181	0		0.0000012
12a	Average Annual Carbon Emissions Years 11-30	59	0		0.0000001
Carbon Storage and Changes for the Analysis Period (30 Years, 2010-2040)					
13	Total Carbon Emissions, Project Area	6,233	0	Item 11 + Item 12	0.0000062
13a	Average Annual Carbon Emissions, Years 1-30	208	0		
15	Net Change to Live Tree Pool (2040)	28,056	64,365	Item 4 - Item 1	0.0000281
14	Net Change to Carbon Storage (2040)	42,512	64,365	Item 14 + Item 6	0.0000425

Long-term Effects (11-30 years after timber harvest)

Carbon Emissions and Storage

Live Trees Pool: Following thinning, approximately 50-175 of the largest trees per acre would remain on site (Table 6). These trees would store carbon as they grow. Table 17 shows that live tree carbon would increase to 146,082 tonnes after 30 years of growth, compared to 118,026 tonnes prior to treatment and 78,433 tonnes immediately after treatment. This is a net increase of 28,056 tonnes of carbon in the live trees pool after 30 years (Table 17, items 4, 1a, 2, 14).

Harvested Wood Products Pool: From 11-30 years after harvest an additional 1,181 tonnes of carbon would be emitted from harvested wood by decay and burning without energy capture. 14,456 tonnes of carbon would remain stored in wood products still in use, in landfills, or burned with energy capture (2008 FEIS, pp. 540-541; Appendices, p. 30, EA Table 17, item 6).

3.3.7.2 Cumulative Effects

Global and US emissions of greenhouse gasses are commonly reported as tonnes of carbon dioxide (CO_2) and analysis so far in this document has reported tonnes of elemental carbon (C). Table 18 presents both CO_2 and C. One tonne of C yields approximately 3.67 tonnes of CO_2. Carbon storage and emissions are also reported in Gigatonnes (Gt, or one billion tonnes) at global, national and regional scales, so units will also be given in Gt.

Table 18: Context and Scale: Highland Fling Carbon Relative to Regional, National and Global Carbon Stores and Cycles

Item	Description	Proposed Action			No Action			Source of the Information
		Tonnes	Gt	HLF Percent*	Tonnes	Gt	HLF Percent*	
A	Average Annual Carbon Sequestration (Accumulation), US	191,000,000	0.191	0.0012%	191,000,000	0.191	0.0011%	USDI BLM, 2008. p.4-537
B	Average Annual Carbon Sequestration (Accumulation), Current Management of BLM Lands in Western Oregon	1,690,000	0.00169	0.13%	1,690,000	0.00169	0.13%	USDI BLM, 2008. p.4-537
C	Average Annual Carbon Sequestration (Accumulation), Highland Fling Project Area	2,255	0.0000023	100.0%	2,146	0.0000021	100.0%	EA Table 17, item 3a.
D	Average Annual Carbon (C) Emissions, US	1,634,877,384	1.6	0.00003%				Calculated from CO_2 (Item D-1) (CO_2 /3.67)
D-1	Average Annual Carbon Dioxide (CO_2) Emissions, US	6,000,000,000	6.0	0.00003%				US EPA, 2007. pp. 2-3.
E	Average Annual Carbon (C) Emissions, Global	6,811,989,100	6.8	0.000007%				Calculated from CO_2 (Item E-1) (CO_2 /3.67)
E-1	Average Annual Carbon Dioxide (CO_2) Emissions, Global	25,000,000,000	25.0	0.000007%	*Not Applicable*			IPCC 2007. p. 513.
F	Average Annual Carbon (C) Emissions, Highland Fling Project Area (Years 1-10)	505	0.0000005	100.0%				EA Table 17, item 11a.
F-1	Average Annual Carbon Dioxide (CO_2) Emissions, Highland Fling Project Area	1,854	0.0000019	100.0%				Calculated from Elemental C (Item F) * 3.67

* "HLF Percent" indicates what percentage of the category described in column 2 is represented by the Highland Fling Project.

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. The proposed thinning would contribute to cumulative effects to carbon storage and carbon emissions by emitting a total of 0.000005 Gt of Carbon over the next 10 years (Table 17, Item 11).

The short-term (1 - 10 years) emissions from the proposed thinning would constitute 0.000007 percent of current global CO_2 emissions and 0.00003 percent of current U.S. emissions for the 10 year period (Table 18, Items D - F-1). Current annual global carbon emissions as carbon dioxide (CO_2) total 6.8 Gt of Carbon (IPCC 2007, p. 513), and current annual U.S. emissions total 1.6 Gt of Carbon (EPA 2007, p 2-3). Global emissions over 10 years of the short term analysis period total 68 Gt of Carbon and U.S. emissions of Carbon total 16 Gt. In addition, the net carbon emissions would be of short duration. The retained trees in the harvest units would sequester 2,255 tonnes of carbon per year (average for the 30 year analysis period), restoring the 5,052 tonnes of short term carbon emissions from harvested products, harvest operations and forest fuels treatments within three years after thinning (Table 17, items 3a, 11).

During the thirty years following the proposed thinning, the increase of 67,639 tonnes (0.000068 Gt) of live tree carbon would contribute an annual average of 2,255 tonnes (0.000002 Gt) (Table 17, Items 3 and 3a), or 0.0012 percent of the 0.19 Gt U.S. annual accumulation of carbon from forest management.

At the BLM forest management in Western Oregon scale, this is equal to 0.13 percent of the 0.0017 Gt annual accumulation of carbon as a result of current implementation on BLM-managed lands in western Oregon (Table 18, Items A and B) (2008 FEIS, p. 4-537). The 2008 FEIS (p. 4-538), which is incorporated here by reference, states that by 2106, the No Action Alternative (management under the 1995 RMP) would result in a total carbon storage of approximately 628 million tonnes, 9% higher than average historic conditions (576 million tonnes, 2008 FEIS, 3-224, as reanalyzed in November 6, 2009 memo, on file and incorporated by reference, Cascades Resource Area).

3.3.7.3 No Action Alternative

Under the no action alternative, no carbon as greenhouse gases would be emitted from harvest operations or fuels treatments. Carbon stored in live trees would not be converted to the harvested wood carbon pool, and would be converted to the other than live tree pool through ongoing processes of tree mortality. Table 17 shows that live tree carbon would increase to 182,455 tonnes (0.000182 Gt) (Table 17, item 4) after 30 years of growth, an increase of 64,429 tonnes (0.000064 Gt) (Table 17, item 3) from the 2010 levels of 118,026 tonnes (0.000118 Gt) (Table 17, item 1a).

The no action alternative would result in greater increase in net carbon over the 30 year analysis period than the proposed action by approximately 21,644 tonnes (0.000022 Gt) (calculated Table 17, item 14), which is 13.5 percent greater increase in carbon storage than for the action alternative (calculated from Table 17, item 7).

3.3.7.4 Cumulative Effects, No Action Alternative

The increase of 64,429 tonnes (0.000064 Gt) of live tree carbon associated with the no action alternative would contribute to an annual average of 6,443 tonnes (0.0000064 Gt), or 0.001 percent to the U.S. annual accumulation of carbon from forest management of 0.191 Gt; or 0.13 percent of the annual accumulation of 0.0017 Gt of carbon as a result of current implementation on BLM-managed lands in western Oregon (Table 18, Items A and B) (2008 FEIS, p. 4-537). On a regional scale it is reasonable to assume that, without a fundamental change in market demand for wood products, harvest of an equal amount of timber would be done on other lands to fill that demand. This would result in no difference between the net effects of the proposed action and the no action alternatives on a regional or global scale for either carbon cycling or climate change.

3.3.8 Recreation, Visual Resources and Rural Interface

Source incorporated by reference: *Recreation/Visual/Rural Interface Evaluation,* Jarrett 2008.

Affected Environment

Access

Access to the proposed units is highly variable. Many units have direct access from Clackamas County roads (3S3E-35C&35D; 4S3E-21A,21B,&21C; 4S3E-27B; 4S3E-29B; 4S3E-29B; 4S4E-29B,&29C). Others are accessed by logging roads, most of which are closed to public vehicle access by gates or blockades (4S3E-1; 4S4E-21; 4S4E-27A,27B,&27C; 4S4E-29A,&29B). The remaining units do not currently have road access and will require access across private land (3S3E-35A,&35B; 4S3E-27A).

Recreation

All of the proposed project areas are characterized by a forest setting and are accessed by either paved or gravel roads. Evidence of man made modifications such as roads and timber harvest are common on both private and public land within the project area.

Approximately 4 miles of unauthorized multiple use trails, primarily non-motorized, have been created within the project area. The majority of these "user"- created trails are in Units 3S3E-35A, B, C and D and Unit 4S3E-1. User-created trails within the project area have not been designed consistent with BLM trail construction standards. One scoping comment indicates that there are also some trails through BLM lands in the Elwood area, east of Highway 211.

These areas with unauthorized user-created trails are outside of any designated Special Recreation Management Area (SRMA), and are located in the General Forest Management Area (GFMA) land use allocation. Providing and/or enhancing recreational opportunities in areas outside of an SRMA conflict with the goal and intent of a GFMA LUA.

There are no established public access trailheads within the project area. Access into the user created trail system appears to be mainly from private residences adjacent to BLM managed lands. The majority of use on these trails appears to be by equestrians and hikers, with some bicycle and ATV/motorcycle use on some trails.

Most of Unit 4S3E-1, which has an extensive network of these trails, was commercially thinned in 1979. None of the scoping comments received mentioned any detrimental impacts to the trail system from that thinning. Comments indicate that the roads used for the 1979 thinning are used as part of the equestrian trail network, and that recently they are being used for passenger vehicle and OHV access from private industrial forest land to the west.

Visual Resources

All of the proposed units fall within Visual Resource Management (VRM) class 4. VRM class 4 areas allow for management activities that may dominate the view, and be the major focus of viewer attention.

Rural Interface Areas (RIAs)

All proposed units are within ½ mile of residences. 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. Roads surrounding these proposed units have historically experienced log truck traffic.

Environmental Effects

3.3.8.1 Proposed Action

Recreation

Public use of the proposed thinning units would be restricted for weeks to months during active thinning activities and an increase in log truck traffic would be experienced during the thinning operation. Similar recreational opportunities, such as the Molalla River Shared Use Trail System in the Molalla SRMA, are available in other nearby public lands for those temporarily displaced.

Some of the user-created trails may be obliterated or altered by logging operations.

Visual Resources

The proposed timber sale project would not have a significant impact on visual resources.

After harvest a forested setting would still be maintained in all of the proposed units. Changes to landscape character are expected to be low and primarily associated with disturbance to understory vegetation. Understory vegetation would be expected to grow so that the disturbance would not be visible within two to five years.

Rural Interface Areas (RIAs)

The proposed timber sale project would not cause changes to private property or have a long term (more than a few weeks) impact on rural interface areas. Local residents would experience slight impacts (noise, dust and increased traffic on public roads for a few weeks on each road system). These impacts are not unusual because logging operations on private lands in the vicinity are common occurrences.

3.3.8.2 Cumulative Effects

Along county roads there would be small short term (weeks to months) cumulative increase in log truck hauling to overall traffic near residences along county roads accessing the units. Because a forested setting would be maintained, the cumulative impacts would be minimal.

3.3.8.3 No Action Alternative

With the exception of unplanned changes (i.e. wildfire, disease etc.) no modifications to the landscape character of the proposed units would be expected to occur.

3.3.9 Cultural Resources

Incorporated by reference: Cultural Resource Pre-Disturbance Inventory Report – Highland Fling Timber Sale, P. Hazen 2008

Resource Specific Methodology

- The 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.

Affected Environment

The only cultural resources found in the project area and vicinity are railroad grades and the remains of a cedar cabin (unit 1-4S3E) thought to have been used by a woodcutter after the original logging in the area. These resources are interesting, but they are not unique and do not provide new or significant information about forest use or domestic life in the early to mid 20th century. No prehistoric sites have been found and none were expected because the entire area was heavily disturbed by logging operations in the 1920s-40s and the ground in the project area is covered by vegetation, duff and litter. No mitigation beyond recording and mapping sites and railroad routes is recommended by the District Archaeologist.

Environmental Effects

3.3.9.1 Proposed Action

Segments of old railroad grades and truck roads would be used as truck roads and skid trails, which would preserve their location and general form, but would change the appearance from rustic/overgrown to currently useable roads and skid trails. No other effects would be anticipated.

3.3.9.2 Cumulative Effects

No direct effects to cultural resources would be expected, therefore no cumulative effects would be expected.

3.3.9.3 No Action Alternative

Current status and trends would continue for railroad grades and roadbeds. The remains of the cedar cabin would continue to deteriorate.

3.3.10 Review of Elements of the Environment Based On Authorities and Management Direction

Table 19: 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 sections 3.2, 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5, 3.3.10, 3.4, and 5.1 show how the Highland Fling thinning project meets the Aquatic Conservation Strategy in the context of the PCFFA cases.
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 3.3.6).
Cultural Resources (National Historic Preservation Act, as amended (16 USC 470) [40 CFR 1508.27(b)(3)], [40 CFR 1508.27(b)(8)]	This project is in compliance with this direction and the project would have no effect on this element because cultural resource inventories of the affected area would precede management actions that include any ground disturbing activities that could potentially damage cultural resources.
Ecologically critical areas [40 CFR 1508.27(b)(3)]	This project would have no effect on this element because there are no ecologically critical areas present within the project area.
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.

Element of the Environment /Authority	Remarks/Effects
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 NOAA's Biological Opinion (2008) found habitat restoration actions would not result in adverse modification of EFH. Effects to this element are addressed in text (EA Section 3.3.3).
Farm Lands, Prime [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because no prime farm lands are present on 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 fire and help restore forests to healthy functioning condition (EA Section 3.3.1, 3.3.6)
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 3.3.5 and 7.1, Table 22).
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 1.4).
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 2.3.4 and 3.3.1)
Park lands [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because there are no parks within or 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 project area during operations and the project would not create hazards lasting beyond project operations. (EA section 2.3.4, #6)
Threatened or Endangered Species (Endangered Species Act of 1983, as amended (16 USC 1531)	This project is in compliance with this direction because there would be no adverse effects on Threatened or Endangered Species (EA Section 3.3.1; 3.3.3; 3.3.5).
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 3.3.2)
Wetlands (E.O. 11990 Protection of Wetlands 5/24/77) [40 CFR 1508.27(b)(3)]	This project is in compliance with this direction because no wetlands are within the project area and adjacent wetlands would be protected by buffers. (EA Section 3.3.2)
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.

Element of the Environment /Authority	Remarks/Effects
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.

3.4 Compliance with the Aquatic Conservation Strategy

Based on the environmental analysis described in the previous sections of the EA, Cascades Resource Area Staff have determined that the project complies with the 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. 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 Highland Fling Thinning project is not within a Key watershed. (RMP p. 7).
- ***ACS Component 3 - Watershed Analysis:*** The project would comply with Component 3 by incorporating the following recommendations from the CFCWA and MCWA.
  - Density management and thinning in Riparian Reserve to develop and maintain late seral stand characteristics. Thinning in this project is designed to develop the large tree component faster, leading to earlier potential for recruiting CWD, LWD, snag and large tree habitat and to develop understory vegetation. Maintains 50% average crown closure in Riparian Reserve. Untreated areas provide additional range of species and density mix.
  - Develop standing dead and down LWD by leaving enough trees for future recruitment if needed. Thinning would leave many times the recommended retention to develop large trees for future recruitment. This goal would be achieved over time.
  - Road densities. Roads to be constructed, improved or renovated for use in this project would be located on ridgetops and stable, gentle slopes to avoid sedimentation impacts, except for the crossing of Randall Creek in Unit 29-4S3E. At this crossing, different practices would limit potential for sediment impacts. Roads used in the project would be stabilized and closed after use.
  - Noxious weeds. Equipment washing required. Vegetation Management EIS provides further guidance.
  - Riparian Condition and LWD on Federal Lands, accelerate growth for recruitment of LWD for stream structure. Thinning is designed to accelerate growth. Suitable large trees would be available years to decades sooner than without treatment.
  - Stream flows, water quality, ODEQ 303(d), and stream temperatures. The project would not contribute to detectable changes in these elements.
  - Soils, Slope Stability and Mass Wasting: Project design avoids erosion. There are no slides or bare slopes identified in the project area.

- Timber Management in the Matrix Land Use Allocation. Provide timber sales that are marketable, provide a balance between wood volume/quality/value, and maintain a healthy forest ecosystem. The project was designed so that the proposed action achieves these objectives.

- ***ACS Component 4 - Watershed Restoration*** The project would comply with Component 4 by the combination of thinning and unthinned areas in Riparian Reserves, which would further enhance terrestrial habitat complexity in the long and short term. Thinning in all LUAs would 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.

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.

1. **ACSO 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.** Addressed in Text (*EA sections 3.3.1, 3.3.5*). In summary:

   No Action Alternative: The No Action alternative would maintain the development of the existing vegetation and associated stand structure at its present rate. The current distribution, diversity and complexity of watershed and landscape-scale features would be maintained. Faster restoration of distribution, diversity, and complexity of watershed and landscape features would not occur.

   Proposed Action: The proposed combination of thinning from below and unthinned areas in the Riparian Reserve Land Use Allocation (RR) would result in forest stands that exhibit 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.

   Since Riparian Reserve provides travel corridors and resources for aquatic, riparian dependant and other late-successional associated plants and animals, the increased structural and plant diversity would ensure protection of aquatic systems by maintaining and restoring the distribution, diversity and complexity of watershed and landscape features.

2. **ACSO 2: Maintain and restore spatial and temporal connectivity within and between watersheds.** Addressed in Text *(EA sections 3.3.1,3.3.3, 3.3.5)* In summary:

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

   Proposed Action: Long term connectivity of terrestrial watershed features would be improved by enhancing conditions for stand structure development. In time, the Riparian Reserve LUA would improve in functioning as refugia for late successional, aquatic and riparian associated and dependent species.

Both terrestrial and aquatic connectivity would be maintained, and over the long-term, as the Riparian Reserve LUA develops late successional characteristics, lateral, longitudinal and drainage connectivity would be restored.

3. **ACSO 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

   No Action Alternative: It is assumed that the current condition of physical integrity would be maintained.

   Proposed Action: Physical integrity of channels at existing stream crossings would be altered for one to several years following use of one ford stream crossing and removal of one collapsed log fill stream crossing.

   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%), 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, armored (rocky) nature of the channel at the ford crossing and the low gradient and vegetation both up and downstream from the fill removal, little to no additional disturbance to channel morphology would be expected either upstream or downstream from the crossings.

4. **ACSO 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

   No Action Alternative: It is assumed that the current condition of the water quality would be maintained.

   Proposed Action: Stream Protection Zones (SPZs) in the Riparian Reserve LUA (RR) would be maintained. The proposed new and improved roads are on ridge top or upper-slope locations with no hydrologic connections or proximity to streams or riparian areas. Overall, the proposed action would be unlikely to have any measurable effect on stream temperatures, pH, or dissolved oxygen. Sediment transport and turbidity in the affected watersheds is likely to increase over the short term as a direct result of road repair and construction, hauling and yarding in and around the RRs. Sediment increases would not be visible beyond 800 meters (0.5 mile) downstream from road/stream intersections and would not be expected to affect fish, aquatic species or habitat, or human uses. Over the long-term (beyond 3-5 years), current conditions and trends in turbidity and sediment yield would likely be maintained under the proposed action.

5. **ACSO 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

   No Action Alternative: It is assumed that the current levels of sediment into streams would be maintained.

   Proposed Action: 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). Hauling restrictions and sediment control measures would minimize sediment delivery. Short-term localized increases in stream sediment can be expected during temporary stream

fording, collapsed fill removal and routine repair and maintenance of existing culverts, but BMPs and mitigation measures would be implemented to limit acceleration of sediment delivery to streams.

6. **ACSO 6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

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

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

   Because the proposed project would remove less than half the existing forest canopy and only a small fraction of the forest cover (roads and landings), it is unlikely to produce any measurable effect on stream flows. Within the Riparian Reserve, the riparian canopy would be retained intact within the primary shade zone and substantial portions of the canopy would be retained in the secondary shade zone, therefore maintaining riparian microclimate conditions and protecting streams from increases in temperature.

7. **ACSO 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.** Addressed in Text (*EA sections 2.3.4; 3.1.2; 3.3.2*). 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.

   Proposed Action: There would be no alteration of any stream channel, wetland or pond morphological feature. 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. Thus, the current condition of floodplain inundation and water tables would be maintained.

8. **ACSO 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.** Addressed in Text (*EA sections 2.3.1; 2.3.4; 3.3.1; 3.3.2; and 3.3.3*). In summary:

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

   Proposed Action: SPZs would maintain the current species composition and structural diversity of plant communities in riparian areas and wetlands from 30 feet (intermittent streams) to 60 feet (perennial streams) in treatment areas.

9. **ACSO 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.** Addressed in Text (*EA sections 2.3.1; 2.3.4; 3.3.1; 3.3.2; 3.3.3 and 3.3.5*). 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 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.

3.4.1 Comparison of Alternatives with regard to the Decision Factors

This section compares the alternatives with regard to the decision factors described in *EA section 1.2.3* and the project objectives in *EA section 1.2.2*.

1. *Provide timber resources and revenue to the government from the sale of those resources (objectives 1 and 2);*
2. *Reduce the costs both short-term and long-term of managing the lands in the project area objectives 1 and 2); and*
3. *Provides safe, cost-effective access for logging operations, fuels management and fire suppression (objectives 2, 6, and 7):*

   Decision Factors 1-3: The No Action alternative would not meet these factors since no timber sale would take place. The proposed action would provide timber resources to the market and would use commonly used silvicultural, transportation and logging practices that BLM experience with past timber sales has shown to be cost effective, providing revenue with reasonable logging costs (*EA section 2.3.1; 2.3.2; 2.3.3f, and 2.3.4*).

4. *Reduce competition-related mortality and wildfire risk, and increase tree vigor and growth (objectives 1 and 7):*

   Decision Factor 4: The No Action alternative would not meet this factor. The proposed action would meet this factor. (*EA sections 3.3.1 and 3.3.6*).

5. *Reduce erosion and subsequent sedimentation from roads (objectives 3 and 6):*

   Decision Factor 5: The proposed action meets this factor because roads would be maintained, reducing the risk of erosion and sedimentation associated with the existing road system, and because new road construction and improvement would not cause sedimentation. *(EA sections 2.3.4, 3.3.2 and 3.3.3)*

6. *Provide for the establishment and growth of conifer species while retaining structural and habitat components, such as large trees, snags, and coarse woody debris (objectives 4 and 5); and*
7. *Promote the development of healthy late-successional characteristics in the Riparian Reserve land use allocation (objective 4):*

Decision Factors 6 and 7: Under the No Action alternative, stand health and tree growth rates would decline if stands are not thinned. Competition would result in mortality of smaller trees and some co-dominant trees in the stands, resulting in numerous snags and CWD that are too small to meet resource objectives (minimum 15 inches diameter for snags, minimum 20 inches diameter for CWD). This alternative retains existing elements, but does not enhance conditions to provide these elements for the future stand. Trees would continue to grow slowly until reaching suitable size for large woody debris, snags and late successional habitat. (EA sections 3.3.1, 3.3.5)

The proposed action would meet decision factors 6 and 7. Stand health and tree growth rates would be maintained as trees are released from competition. The alternative retains the elements described under "no action" on untreated areas of the stands in the project area and encourages development of larger diameter trees and more open stand conditions in treated areas.

These conditions add an element of diversity to the landscape on BLM lands which is not provided under the No Action alternative. (EA sections 3.3.1, 3.3.5).

8. *Establish a defensible area for use during extended fire suppression activities and possibly reduce the overall size of a wildfire (objective 7);* and
9. *Reduce potential human sources of wildfire ignition by controlling access and by reducing activity fuels in the areas most accessible to humans (objective 7):*

Decision Factors 8 and 9: Both alternatives meet these factors. See *EA sections 2.3.3; 2.3.4; and 3.3.6.* However, under the No Action alternative, dense forest stands with high crown densities are more susceptible to a high intensity, stand replacement wildfire that escapes initial attack and could threaten the public and other resources. Under the proposed action, managed, thinned forest stands are less prone to catastrophic wildfires. Fires that do start tend to be easier to control in managed stands.

Maintaining logging roads provides faster access for suppression forces if a fire does start. See *EA sections 2.3.4, 3.3.6 and 3.3.7*.

4.0 LIST OF PREPARERS

Table 20: List of Preparers

Resource	Name
Writer/Editor	Keith Walton
NEPA Review	Carolyn Sands
Botany	Terry Fennell
Cultural Resources	Pete Hazen
Engineering	Amy Herburger
Fire/Fuels	Barbara Raible
Fisheries	Bruce Zoellick
Hydrology/ Water Quality	Patrick Hawe
Logging Systems	Michael Barger
Recreation, Visual Resources Management and Rural Interface	Zachary Jarrett
Silviculture	Dugan Bonney
Soils	Patrick Hawe
Wildlife	Jim England, Corbin Murphy

5.0 CONTACTS AND CONSULTATION

5.1 Consultation

5.1.1 US Fish and Wildlife Service (USFWS)

The timber sale was 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 FY2009/2010 consultation process. The Biological Assessment of NLAA Projects with the Potential to Modify the Habitat of Northern Spotted Owls Willamette Planning Province - FY 2009-2010 (BA), was submitted in August 2008.

Using effect determination guidelines, the BA concluded that the Highland Fling Project may affect, but is not likely to adversely affect the northern spotted owl due to the modification of dispersal and suitable habitat (BA, pp. 21-23).

The Letter of Concurrence Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY2009-2010 (LOC) associated with the Highland Fling Project was issued in October 2008 (reference # 13420-2008-I-0140). The LOC concurred that the habitat modification activities described in the BA, including the Highland Fling Project, are not likely to adversely affect spotted owls and are not likely to adversely affect spotted owl Critical Habitat (LOC, p. 31).

Furthermore, the proposed action is not likely to diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat on federal lands within its range (LOC, p. 31).

The proposed thinning and connected actions described in this EA have incorporated the applicable General Standards that were described in the BA (p. 6-7) and LOC (LOC, pp. 12-14). This includes 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 on the potential effects of the proposed project on LCR coho salmon and LCR steelhead trout will be completed under the programmatic consultation process outlined in the *Biological Assessment for Fiscal Year 2007-2009 Low-Risk Thinning Timber Sales on the Mt. Hood and Willamette National Forests, and portions of the Eugene and Salem Bureau of Land Management Districts* and NMFS's Letter of Concurrence, dated July 10, 2008. Consultation will be completed prior to the Field Manager selecting an alternative.

5.1.3 Cultural Resources: Section 106 Consultation with State Historical Preservation Office

Cultural resource surveys were conducted throughout the sale area between January and March, 2008 (Report # C0802). Records indicate homesteading, logging and trail building activities in the general sale area beginning in the 1920s. Within the units springboard notched stumps, old cable, skid roads and traces of old railroad grades were found.

No artifacts or other cultural resources with historical value have been found and none are expected to occur in the project area, therefore no consultation was required.

5.2 Public Scoping and Notification - Tribal Governments, Adjacent Landowners, General Public, and State County and local government offices

For the results of project scoping, see *EA section 1.4*. The EA and FONSI will be made available for public review from March 24, 2010 to April 23, 2010 and posted at the Salem District website at http://www.blm.gov/or/districts/salem/plans/index.php. The notice for public comment will be published in a legal notice in the *Molalla Pioneer* newspaper. Written comments should be addressed to Cindy Enstrom, Field Manager, Cascades Resource Area, 1717 Fabry Road S., Salem, Oregon 97306. Emailed comments may be sent to OR_Salem_Mail@blm.gov. Attention: Cindy Enstrom

6.0 LIST OF INTERDISCIPLINARY TEAM REPORTS INCORPORATED BY REFERENCE

The Interdisciplinary team reports can be found in the Highland Fling Thinning EA project file and are available for review at the Salem District Office.

Barger , M., 2008. *Highland Fling Logging Systems Report* (Logging Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Bonney, D., 2008. *Highland Fling Thinning and Silvicultural Prescriptions* (Silviculture Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

England, J., Murphy, C., 2009. *Cascades Resource Area Wildlife Report Highland Fling Project* (Wildlife Report) Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Fennell, T., 2008. *Cascades Resource Area Botanical Report Proposed Highland Fling Thinning Timber Sale* (Botany Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, W. P., 2008. *2008 Hydrology/Channels/Water Quality: Specialist Report for the Highland Fling Thinning Project*, (Hydro Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, W. P., 2008. *WEPP (Water Erosion Prediction Project) Report for Highland Fling Thinning* (WEPP Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, W.P. 2008. *2008 Soils Environmental Assessment for the Proposed Highland Fling Thinning Project* (Soils Report) Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hazen, P., 2008. *Cultural Resource Inventory Reports, Highland Fling Thinning Timber Sale Pre-project Surveys.* Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Jarrett, Z., 2008. *Recreation, Visual and Rural Interface Resources Report.* Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Raible, B. 2009. *Highland Fling Thinning Project Air Quality and Fire Hazard/Risk Specialist Report* (Fuels Report), Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Zoellick, B., 2009. *Highland Fling Thinning Fisheries Specialist Report* (Fisheries Report) Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

7.0 ADDITIONAL SUPPORTING DATA AND MAPS OF THE PROPOSED ACTION

7.1 Tables

Table 21: Special Status Wildlife Species For Highland Fling, Cascades Resource Area (Bureau Sensitive, USFWS SOC and Federally Listed)

Occurrence	Species & Status	Habitat Description
Invertebrates		
N	CALLOPHRYS JOHNSONI BS Johnson's Hairstreak	Cool, moist, old-growth conifer forests of the Pacific Northwest, primarily west of the Cascades Mountains. Feeds on dwarf mistletoe associated with Western hemlock and true firs. In Oregon, it is found at higher elevations over 2,000 feet. Highland Fling is below 1,600 feet and no old-growth forests are proposed for thinning.
N	COLLIGYRUS SP. BS Columbia Duskysnail	A Columbia Gorge endemic, found on both sides from east and south of Portland to Hood River, Oregon. Found in cold, pure, well-oxygenated springs within Clackamas and Multnomah Counties. Highland Fling is outside of its range.
N	CRYPTOMASTIX DEVIA BS Puget Oregonian (snail)	Mature and old growth forests, typically under hardwood logs and leaf litter, rocks and talus, in litter under sword ferns growing under hardwood trees and shrubs, and under moss growing on big leaf maple trunks. No mature or old-growth forest habitat is proposed for thinning. None were found during purposive surveys conducted in the Cascades Resource area in 2006.
N	DEROCERUS HESPERIUM BS Evening fieldslug	Occurs in wet meadows in forested situations in a variety of low vegetation, litter, debris and rocks. Search area limited to within 30 meters of perennial wetlands, springs, seeps and riparian areas. This habitat is not present in the Highland Fling Area.
N	GLIABATES OREGONIUS BS Salamander slug	Type locality is in leaf litter under bushes in mature conifer forest at elevation of 600' in east side of the Oregon Coast Range. Has been found at 11 sites in the Cascades Resource Area, ranging from unharvested or unthinned late-successional forest, to a 45 year old stand that originated after regeneration harvest. There are no salamander slug sites in the Highland Fling Area.
N	GONIDEA ANGULATA BS Western ridged mussel	Substrates of lakes, streams, and rivers that range in size from gravel to firm mud with the presence of at least some fine material (e.g. sand, silt or clay). Preferred sites generally have constant flow, rather shallow water (typically < 3 m in depth), and well-oxygenated substrates, especially when occurring in finer sediments.

Occurrence	Species & Status	Habitat Description
Herpetofauna		
N	ACTINEMYS MARMORATA MARMORATA BS/SOC/ SC Northern Pacific pond turtle	Marshes, ponds, lakes, slow rivers and streams, usually with an abundance of aquatic vegetation and emergent logs or boulders for basking. Associated with Willamette River and its major tributaries in the Willamette Valley.
S	ASCAPHUS TRUEI SOC/SV Tailed frog	Cold, fast-flowing permanent springs and streams in forested areas. Has a very narrow temperature tolerance. Likely to occur in the Highland Fling Area.
D	BATRACHOSEPS WRIGHTORUM BS/SOC/SU Oregon slender salamander	West slope of Cascades. Prefers down logs and woody material in more advanced stages of decay. Most common in mature and old-growth conifer forests. Known to occur in the Highland Fling Area. *Addressed in text.(EA Section 3.3.5)*
N	CHRYSEMYS PICTA BS/SC Painted turtle	Marshes, ponds, lakes, slow rivers and streams, usually with an abundance of aquatic vegetation and emergent logs or boulders for basking. Associated with Willamette River and its major tributaries in the Willamette Valley.
N	DICAMPTODON COPEI BS/SU Cope's giant salamander	Larvae in streams or occasionally (in Washington) in ponds and lakes, sea level to 4,400 feet. Very few sites in Oregon. Known from the northern portion of the Cascades Resource Area in Gordon Creek. Possible in Sandy River sub-basins. Highland Fling is out of its range.
N	PLETHODON LARSELII BS/SV Larch Mountain salamander	Associated with rocky, talus areas on steep slopes and coarse woody debris in older forests close to the Columbia River Gorge. There are no known sites on Salem BLM lands. Highland Fling is out of its range.
S	RANA AURORA SOC/SU Red-legged frog	Common in marshes, ponds, and streams with little or no flow, from the valley floor to about 2,500 feet in mountain forests. Can occur in seasonal waters if wet until late May or June. *Highly likely to occur in the Highland Fling area.*
N	RANA BOYLEI BS/SOC/SV Foothill yellow-legged frog	Permanent streams and vicinity, with rocky, gravelly and sandy substrates in the south half of the Resource Area. Highland Fling is located in the northern part of the Resource Area and no suitable habitat is present.
N	RANA CASCADAE SOC/SV Cascades frog	Found in higher elevation bogs, ponds and stream edges associated with moist meadows above 3,500 feet. Highland Fling is located at low elevations and no suitable habitat is present.
Birds		

Occurrence	Species & Status	Habitat Description
S	ACCIPITER GENTILIS SOC/SC Northern goshawk	Rare Summer resident in Cascades. Prefers mature or old-growth forests with dense canopy cover at higher elevations. Winters at lower elevations. Stands in Highland Fling are young and located at lower elevations. Low probability of occurrence in the Cascades (eastern) portion of the Highland Fling Area. *Addressed in Table 21.*
S	CONTOPUS COOPERI SOC/SV Olive-sided flycatcher	Remnant large trees/snags in forest openings/edges and open forests, high contrast old/young edges. Migratory, arrive late May, leave late August. *Suitable habitat is present in Highland Fling Area. Addressed in Table 21.*
S	EMPIDONAX TRAILLII BRESTERI SOC/SV Little willow flycatcher	Dense shrub and early seral stages, prefers the wet sites/ riparian zones. Migratory, arriving in mid May 15, most leave early September. *Suitable habitat is present in Highland Fling Area. Addressed in Table 21.*
N	FALCO PEREGRINUS ANATUM BS/SE American peregrine falcon	Rare during the nesting season. Usually occurs as a transient/migrant and winter visitor. Found in a variety of open habitats near cliffs or mountains. Prefers areas near larger bodies of water and rivers. No suitable habitat is present in the Highland Fling Area.
N	HALIAEETUS LEUCOCEPHALUS BS Bald eagle	Rare summer resident in Cascades. Uncommon winter resident in Willamette Valley. For nesting and perching, prefers large old-growth trees near major bodies of water and rivers. No suitable habitat is present in the Highland Fling Area.
N	HISTRIONICUS HISTRIONICUS BS/SOC/SU Harlequin duck	An uncommon summer resident found in whitewater mountain rivers and streams during nesting season. Winters on rocky coasts. No suitable habitat is present in the Highland Fling Area.
S	ICTERIA VIRENS SOC/SC yellow-breasted chat (Willamette Valley)	Formerly common in dense riparian thickets along the Willamette Valley floor. Will use brushy young stands after regeneration harvest, blackberry thickets, and dense scotch broom stands. Possible in any young, brushy valley-edge elevation stand. Migratory. *Suitable habitat is present in Highland Fling Area. Addressed in Table 21.*
N	MELANERPES FORMICIVORUS SOC Acorn Woodpecker	Nests in loose colonies in cavities in mature/old-growth oak groves in the Willamette Valley. Most common to the south in the Umpqua, Rogue Valleys and California. Although there are some oaks in the area, it is highly unlikely to occur as a nesting species. No suitable habitat is present in or adjacent to the Highland Fling parcels.

Occurrence	Species & Status	Habitat Description
N	MELANERPES LEWIS BS/SOC/SC Lewis' woodpecker	Formerly a nesting summer resident and uncommon winter visitor in Willamette Valley. Oak woodlands and hardwood forests. Transient on Salem District in fall along high divides. Although there are some oaks in the area, it is highly unlikely to occur as a nesting species. No suitable habitat is present in or adjacent to the Highland Fling parcels.
S	PATAGIOENAS FASCIATA SOC Band-tailed pigeon	Nests in closed-canopy forest; forages in open-canopy forest. Keys in on mineral sites and berry producing plants. Migratory, most arrive in March, leave in October. *Suitable habitat is present the Highland Fling Area. Addressed in Table 21.*
S	POOECETES GRAMINEUS AFFINIS BS/SOC/SC Oregon vesper sparrow	Rare and local summer resident in Willamette Valley. Very rare in winter. Dry, grassy areas, sometimes associated with Christmas tree farms. Western Oregon interior valley breeding population is of concern. Christmas tree farms and grassy areas are present in the Highland Fling Area, but no suitable habitat is present in the Highland Fling BLM parcels. *Addressed in Table 21.*
N	PROGNE SUBIS BS/SOC/SC Purple martin	Rare summer resident. Typically occurs along rivers and other water bodies. Nests colonially in cavities in old buildings, abandoned woodpecker holes, and nest boxes. Low probability of occurrence in the Highland Fling Area. No suitable habitat is present in the Highland Fling BLM parcels. *Addressed in Table 21.*
S	STRIX OCCIDENTALIS CAURINA LT/ST Northern spotted owl	Permanent resident. Prefers mature and old-growth conifer forests with large down logs, standing snags in various stages of decay, high canopy closure and a high degree of vertical stand structure. Willamette Valley (western) portion is outside the normal range, but could occur in the Cascades (eastern) portion of Highland Fling. None known within the provincial home range radius 1.2 miles of Highland Fling Units. *Addressed in text (EA section 3.3.5).*
Mammals		
N	ANTROZUS PALLIDUS BS/SOC/SV Pallid bat	Occurs sporadically in w. Oregon. Associated with arid habitats, generally drier interior valleys of Southwestern Oregon. Found in caves, under bridges, cracks in rocks, hollow trees, old buildings, other secluded and protected places. No suitable habitat is present in the Highland Fling Area.

Occurrence	Species & Status	Habitat Description
S	ARBORIMUS LONGICAUDUS SOC Oregon red tree vole	Former Survey and Manage Species. The red tree vole is an arboreal vole of conifer forests below about 3,500 to 4,500 feet in elevation. Optimum habitat is older forests, but it is found in younger stands. Likely to occur in the Cascades (eastern) portion of the Highland Fling Area. *Addressed in text (EA section 3.3.5).*
S	CORYNORHINUS TOWNSENDII BS/SOC/SC Townsend's big-eared bat	Feeds on flying insects in a variety of habitats in forested areas. Primary habitat is caves, bridges, buildings and mines. No suitable roost sites are present in the Highland Fling parcels but there is in the vicinity. *Addressed in text (EA section 3.3.5).*
S	LASIONYCTERIS NOCTIVAGANS SOC silver-haired bat	Associated with buildings, snags, loose bark and cliff/cave habitat. Prefers older forests. Forages in a variety of forest habitats and riparian areas. *Addressed in text (EA section 3.3.5).*
S	MYOTIS EVOTIS SOC/SU Long-eared myotis	Associated with snags, loose bark, buildings and cliff/cave habitat. Prefers older forests. Forages over water and riparian areas. *Addressed in text (EA section 3.3.5).*
S	MYOTIS THYSANODES BS/SOC/SV Fringed myotis	Associated with buildings, bridges, mines, snags and cliff/cave habitat. Likely in the north half of the Resource Area, at lower elevations closer to the Willamette Valley. Prefers older forests. Forages over water and riparian areas. Highland Fling is within the range of the fringed myotis. *Addressed in text (EA section 3.3.5).*
S	MYOTIS VOLANS SOC/SU Long-legged myotis	Associated with snags, loose bark, buildings, bridges and cliff/cave habitat. Prefers older forests. Forages over water and riparian areas. *Addressed in text (EA section 3.3.5).*
S	MYOTIS YUMANENSIS SOC Yuma myotis	Associated with buildings, bridges, snags and cliff/cave habitat. More closely associated with riparian areas than the other myotis. Prefers older forests. Forages over water and riparian areas. *Addressed in text (EA section 3.3.5).*

KEY

Occurrence:
N=Not Likely to Occur
S = Suspected (highly likely to occur)
D = Documented to occur

Status:
LE = Federal Endangered
LT = Federal Threatened
SOC = Species of Concern
BS = Bureau Sensitive
SE = State Endangered
ST = State Threatened
SC = State Critical
SV = State Vulnerable
SU = State Uncertain
SP = State Peripheral

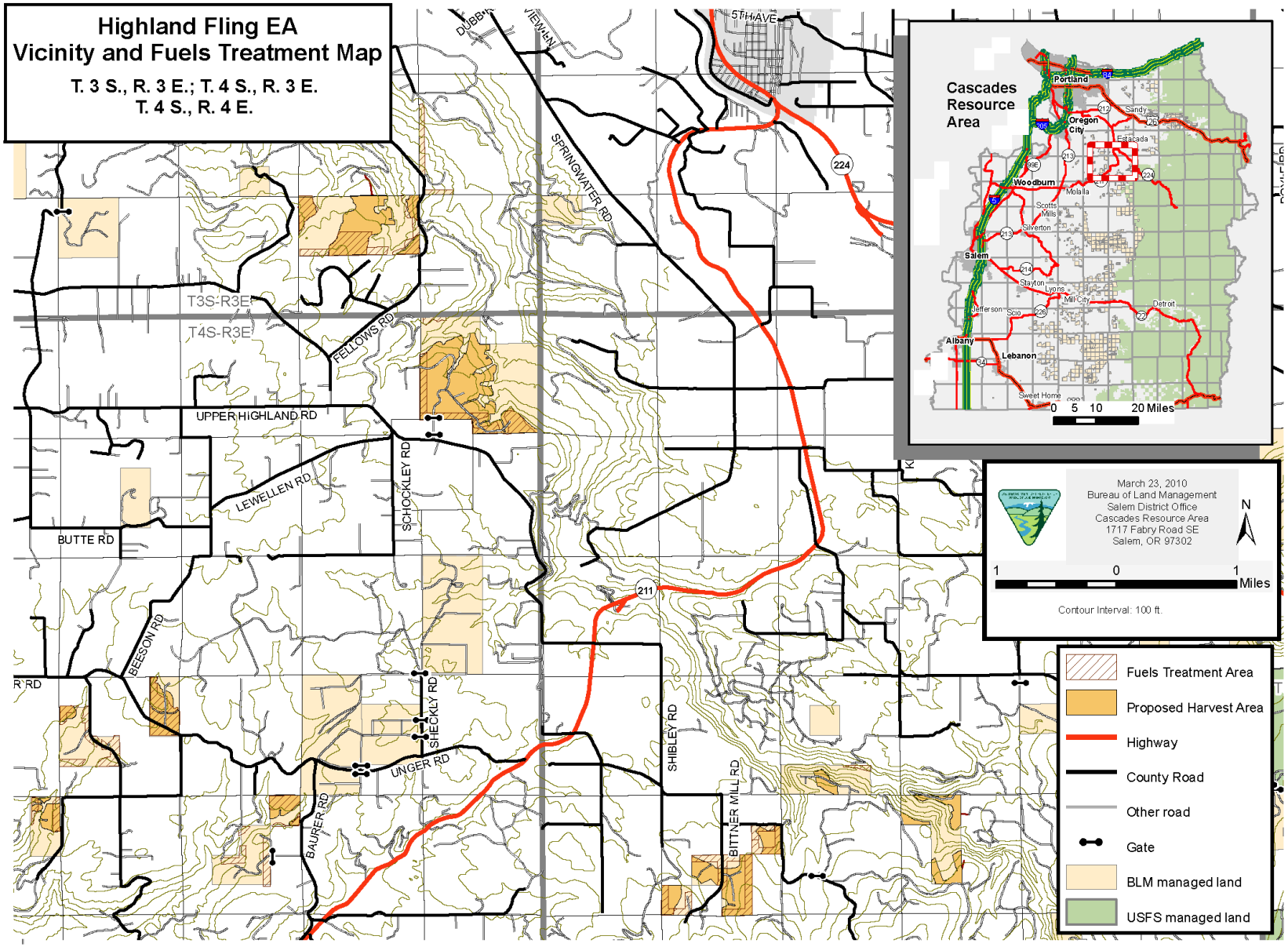
Table 22: Effects of Thinning On Migratory Bird Species

Species' Common Name	Short-term 0 – 5 Years Response	Mid-Term to Long-term 6+ Years Response
** Bird species which have been observed in the project area.*		
*Band-tailed Pigeon**	*Negative due to opening the canopy*	*Positive with increase in deciduous component and as canopy closes*
Black-throated Gray Warbler	No effect due to lack of hardwood component	Positive due to increase in hardwood component especially in Riparian Reserves (RR)
Blue Grouse	Positive due to understory development	Positive due to understory development especially in RR
*Brown Creeper**	*Negative due to opening the canopy*	*No effect as canopy closes, positive due to large tree development in RR*
Bullock's Oriole	No effect due to lack of well developed riparian along major streams	No effect due to lack of well developed riparian along major streams
Cassin's Vireo	No effect due to lack of deciduous component	Positive due to increase in deciduous component
*Chestnut-backed Chickadee**	*Similar abundance in thinned and unthinned stands, slight negative due to loss of <10% snags in smaller sizes*	*Similar abundance in thinned and unthinned stands. No effect*
Chipping Sparrow	No effect due to lack of habitat in these closed stands	Slight positive effect due to opening up stands
Common Nighthawk	Open habitats no effect	Open habitats no effect
Cooper's Hawk	No effect	Positive by encouraging late successional in RR
Downy Woodpecker	Slight negative due to 10% loss of snags in smaller sizes	Positive due to encouraging late successional conditions and hardwood component, especially in RR
*Golden-crowned Kinglet**	*Negative due to opening the canopy*	*No effect as canopy closes*
Hammond's Flycatcher	Positive due to opening up stand	Positive due to opening up stand
*Hermit Warbler**	*Negative due to opening the canopy*	*No effect as canopy closes, positive effect in RR by encouraging late successional conditions*
Hutton's Vireo	No effect due to lack of hardwood component	Positive due to increase in hardwood component and understory development
MacGillivray's Warbler	Brushy open habitats No effect	Brushy open habitats No effect
Mountain Quail	Open habitats no effect	Open habitats no effect
Mourning Dove	Open habitats no effect	Open habitats no effect
*Northern Flicker**	*Open habitats no effect; slight negative due to <10% loss of snags*	*Open habitats no effect*
Northern Goshawk	No effect	Positive by encouraging late successional in RR
Northern Pygmy-Owl	Negative due to opening the canopy, and <10% loss of snags	No effect as canopy closes
Northern Saw-whet Owl	Negative due to opening the canopy, and <10% loss of snags	No effect as canopy closes
Northern Spotted Owl	May Affect, but not likely to adversely affect due to modification of dispersal habitat	No effect as canopy closes, positive effect in RR by encouraging late successional conditions
Olive-sided Flycatcher	No effect due to lack of two story habitat	Positive due to encouraging late successional conditions

Species' Common Name	Short-term 0 – 5 Years Response	Mid-Term to Long-term 6+ Years Response
** Bird species which have been observed in the project area.*		
Orange-crowned Warbler	Brushy open habitats No effect	Brushy open habitats No effect
Oregon Vesper Sparrow	Brushy open habitats No effect	Brushy open habitats No effect
*Pacific-slope Flycatcher**	*Negative due to opening the canopy*	*No effect as canopy closes, positive with deciduous development in RR*
*Pileated Woodpecker**	*No effect due to retention of old-growth remnants and large snags*	*Positive due to encouraging late successional conditions in RR*
Purple Finch	Open to semi open mixed forest edges No effect	Open to semi open mixed forest edges No effect
Purple Martin	Open habitats No effect	Open habitats No effect
Red-breasted Sapsucker	Slight negative due to 10% loss of snags in smaller sizes	Positive due to encouraging late successional conditions and hardwood component, especially in RR
*Red Crossbill**	*Negative due to opening the canopy*	*No effect as canopy closes*
*Ruffed Grouse**	*Positive due to understory development*	*Positive due to understory development, especially in RR*
Rufous Hummingbird	Open habitats no effect	Open habitats no effect
Slender-billed Nuthatch	Primarily associated with hardwoods(oak), slight negative due to 10% loss of snags in smaller sizes	Positive due to encouraging late successional conditions and hardwood component, especially in RR
*Spotted Towhee**	*Edge and brushy openings No effect*	*Edge and brushy openings No effect*
*Steller's Jay**	*No effect*	*No effect*
Swainson's Thrush	No effect due to lack of understory	Positive due to understory development especially in RR
*Varied Thrush**	*Negative due to opening canopy*	*No effect as canopy closes*
Vaux's Swift	No effect due to retention of old-growth remnants and large snags	Positive due to encouraging late successional conditions in RR
Western bluebird	Snags in/open habitats no effect	Snags in/open habitats no effect
Willow Flycather	Brushy open habitats No effect	Brushy open habitats No effect
*Wilson's Warbler**	*No effect due to lack of understory*	*Positive due to understory development especially in RR*
*Winter Wren**	*Negative due to ground disturbance, opening canopy*	*No effect as canopy closes*
*Wood Duck**	*No effect due to retention of large snags*	*Positive due to encouraging late successional conditions in RR*
Yellow-breasted Chat	Brushy open habitats No effect	Brushy open habitats No effect
Yellow Warbler	No effect due to lack of subcanopy layers	Positive due to subcanopy understory development especially in RR

7.2 Maps of the Proposed Action

7.2.1 Vicinity and Fuels Treatment Map



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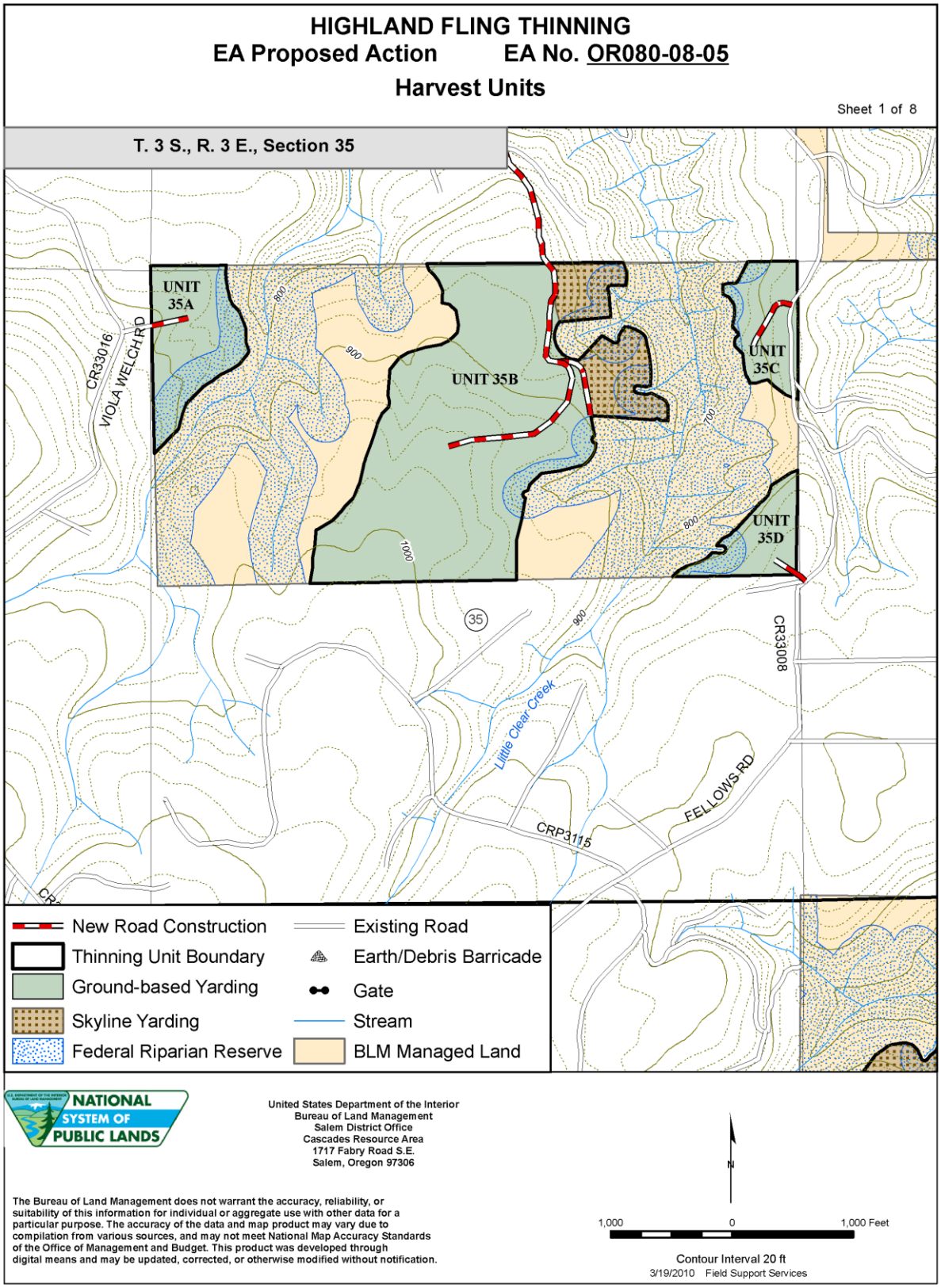
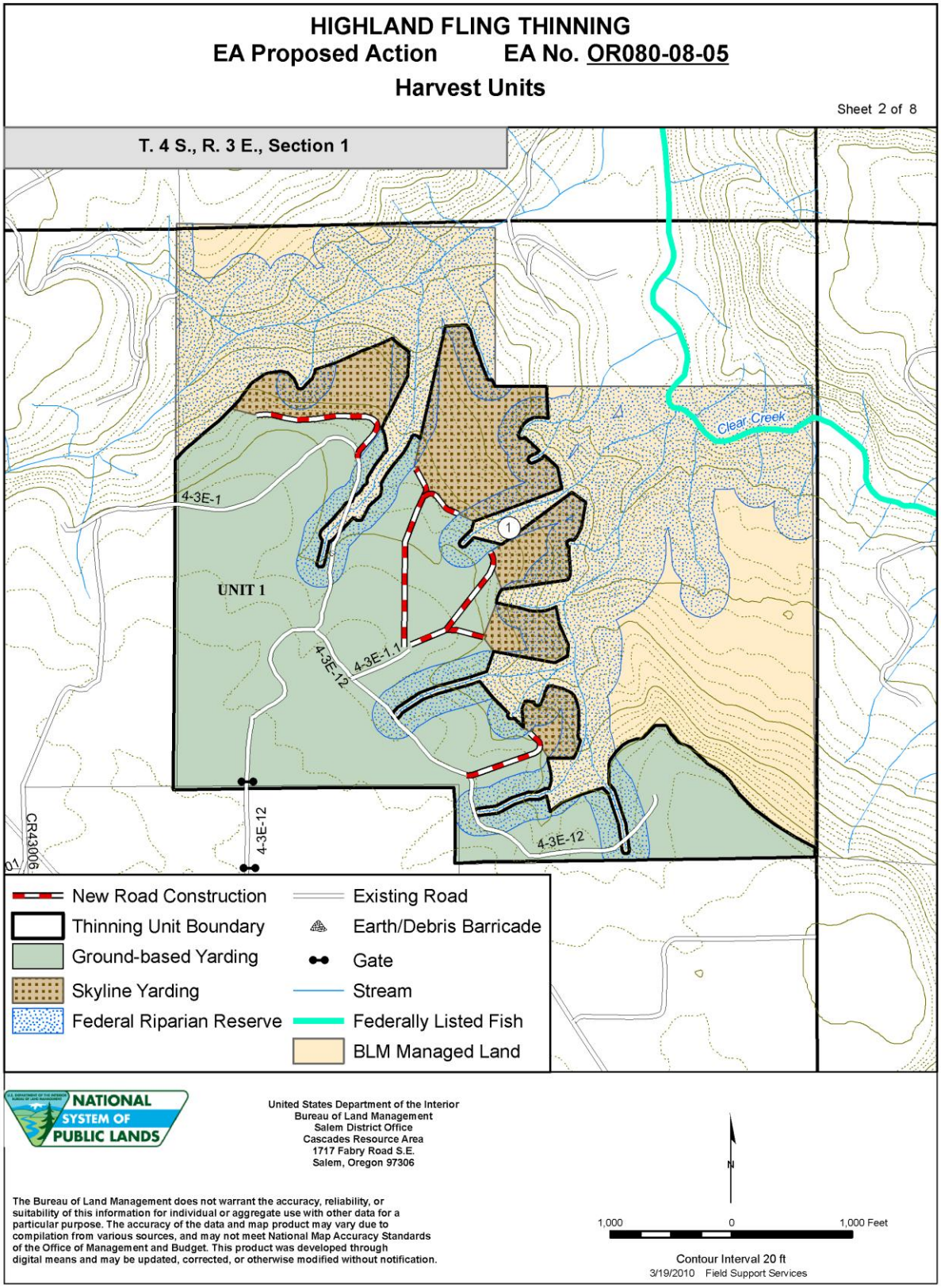
7.2.2 Proposed Action

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EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 2 of 8
T. 4 S., R. 3 E., Section 1
Clear Creek
4-3E-1
UNIT 1
1
4-3E-12
4-3E-1.1
4-3E-12
4-3E-12
CR43006
New Road Construction
Thinning Unit Boundary
Ground-based Yarding
Skyline Yarding
Federal Riparian Reserve
Existing Road
Earth/Debris Barricade
Gate
Stream
Federally Listed Fish
BLM Managed Land
NATIONAL SYSTEM OF PUBLIC LANDS
United States Department of the Interior
Bureau of Land Management
Salem District Office
Cascades Resource Area
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Salem, Oregon 97306
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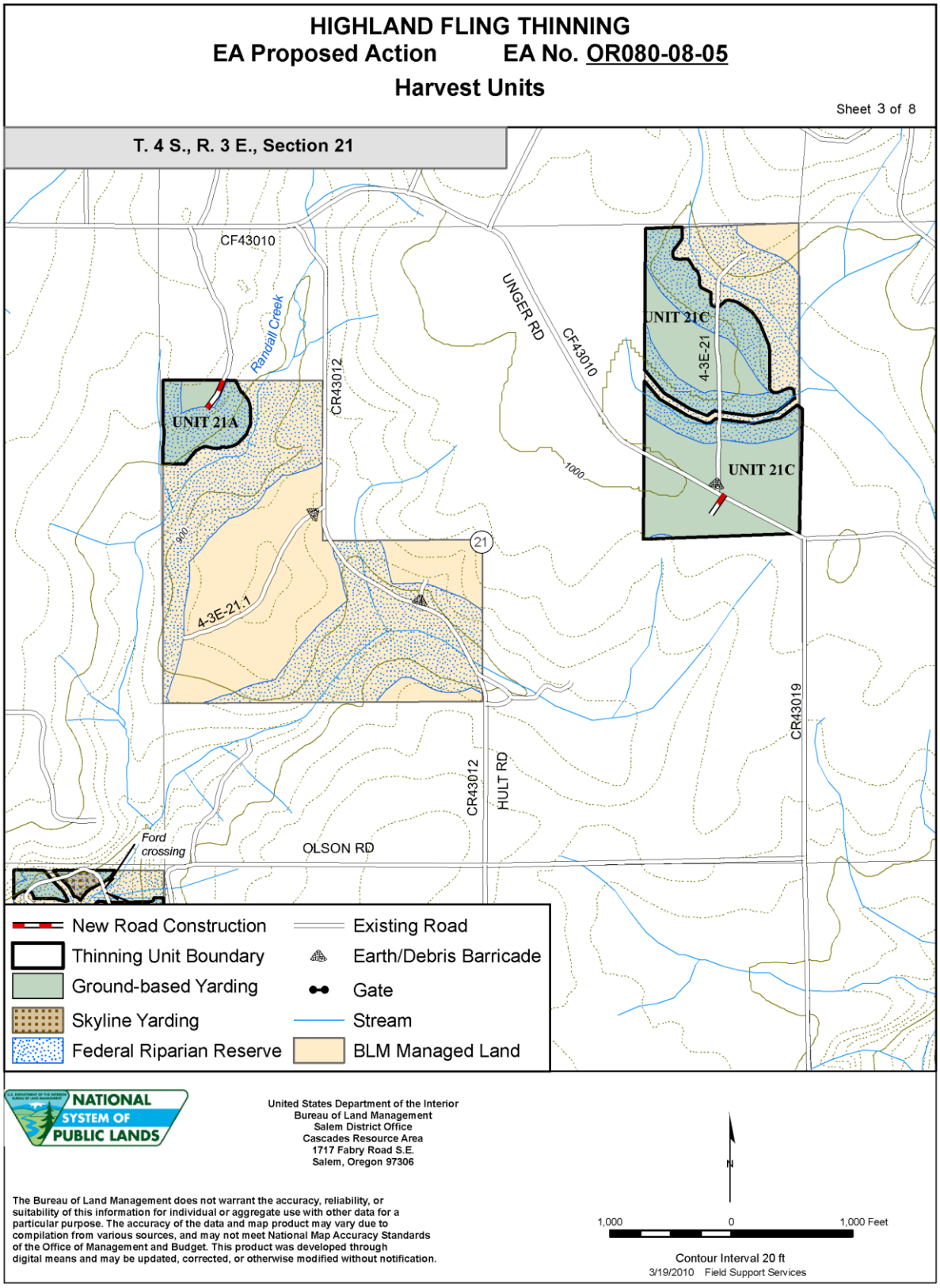
3/19/2010 Field Support Services


HIGHLAND FLING THINNING
EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 3 of 8
T. 4 S., R. 3 E., Section 21
CF43010
Randall Creek
CR43012
UNGER RD
CF43010
UNIT 21C
4-3E-21
UNIT 21C
UNIT 21A
1000
900
21
4-3E-21.1
CR43019
CR43012
HULT RD
Ford crossing
OLSON RD
New Road Construction
Existing Road
Thinning Unit Boundary
Earth/Debris Barricade
Ground-based Yarding
Gate
Skyline Yarding
Stream
Federal Riparian Reserve
BLM Managed Land
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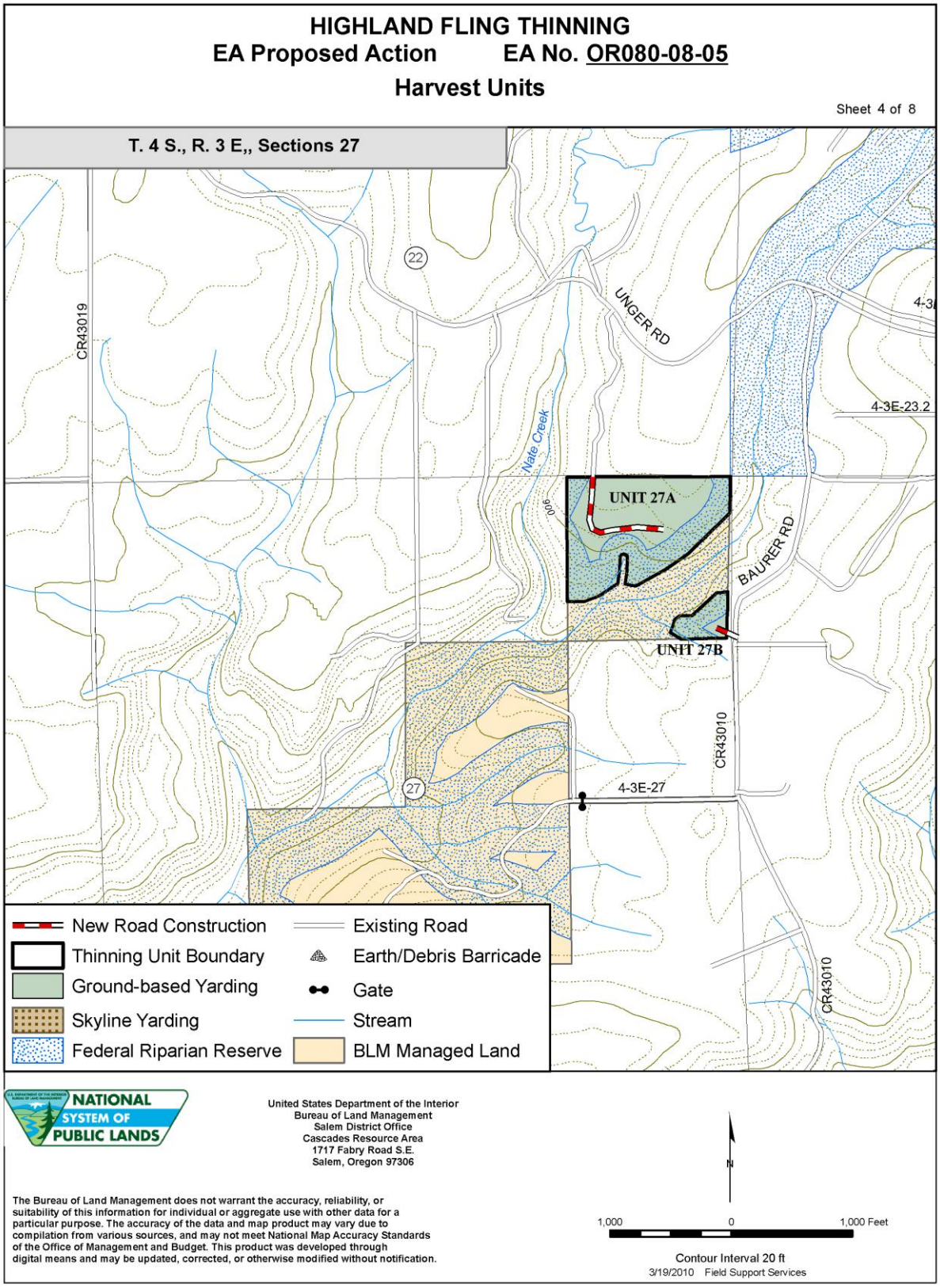
HIGHLAND FLING THINNING
EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 4 of 8
T. 4 S., R. 3 E,, Sections 27
CR43019
22
UNGER RD
Nate Creek
900
UNIT 27A
BAURER RD
UNIT 27B
4-3E-23.2
CR43010
27
4-3E-27
CR43010
New Road Construction
Thinning Unit Boundary
Ground-based Yarding
Skyline Yarding
Federal Riparian Reserve
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
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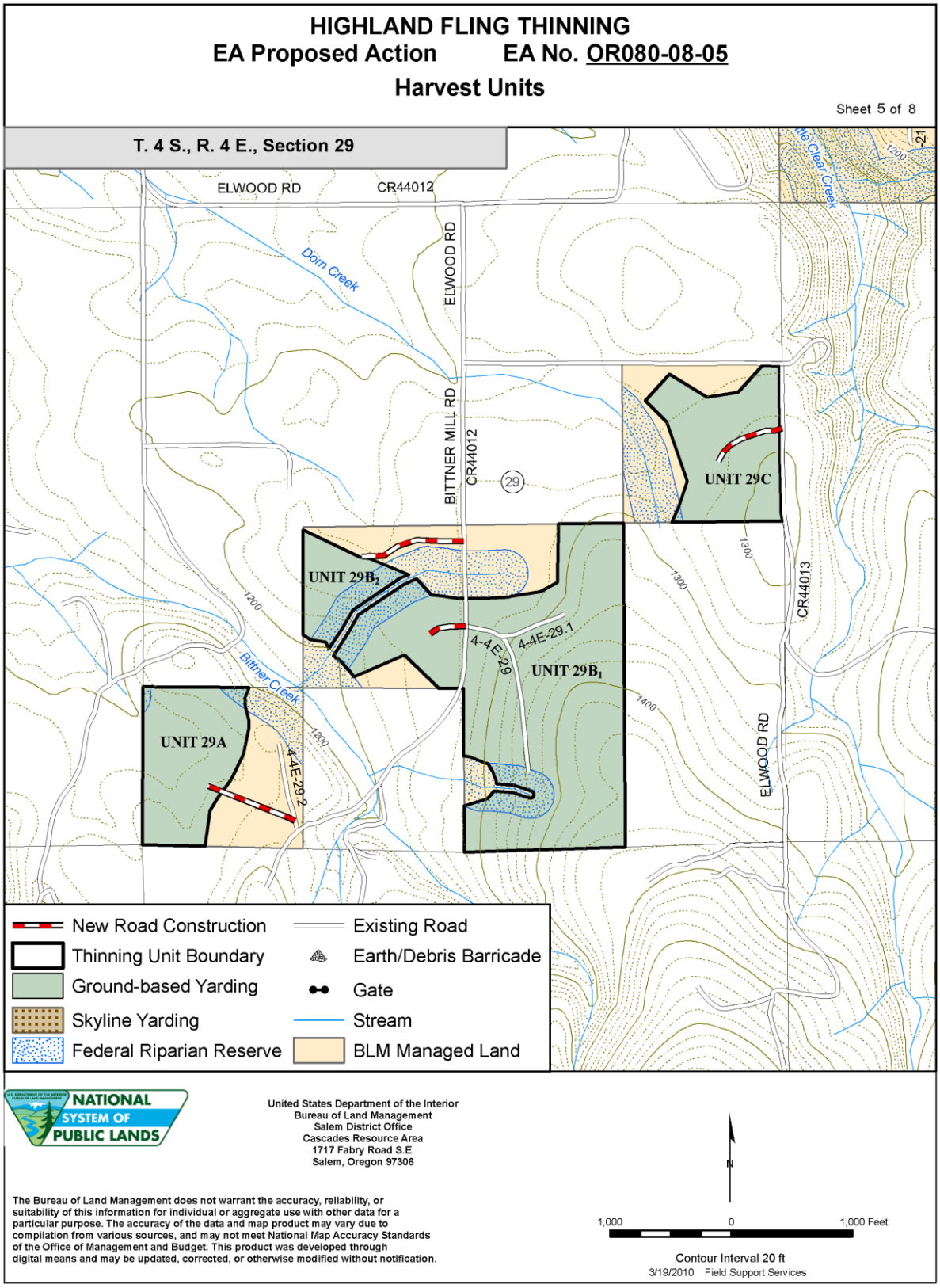
3/19/2010 Field Support Services


HIGHLAND FLING THINNING
EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 5 of 8
T. 4 S., R. 4 E., Section 29
ELWOOD RD
CR44012
Dorn Creek
ELWOOD RD
BITTNER MILL RD
CR44012
29
UNIT 29C
UNIT 29B2
UNIT 29B1
UNIT 29A
4-4E-29
4-4E-29.1
4-4E-29.2
Bittner Creek
CR44013
ELWOOD RD
Clear Creek
1200
1300
1400
21
New Road Construction
Thinning Unit Boundary
Ground-based Yarding
Skyline Yarding
Federal Riparian Reserve
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
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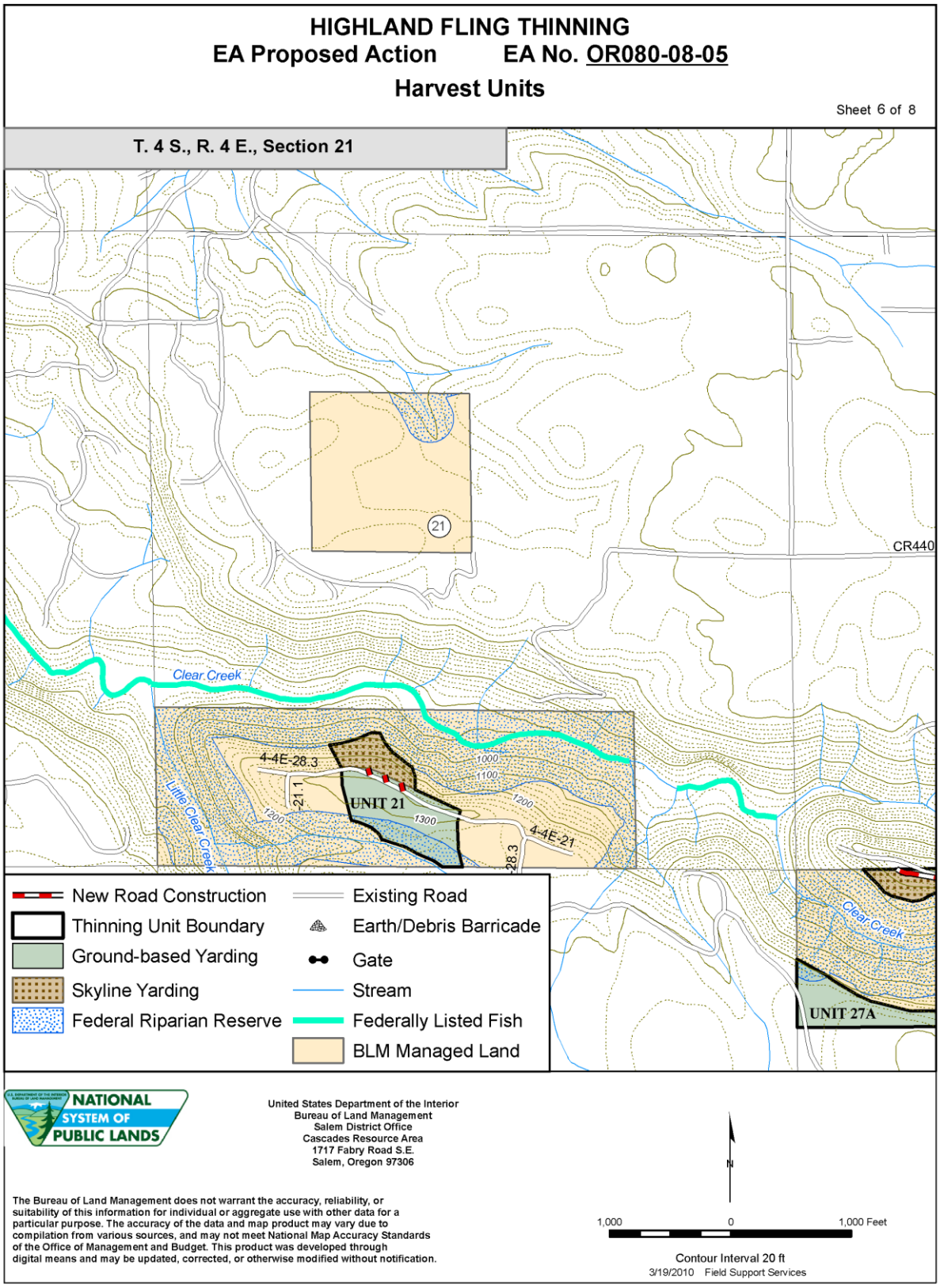
HIGHLAND FLING THINNING
EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 6 of 8
T. 4 S., R. 4 E., Section 21
21
CR440
Clear Creek
Little Clear Creek
4-4E-28.3
21.1
UNIT 21
1000
1100
1200
1300
4-4E-21
28.3
UNIT 27A
New Road Construction
Thinning Unit Boundary
Ground-based Yarding
Skyline Yarding
Federal Riparian Reserve
Existing Road
Earth/Debris Barricade
Gate
Stream
Federally Listed Fish
BLM Managed Land
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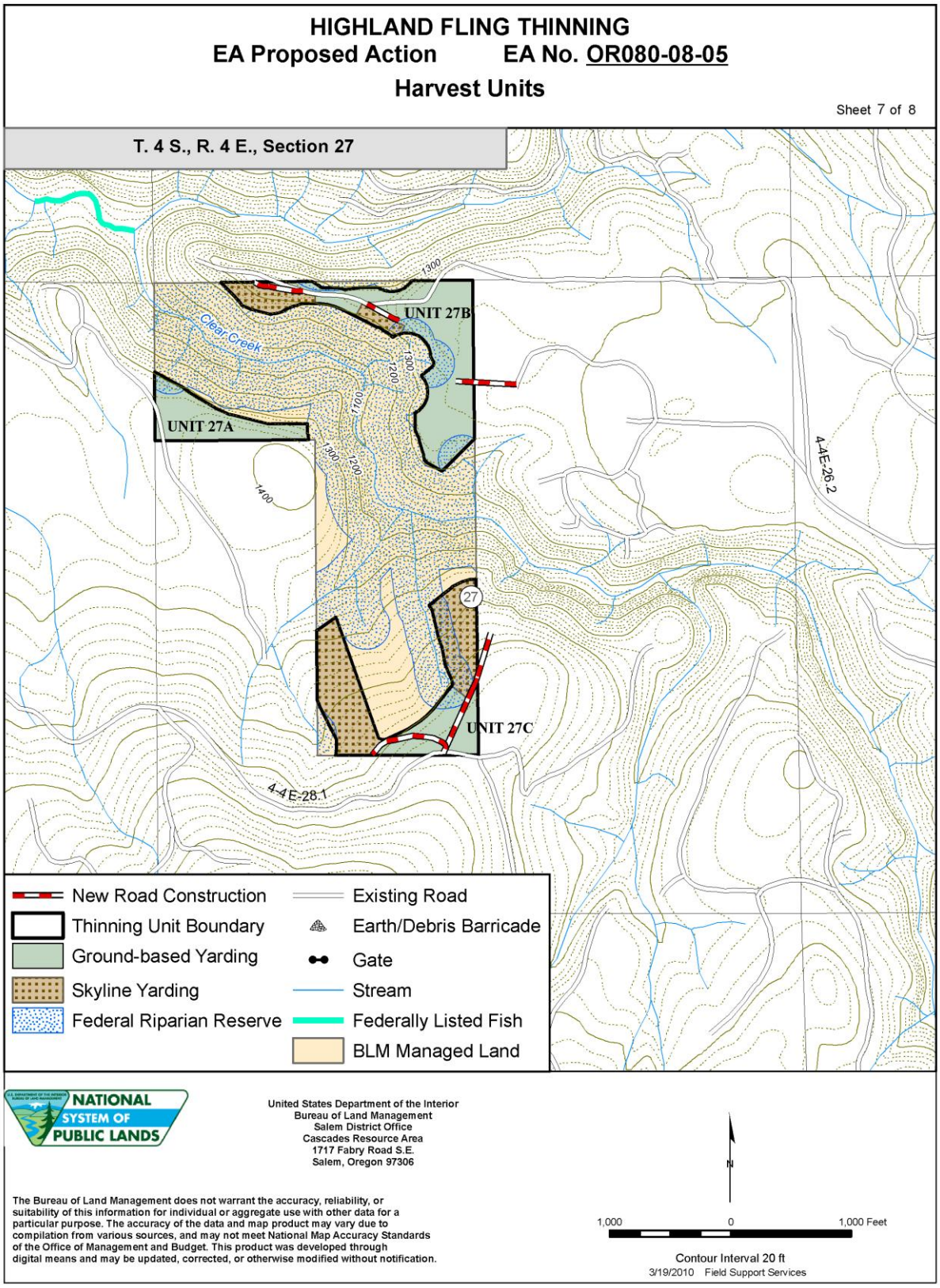
HIGHLAND FLING THINNING
EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 7 of 8
T. 4 S., R. 4 E., Section 27
UNIT 27A
UNIT 27B
UNIT 27C
Clear Creek
4-4E-26.2
4-4E-28.1
1300
1200
1100
1400
27
New Road Construction
Thinning Unit Boundary
Ground-based Yarding
Skyline Yarding
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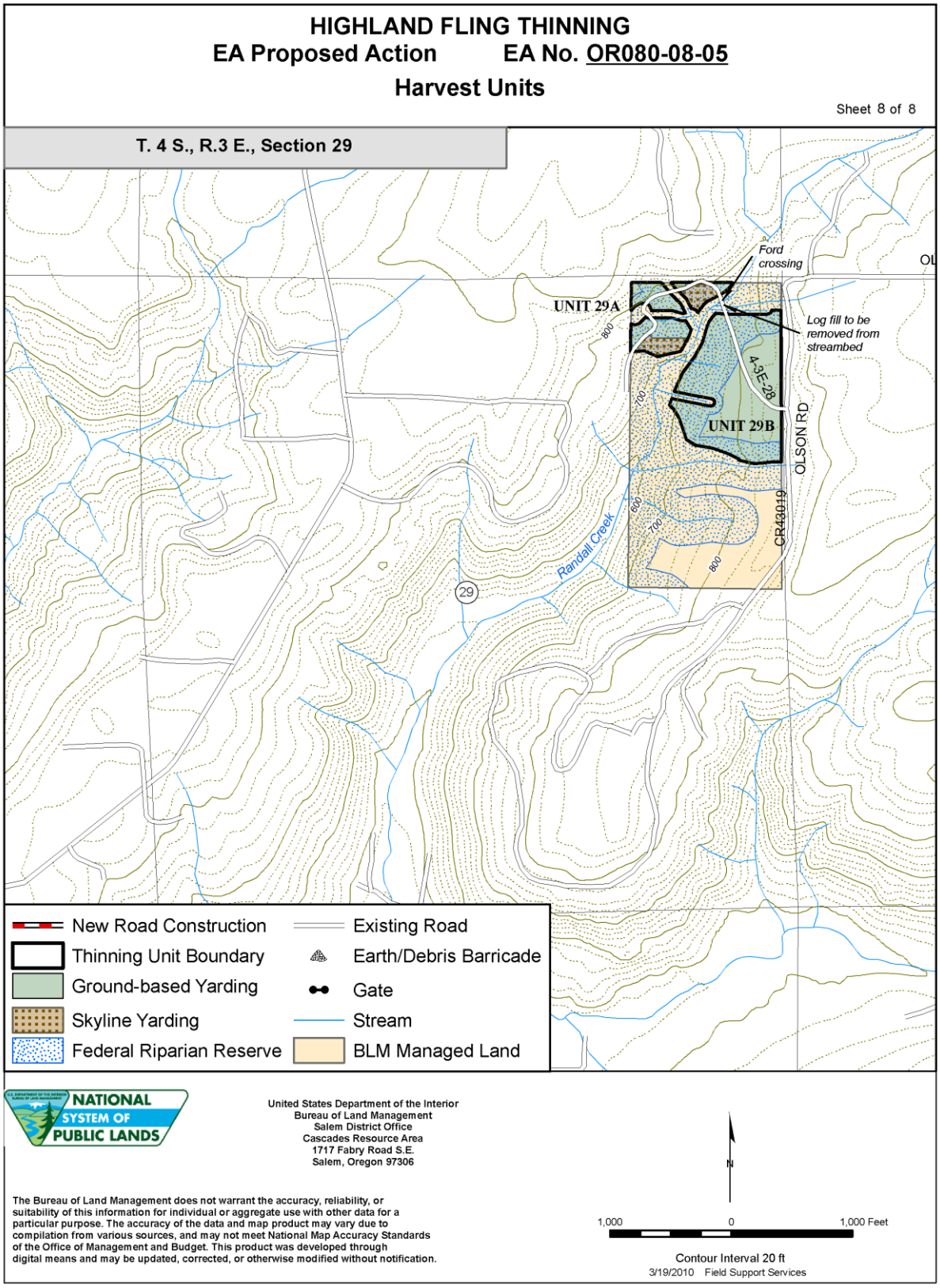
HIGHLAND FLING THINNING
EA Proposed Action EA No. OR080-08-05
Harvest Units
Sheet 8 of 8
T. 4 S., R.3 E., Section 29
UNIT 29A
UNIT 29B
Ford crossing
Log fill to be removed from streambed
4-3E-29
OLSON RD
CR43019
Randall Creek
29
800
700
600
New Road Construction
Thinning Unit Boundary
Ground-based Yarding
Skyline Yarding
Federal Riparian Reserve
Existing Road
Earth/Debris Barricade
Gate
Stream
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Contour Interval 20 ft
3/19/2010 Field Support Services

8.0 GLOSSARY AND COMMON ACRONYMS

8.1 Glossary

303(d) Water Quality Listing - Impaired waters that do not meet water quality standards, identified by DEQ, as required by the Clean Water Act.

acre - A measure of surface land area in U.S.customary units that is 43,560 square feet, which is 1/640 of a square mile (or approximately 0.4 hectares).If square, it is nearly 209 feet on each side.

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.*

analysis - The scientific evaluation of the environmental impacts of proposed planning decisions.

analytical assumption - A judgmental decision that is based on the science and relationships of natural systems assumed to be true and from which conclusions can be drawn to supply the missing values, relationships, or societal preferences needed for proceeding with an analysis of alternatives.

(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.

aquatic habitat - Habitat for vertebrate and invertebrate wildlife species and vascular and non-vascular plants occurring in free water (e.g.lakes, ponds, streams, rivers, springs and seeps).

authority - The right and power to make decisions and give orders such as the United States Congress exerts when passing legislation (e.g.the O&C Act and the Endangered Species Act).

basal area - The cross-sectional area of a single stem, of all stems of a species in a stand, or of all plants in a stand (including the bark) that is measured at breast height (about 4.5 feet up from the ground) for larger plants (like trees) or measured at ground level for smaller plants.

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 - 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).

biological assessment A biological assessment is a document that evaluates potential effects of a proposed action to listed and proposed species and designated and proposed critical habitat and determines whether any such species or habitats are likely to be adversely affected by the action. It is used in determining whether formal consultation or conferencing with the U.S.Fish and Wildlife Service or National Marine Fisheries Service is necessary (50 CFR 402.12[a])

(BO) biological opinion - An opinion by the U.S, Fish and Wildlife Service or the National Marine Fisheries Service as to whether or not a federal action is likely or not to jeopardize the continued existence of listed species, or would result **in** the destruction of or adverse modification of critical habitat. The opinion may contain reasonable and prudent alternatives, a statement of anticipated take of listed animals, and conservation recommendations for listed plants.

canopy - The more or less continuous cover of branches and foliage formed collectively by adjacent trees and other woody species in a forest stand. Where significant height differences occur between trees within a stand, formation of a multiple canopy (multi-layered) condition can result.

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. Usually refers to pieces at least 20 inches in diameter. 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).

commercial thinning - Any type of thinning producing merchantable material at least equal to the value of the direct cost of harvesting. See *thinning*.

Consultation - A formal review between the U.S.Fish and Wildlife Service or National Marine fisheries Service and another federal agency when it is determined that an action by the agency may affect critical habitat or a species that has been listed as threatened or endangered to ensure that the agency's action does not jeopardize a listed species or destroy or adversely modify critical habitat. Critical habitat is an Endangered Species Act term denoting a specified geographic area occupied by a federally listed species, and on which the physical and biological features are found that are essential to the conservation and recovery of that species and that may require special management or protection.
crown - The upper part of a tree that has live branches and foliage.

crown fire - Fire that moves through the crowns of adjacent trees independent of any surface fire. Crown fires can often move faster and ahead of ground fires.

culmination of mean annual increment (CMAI) The age in the growth cycle of a tree or stand at which the *mean annual increment* (MAI) for volume is at its maximum.

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.

diameter at breast height (DBH) - 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).

floodplain Level lowland bordering a stream or river onto which the flow spreads at flood stage.

Forest Operations Inventory (FOI) - An intensive inventory that provides managers with information regarding the age, species, stand location, size, silvicultural needs, and recommended treatment of stands based on individual stand conditions and productivity.

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.

forest habitat - An area containing the forest vegetation with the age class, species composition, structure, sufficient area, and adequate food source to meet some or all of the life needs (such as foraging, roosting, nesting, breeding habitat for northern spotted owls) of specific species.

harvesting -The process of onsite cutting and removing of merchantable trees from a forested area.

key watershed -A Northwest Forest Plan term that denotes a watershed that contains habitat for potentially threatened species, stocks of anadromous salmonids, or other potentially threatened fish, or is an area of high-quality water and fish habitat. Also see *watershed*.

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; starts more than 10 years after implementation of a project, 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

modeling - A scientific method that operates by a structured set of rules and procedures to simulate current conditions and predict future conditions. Also see *analysis*.

multi-layered canopy - Forest stands with two or more distinct tree layers in the *canopy*.

National Marine Fisheries Service - A federal agency under the United States Department of Commerce that is responsible for working with others to conserve, protect, and enhance anadromous fish and their habitats. NMFS is an agency in the National Oceanic Atmospheric Administration .

non-point source pollution - Water or air pollutants where the source of the pollutant is not readily identified and is diffuse, such as the runoff from urban areas, agricultural lands, or forest lands. Also see *point source*.

(NWFP) Northwest Forest Plan - 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 Related Species within the Range of the Northern Spotted Owl (1994) (Northwest Forest Plan). A 1994 common management approach for the 19 national forests and 7 BLM districts located in the Pacific Northwest ecological region and jointly approved by the Secretary of Agriculture and the Secretary of the Interior.

nutrient cycling - Circulation of elements (such as carbon or nitrogen) between vegetation/organic material and soil, water and air.

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.

plan conformance - The determination that a management action is consistent with the terms, conditions, decisions, and is within the anticipated environmental consequences, of an approved resource management plan.

point source - An origin of water or air pollutants that is readily identified, such as the discharge or runoff from an individual industrial plant or cattle feedlot. Also see *nonpoint source*.

relative density - A means of describing the level of competition among trees or site occupancy in a stand, relative to some theoretical maximum that is based on tree size and species composition. Relative density is determined mathematically by dividing the stand basal area by the square root of the quadratic mean diameter. Also see *basal area and quadratic mean diameter*.

(RMP) Resource Management Plan - Salem District Record of Decision and Resource Management Plan (1995). A BLM planning document, prepared in accordance with Section 202 of the Federal Land Policy and Management Act that presents systematic guidelines for making resource management decisions for a resource area. An RMP is based on an analysis of an area's resources, their existing management, and their capability for alternative uses. RMPs are issue oriented and developed by an interdisciplinary team with public participation.

rotation - The planned number of years between establishment of a forest stand and its regeneration harvest.

salmonid - 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 *anadromous fish.*

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.

special forest products (SFP) - Those plant and fungi resources that are harvested, gathered, or collected by permit, and have social, economical, or spiritual value. Common examples include mushrooms, firewood, Christmas trees, tree burls, edibles and medicinals, mosses and lichens, floral and greenery, and seeds and cones, but not soil, rocks, fossils, insects, animal parts, or any timber products of commercial value.

special status species - Those species that are listed under the Endangered Species Act as threatened or endangered (including proposed and candidate species); listed by a state as threatened, endangered or candidate species; and listed by the BLM as sensitive species. Under the BLM Special Status Species policy (BLM 6840), the BLM State Director has created an additional category called Bureau Strategic Species (see glossary *Bureau strategic species*).

stand - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

standards and guidelines - 1995 RMP rules for managing the different land use allocations.

stream, intermittent - Drainage feature with a dry period, normally for three months or more, where the action of flowing water forms a channel with well-defined bed and banks, supporting bed-forms showing annual scour or deposition, within a continuous channel network.

stream, perennial - Permanent channel drainage feature with varying but continuous year-round discharge, where the base level is at or below the water table.

structurally complex stage - Stage at which stands develop characteristics approximating "old-growth" stands.

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.

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.

Timber Production Capability Classification (TPCC) - An analytical tool that inventories and identifies sites as capable of sustaining intensive timber management without it degrading their productive capacity. This tool evaluates a site's soil depth, available moisture, slope, drainage, and stability to determine site capacity for timber management activity. Sites that prove incapable of sustaining intensive timber management are typically not included in the harvest land base.

understory - Portion of trees or other woody vegetation that forms the lower layer in a forest stand, and that consists of more than one distinct layer.

(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.

8.2 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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